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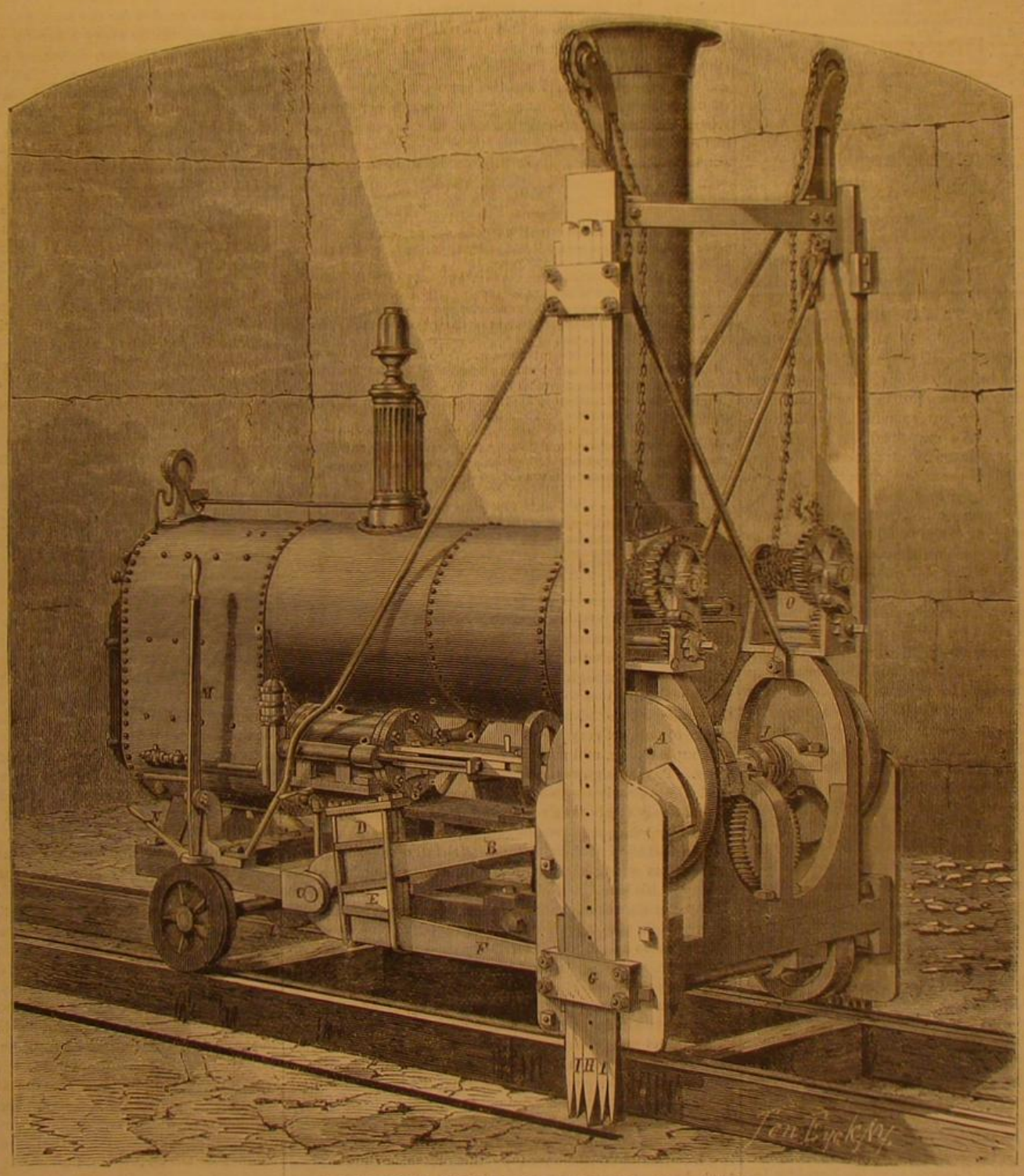
IMPROVED STONE QUARRYING MACHINE.

The largely increasing demand for stone for building purposes calls for the introduction of labor-saving devices which, while increasing the supply, will tend to lower its cost of production. To this class belongs the machine which we herewith illustrate, and which is extensively used for channelling or cutting stone in various quarries throughout the country.

It is a double gang machine, and is represented mounted upon its track on the bed of the quarry. The frame which supports the boiler, engine, and other machinery, consists of one piece of forged iron, thereby gaining great strength and durability. The principal portions of the device to which it is necessary to call attention in detail are the cutters, the mechanism which actuates them, and also the connections which render the machine locomotive. The engine is of six horse power. Through the interposition of suitable appliances the piston rod imparts motion to the crank face plate, A. This, in turn, by means of a swivel stirrup applied to its wrist pin (not shown) moves the upper arm, B, of a bifurcated or compound lever, which is pivoted to the frame at C. Arrangements are provided by which the throw of this arm can be shortened and, as will be seen, the movement of the cutters regulated. D and E are springs of rubber, or other elastic medium, arranged above the arm, B, and between it and the lower arm, F. A clamp passes around these springs, as shown, and serves to adjust them, and also to connect the two portions of the lever. The free end of the arm, F, actuates the gang of chisels on its side of the machine. The latter consist of five bars of steel, pointed at their lower ends and clamped together by head and foot clamps or guide blocks, with the lower of which, G, the lever arm, F, connects. Of the five, two chisels, I I, have diagonal cutting edges, and three, the middle, H, and two outer ones, have their edges transverse. The middle chisel, H, extends the lowest, and all together form a stepped arrangement each way from the center. By this device it will be seen that when the machine is moving ahead the two forward and middle cutters operate; on a retrograde motion being assumed the two rear chisels, in connection with that in the center, do the work.



WARDWELL'S STONE QUARRYING MACHINE.

The bars are from seven to fourteen feet in length, according to the depth it is required to penetrate, and are supported by standards arranged on each side of the frames. At their upper ends, on one side, they are serrated to match corresponding serrations in the head clamps, for the purpose of preventing any displacement of the cutters while in use. J is a worm on the main shaft, and actuates the toothed wheel, K. The axle of the latter extends diagonally downwards to the rear of the machine where it terminates in a bevel pinion which, by the lever, M, may be thrown into action with either of two adjoining bevel wheels—part of one of which is shown at L—on the axle of the rear trucks. It will be readily understood that the motion thus communicated serves to turn the axle either backward or forward, according to with which wheel the pinion is caused to engage. When the machine is required to be stationary, the pinion is so placed in reference to the wheels that neither is moved. N is a hand lever which communicates with suitable mechanism which serves to lock the pinion in whatever position it may be situated. O O are winches from the barrels of which chains are led, as shown, over pulleys, and are connected with the cutter bars. Their object is to afford a means of withdrawing the latter from deep channels. The mechanism for driving the gang of chisels on the opposite side of the machine is of course the same as that already described.

From one to two hundred blows per minute can be delivered with each gang of cutters, and the penetration, we are informed, will be about three fourths of an inch each time the apparatus is passed over a given surface. The channels are generally cut down for from four to six feet, and may be of any desired length. It may be noted, as an important advantage claimed, that their sides, as made by the chisels, are quite as true and as even as a sawn surface, so that the machine serves the double purpose of dressing as well as quarrying. The track can be made in sections to extend any desired distance.

The general use of this invention in the marble quarries of Rutland, Vt., during the past seven years has fully demonstrated its efficiency. It is stated to have averaged from 50 to 100 feet of channel a day during the quarrying season, thereby performing the labor of from 50 to 75 men.

Several patents have been granted upon its different portions and improvements thereon. Geo. J. Wardwell is the patentee. Further information may be obtained by addressing the Steam Stone Cutter Company, Rutland, Vt.

The Works of the Joliet Iron and Steel Company.

This establishmennt occupies an area of some one hundred acres on the Chicago and Alton Railroad, at Joliet, Ill., and is one of the largest of its class in the United States. There are two blast furnaces of a capacity of 1,400 tuns of pig iron per week, which, together with the hot blast stoves, boiler, and engine house, casting house, etc., occupy a structure 420 by 240 feet in dimensions. Twelve boilers and four large engines are here employed. The water works, situated to the north of the furnaces, contain a boiler and two steam pumps capable of throwing 1,600 gallons per minute each. In the buildings devoted to the processes of coke making and coal washing, are 25 brick ovens of the most improved form, and also two washers with extensive machinery. Twenty-five tuns of coke and one hundred and fifty tuns of washed slack are produced daily. The fire brick works occupy a system of buildings 400 feet long, fitted with grinding and molding apparatus, boiler, engine, kilns, etc., and are capable of making 3,000,000 bricks per year.

The Bessemer plant has a capacity of 700 tuns of ingots per week. Two five tun converters are used. The new steel rail mill occupies one of the largest edifices. The steel rail train is divided into three stands of short rolls, so as to insure great strength. There are six Siemens furnaces of the largest class, and a blooming engine and blooming train. The capacity of this branch of the establishment is 1,000 tuns of rail per week. The iron rail mill is provided with an artesian well, and, besides other machinery, has eight heating furnaces and a three foot horizontal engine with a 28 tun twenty foot fly wheel. Six hundred tuns of rail per week are here manufactured. The puddle mill has nine double puddling and one double heating furnace, and produces two hundred and fifty tuns of muck bar per week. The shops are of sufficient capacity to keep in repair all these works, and also a second Bessemer plant and merchant mill, if required.

A PATENT OYSTER.—Where will the genius of the American inventor end? A down east journal informs us that a Maine man is about to apply for a patent for an artificial oyster, made out of flour paste, tapioca, salt and water. The inventor places these in second hand oyster shells which are carefully glued around the edges; and when a half intoxicated customer calls for a dozen raw on the half shell, he gets them fresh from the shop.

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EXPLOSIONS DUE TO LOW WATER.

In our issue of March 8, we published an article in which we exhibited the fallacy of the popular ideas relating to the consequences of low water in steam boilers, and showed how collapse, even, might occur as a result of this condition. We related a case, as described by a correspondent, in which collapse actually took place. We explained the manner in which explosions might, under some circumstances occur, and, in conclusion, summed up our argument in the statement that overheated surfaces, where low water had occurred, might produce either explosion or collapse, or might cause no dangerous result, according to the peculiar circumstances of the individual case. The question of a correspondent leads us to take up the special case of explosions caused by the increase of pressure which may be produced, in some cases, by the injection of feed water upon overheated surfaces.

In the article above referred to, we showed the possibility of cold feed water, entering a boiler filled with steam, producing the condensation of that steam and the consequent collapse of the boiler. Should, in any case, the feed water be too warm to produce instantaneous condensation, or should it be evaporated so rapidly as to supply fresh steam faster than condensation could take place, an increase of pressure would occur which might produce, and probably in many cases has produced, the explosion of the boiler.

Let us suppose, as an extreme case, a plain cylindrical boiler, of 42 inches diameter and 30 feet length, to have become completely emptied, by some accident, and then to have a supply of water forced in under the conditions last described. We may easily calculate what pressure of steam will be produced, if the feed water were boiling and the plates red hot,—conditions most favorable to increase of pressure. Such a boiler, if of quarter inch plate, would weigh not far from one and a half gross tuns. If the fire line were at the middle line of the boiler, about 1,800 pounds of iron might become red hot, were the boiler to become empty. Nine pounds of red hot iron were proved, by Professor Johnson and the Committee of the Franklin Institute in investigation of this subject, to contain heat enough to be just capable of evaporating one pound of water. Seventeen hundred pounds of iron might therefore evaporate $\frac{1800}{9} = 200$ pounds of water, under most favorable circumstances. This weight of water, occupying the full capacity of the boiler, 290 cubic feet, would produce a pressure of about 300 pounds per square inch. In one actual experiment by the Committee of the Franklin Institute, the pressure rose above 200 pounds per square inch, when it overcame the resisting power of a portion of the boiler, and they were unable to determine the maximum limit.

The case which we have supposed would, evidently, be likely to produce explosion, were the pressure not relieved by the safety valve; but it must be remembered that this is the extreme case, and one likely to be seldom met with. It will rarely happen that one half a boiler will be thus heated to a red heat, and that it will yield its surplus heat to heated and rapidly injected feed water; and even then it is only when the safety valve is inoperative that the pressure can reach the indicated figure. Suppose a boiler of the locomotive type to have its crown sheet similarly overheated, while a heavy pressure still exists within it, say 120 pounds. By similar calculation we can readily determine the increase of pressure. The crown sheet being, say 4 feet square and $\frac{3}{8}$ inch thick, and the boiler containing 100 cubic feet of capacity above the then existing water line, the pressure, if unrelieved by the safety valve, would, in this example, rise to nearly 300 pounds per square inch, except for one very important circumstance: that is, that saturated steam already existing would, as shown by experiment, be condensed by the slightest increase of pressure and, thus yielding before the newly developed vapor, the result would be that the pressure would really be but very slightly increased. It is far more likely that, in this case, the overheated crown sheet would yield from simple weakness, and that an explosion would result in that manner, as has actually occurred under our own observation.

Our readers will be very likely to agree with us, we think, when we draw the conclusion that the statement that "water coming in contact with red hot iron creates a gas ten times as explosive as the best gunpowder" requires some modification. Learning more precisely in what manner deficiency of water produces danger, those among them who have steam boilers under their charge will be able to act more intelligently in avoiding such risk.

INJUSTICE TO WORKMEN.

It is always the case among antagonistic parties that there are a few on either side who rush to extremes and, by their precipitate and ill advised measures, neutralize such satisfactory adjustment of the question in dispute as might be effected through the efforts of the more cautious and conservative majority. We have given a multiplicity of instances of the imprudent proceedings of trade associations, and have repeatedly condemned the coercive system which these societies have seen fit to adopt in order to compel the support of disaffected working men. From the following document, however, which we have recently received from a correspondent, it appears that the extremists are not all arrayed on the side of the unions. The Joliet Iron and Steel Company is one of the largest establishments of its class in Illinois, as will be seen from the description printed in another column.

RECEIPT AND CONTRACT.

JOLIET, ILL., February ——, 1873.

Received of Joliet Iron and Steel Company, the full amount due me as per pay roll for services rendered said company during the month of January, 1873.

And for the consideration of the above mentioned, I do hereby agree that said company shall not be liable to me (nor my heirs, executors, administrators, or other persons who may be dependent upon me for support in case of my death) for any damage or accident resulting or occurring to me while in its employ, whether caused by the negligence or carelessness of any of the officers or employees of said company, or from any other cause whatsoever. And that said company shall have the right, at any time, to discharge me from its employ without notice.

Further, that I will continue in the employ of said company from month to month at the current rate paid by said company for the class or kind of work done by me, and not leave the employ of said company or refuse to perform my daily duties without fourteen (14) days notice in writing of such intention to the superintendent, foreman, or the person under whose orders I am employed, previous to the time of leaving or failing to perform my daily duties.

And in consideration as aforesaid, I do further agree that in case I fail to comply with the conditions last aforesaid, that I will forfeit all moneys earned by me and remaining unpaid at the time of such failure on my part to comply with the terms of this contract.

Signed,——————————

Witness.

Although it is possible that this contract may be legally valid under the statutes of Illinois, we doubt whether its terms would receive a rigid interpretation from any court or be enforced through any jury. It is plainly inequitable, inasmuch as it gives to the employer rights which it denies to the employee, and places the latter in a position in which his means of support may be at any moment taken from him without warning, and without leaving him any mode of redress. That this power may be so used as to cause great hardship is clearly obvious, while the system of requiring men not only to give their time and labor, but to bind themselves by such oppressive obligations, for the simple and single consideration of their already faithfully earned wages, seems to us wrongful and highly unjust. "The laborer is worthy of his hire," and although employers have a perfect right to regulate the quantity, quality, and manner of performing his work, they should not take advantage of the necessity which impels a man to toil for the existence of himself and his family, to impose upon him extreme conditions which, were he less dependent, he would unhesitatingly refuse.

We cannot too strongly protest against the adoption of such a method of governing workmen as the above would signify, and we would earnestly advise its discontinuance. It is on such proceedings as this that the harangues of the leaders of strikes and labor uprisings find a substantial basis, which lends to their arguments a weight with men who otherwise would fail to be moved by them. The doubtful benefit, which perhaps may accrue to a single establishment is a hundredfold outbalanced by the obstacles thus thrown in the way of those who are striving to reach a fair and equitable adjustment of the question of labor reform.

It seems to us that the coercion in this case is as evident and in every respect as much to be condemned as that exercised in the contrary direction by the unions. Indeed, if employers adopt this course, with their restrictions on one hand and those of his society on the other, the future of the working man is at best sadly unpromising.

PROPOSED NEW PATENT LAW IN ENGLAND.

A committee of London patent agents has prepared a bill for a new patent law, the passage of which through Parliament is proposed. It is a sort of a patent hash, having been made up, apparently, by means of scissors and paste, its components being derived, in small items, from the patent laws of various countries. It provides that the present set of supernumerary officials, the "Lords and Commissioners," shall still remain in office, to draw their salaries, for that is all they have done or are expected to do. To this gallant body, a corps of six new members are to be added, with salaries varying from $7,500 to $10,000 each.

Some items are then taken from the American law. Examiners are to be appointed, all cases are to be examined as to novelty, and rejections made when the examiner thinks proper. This officer may summon the applicant and compel him to make such amendments as he may require. The present burdensome patent fees are to be retained, while another section provides that the patentee shall be compelled to grant licenses for the use of his invention, on such terms as the examining committee may think proper; and they may also vary or cancel licenses. Issues of infringements are to be determined by a judge, without a jury, who may call in examiners, if he desires, to assist him. Items from the Austrian and continental systems are introduced, requiring that the invention shall be worked within a specific time or the patent rendered invalid.

The grant of patents to the first applicant, whether inventor or introducer, as at present provided, is prohibited, and patents are only to be granted to the inventor or his authorized agent.

The last mentioned clause is the only really sensible improvement that the bill contains. The effect of the other provisions will be to place difficulties and troubles in the way of inventors, without conferring benefit on anybody. We are surprised at the stupidity which this proposed bill exhibits.

What is needed for the encouragement of the useful arts in England, and in every other country, is:

First, the publication in cheap and popular form of the drawings and specifications of all patented inventions, so that the people may become fully informed as to what is doing or has been done in the arts.

Second, the reduction of the fees and the forms for obtaining patents, so that the masses of the people, who are poor, but among whom the real thinkers and inventors are to be found, may readily secure patents for their new ideas.

Third, the placing of the entire control of the patent, from the day of its issue to the close of its term, in the hands of the inventor, to be his property, to be used as he thinks proper, subject to no compulsion or other official interference.

Nearly all of the changes proposed in this bill are steps in a backward direction, not an advance in keeping with the spirit of the age. The present British law is immeasurably superior to this one now proposed. Indeed the existing law is admirable in nearly every respect and works admirably. Almost the only change it needs is a reduction of the enormous patent fees it now requires, and the limitation of the issue of patents to inventors only.

PSEUDO SCIENCE.

We have before referred to the fact that mere reasoning, not based on sufficient observation of Nature, almost always leads to false conclusions and baseless theories, that this was the main fault of the ancient philosophers, and is still the fault of that class of moderns who labor under the serious disadvantage of deficient mental training; we have also asserted that docility to Nature's teachings and a liberal amount of resignation of our own speculative faculties are the real means to come to the knowledge of the truth. Even some of the most eminent men have erred in this way, and are lasting monuments of warning against mere speculation: one such is no less a personage than the famous German philosopher Emanuel Kant, who risked himself on the field of mechanics so far as to write a volume on dynamics, or, rather, on a false imaginary theory of motion, which he calls dynamics. We will only point out a few of his errors:

Kant had evidently never been instructed in regard to the resistance of motion by friction, and he was ignorant of the fact that all motion, once imparted, would continue in the same direction as long as it was not prevented by other causes, of which friction is the most common and, on the surface of our earth, the permanent cause which finally arrests all motion. Having no conception of this, but imagining that force must be a metaphysical immaterial thing which can be communicated to matter, he distinguishes two kinds of force, living force (*vis viva*) and dead force (*vis mortis*), and he illustrates these two forces by the following experiment: "When a book lays on the table," he says, "and I push it forward with my hand so slowly that it stops moving as soon as the contact of my hand ceases, I give it only a dead force; but when moving it with such violence that it continues its motion after the contact of the force-giving hand has ceased, I give it a living force. So a heavy box or trunk, dragged over the floor, is moved by a dead force, but a stone thrown by hand is moved by a living force." He considers that a body, when moving it without contact of a moving force, possesses the force *viva*, the living force; and the conclusions he further arrives at, being based on such false premises, are, of course, totally at fault and contrary to experience and even, we dare say, to common sense.

If Kant had discussed this matter with a good physicist of his time, and obtained some information on the subject of friction, and absorbed this information, in place of exclusively indulging in his own fanciful and groundless speculation, he would never have published his volume on dynamics, which must injure him in the eyes of all impartial investigators. It shows how superficial a thinker Kant was after all; it raises the suspicion that if he was not more correct in his metaphysical reasonings than in his plain physics, he does not deserve the confidence of his readers, and his conclusions may go for naught.

Another illustration of a similar nature is Goethe, who in the latter years of his life had a notion to study optics, and wrote a volume on light and colors, in which he proves that he had not the least capability of making experiments, and was still more deficient in his powers of observation. His conclusions are almost all false; he is perhaps worse than

Kant, and his book is nothing but a confession of deficient judgment in regard to experiments and defective training, his education being, as is well known, exclusively literary.

As there is no more useful labor than opening the eyes of people to the truth and rooting out their prejudices, we consider it a necessary and progressive step to tear away a portion of the halo which surrounds certain names, and which has almost become to mankind sacred, owing to the habit men have of regarding their heroes as superior in all respects to the ordinary run of humanity.

LENS FIRES.

Dr. H. C. Bolton, of Columbia College, New York city, states that on a recent occasion, at 9 A. M., on entering his laboratory he found a wooden table on fire, ignition having been occasioned by the rays of the morning sun, which fell upon a glass spherical flask containing water. The flask served as a lens which concentrated the rays and set fire to the wood. The author also alludes to the statement of Lactantius (A. D. 300) who mentions the use of glass globes, filled with water, to be used in kindling fires; while Pliny recommends the use of lenses for the purpose of cauterizing the flesh of sick persons. As to the latter, one Mr. Barnes, of Connecticut, took a patent in this country some five years ago for the use of lenses for the purpose suggested by Pliny.

In respect to fires occasioned by lenses, doubtless there are many examples. It is well known that vessels at sea have been set on fire by the bullseye glasses used to admit light to between decks. These glasses were formerly made convex on one side, thus forming powerful lenses. In consequence of the loss of property and danger their use has been discontinued, and thick plates of glass, flat on both sides, have been generally substituted.

Captain Scoresby and Dr. Kane used to astonish the natives of the polar regions by taking blocks of clear ice and cutting them into the form of lenses, with which they instantly kindled fires.

CURIOUS EFFECT OF LIGHT ON SELENIUM.

Selenium is a substance that resembles and is allied to sulphur. It is found in connection with some natural deposits of sulphur, but it more commonly occurs in combination with metals, forming selenides. Selenium is less combustible than sulphur, burns with a blue flame, and emits a putrid horse-radish odor.

Mr. Willoughby Smith has been making a series of electrical experiments with selenium, and, at a recent meeting of the Society of Telegraph Engineers, London, he made known the following remarkable results:

The sticks of selenium were connected with platinum wire and hermetically sealed in glass tubes. The electrical resistance of some of the sticks was very great, others much less, and he was at a loss to account for this lack of constancy, until, after various trials, he found that it was due to the action of light. When the sticks of selenium were shut up in a box so as to exclude light, the electrical resistance was highest and remained constant; but when the cover was withdrawn and light was allowed to fall on the sticks, the electrical resistance diminished 15 to 100 per cent, according to the intensity of the light. The shading of the selenium by means of glass plates of different colors showed that the conductivity was altered in proportion to the interception of the light. These are very singular observations, and may lead to new and useful discoveries concerning the qualities of other substances, and the manner in which light and electricity affect them.

THE SIPHON RECORDING TELEGRAPH INSTRUMENT.

Perhaps the most valuable inventions in connection with submarine telegraphy have been made by Professor William Thomson. During the laying of the Atlantic cable, the services of Thomson's reflecting galvanometer were most valuable, but lately he has succeeded in perfecting a recording instrument which is worthy of description. The instrument in question is in use at Duxbury, operating through the French Atlantic cable. It is available for recording a positive and a negative current upon a strip of paper in the long and short signals of which the Morse alphabet is composed. The difficulty of producing such a recorder as this has been due to the difficulty of obtaining marks from a very light body in rapid motion without impeding that motion. To effect this, the inventor connects (either by direct attachment or by stretched thread or fiber), to the body moved by the received current, a light marking needle or tube, from the end of which ink or other fluid is spirted upon paper. The signals which are to be recorded give rise to motions of the marking end which are parallel to the plane of the paper, while the paper is drawn along its own plane and in a direct perpendicular to the line of the motions caused by signals. Sir William Thomson employs for the marking needle, by preference, a capillary tube, or a bristle dipping at one end into a stationary reservoir of ink or other fluid; and he causes such fluid to be spirted or drawn from the opposite end of the tube by means of an electric force, or by means of rapid vibrations maintained in the needle or in the paper, in a direct perpendicular to the plane of the paper. These vibrations may be maintained mechanically or pneumatically as by the agency of sound, so that the paper receives ink by a succession of fine contacts, between each of which the tube or bristle is quite free to move. When the electric method is used, the paper is drawn over a metal plate electrified, say, positively, the capillary tube being electrified negatively; and a powerful difference (potential) is maintained between the tube and the metal plate, such as would tend to cause a succession of sparks to pass between them and which, under the circumstances, produce a fine stream of ink, or a succession of fine dots, spirted from the tube on to the paper, leaving a record of the position of the tube at each instant and drawing a continuous line on the paper, without impeding by friction the motion of the tube as directed by the receiving instrument. It has been found most convenient to allow the paper to move in a vertical plane, and to use a small glass siphon with its short leg dipping in the ink and its long leg pointing obliquely downward at the paper and close to it. The receiving instrument used in connection with this marking apparatus is a peculiar arrangement in which the received current passes through a very light coil of a small number of fine wires. Part of this coil is placed in a powerful magnetic field produced by permanent magnets or by electro-magnets, which set with great force upon the coil when the current passes through it. The coil is kept stiff without any complete framework or bobbin, by the use of stiff pieces or booms, drawn asunder by threads or strong fibers stretched to fixed points and serving to support the coil while giving it the requisite freedom to move and the needful stability. The message recorded by the ingenious apparatus appears like a continuous line; but when examined closely, it is found to be made up of a series of ink dots. The line made in a longitudinal direction corresponds to spaces in the Morse alphabet made by heading the current; and the to and fro transverse lines, which may be long or short as the cable current varies in strength, accomplish the same purpose as the dot lines made by the Morse pen. Thus the swinging motion of a delicate coil is perfectly recorded with minimum expenditure of force. Sir William Thomson has accomplished what has been hitherto deemed an impossibility.

THE VIENNA EXHIBITION.

On Saturday, March 15, General Van Buren, with his family, left for Vienna to take charge of the United States Department of the great exhibition. The appropriation by Congress of $200,000 and two vessels for the free transportation of merchandise has enabled the Commissioner to collect a large number of articles for the great show, notwithstanding the unprotective nature of the Austrian patent laws. Most of the exhibitors are manufacturers whose wares are well known here, and whose inventions have been so long in public use that the patent laws of no foreign country would probably afford them protection.

Had the Austrian Government amended their patent laws so as to afford the protection that the word "patent" implies, a larger number of our more recent and important inventions would have found place in the American department. If our part of the show does not compare favorably with other nations, it should be ascribed to the unwillingness of American inventors to trust their novelties to Austria's tender mercies.

The ship Supply completed her cargo and sailed for Trieste a fortnight ago, and the ship Guard will sail, with the last of the goods for the exhibition, on March 20. Both are sailing vessels, and it is therefore uncertain when they will reach their destination: in season, however, it is hoped, to permit their freight to reach Vienna before the opening of the exhibition May 1st. About the same class of articles will be found in the American wing of the Austrian show as is seen year after year at the Fair of the American Institute. Among the most prominent are sewing machines of great variety, the contributions of the Singer Sewing Machine Company alone amounting to one hundred cases. Then there are knitting machines, scroll saws, wood working machines, windmills, pumps, steam engines, water wheels, safes, pianos, school furniture, etc., besides ores, bales of cotton, hemp and other products from various parts of the country, representing the growth and industries of the sections from which they come.

On the main floor of the American department will be shown, in actual operation, shoemaking, bucket, brush, and nail making machines, stone breaking tools, flax cleaning machinery, rock drills, circular looms, machines for making pipe elbows, boot heeling machines, and numerous kinds of wood working machines. General Newton has sent a perfect model of the engineering works now carried on under his direction at Hallett's Point, and the United States Lighthouse Board has forwarded their best specimens of lighthouse lanterns, and the Navy Department their new improved apparatus for hoisting and lowering boats.

About seven hundred exhibitors have space assigned to them, and some who were unprepared to send by the government ships will forward their goods at their own expense by steamer. Commissioner Van Buren has been untiring in his efforts to have our country represented, and it is believed that the American department of the Vienna exhibition will be creditable to the nation.

THE DETROIT RIVER TUNNELS.

We regret to learn that work upon this great enterprise has been indefinitely suspended, for lack of funds, and the expected union of Canada and the United States, by the bonds of an underground railway, is for the present abandoned. This is a great pity, especially as much work had already been done. The original plan contemplated the connection of the Great Western Railway of Canada with the Michigan Central Railway, at Detroit, Mich., by means of two independent circular tunnels of masonry, each 15 feet in diameter, executed by borings under the bed of the river. Each tunnel was to have been 8,568 feet in length.

The preliminary work consisted in drifting a small tunnel 5 feet in diameter, intended as a drain for the two larger works, and it is upon this small tunnel that considerable labor has been expended. Headings were made on both sides of the river, and, up to a recent date when orders were given to stop, these headings had been carried 1,700 feet in all, or 1,220 feet on the American side and 480 feet on the Canadian side.

Mr. D. D. McBean, Superintendent of the works, has published, in a recent number of the Detroit *Post*, an interesting review of the practical operations so far as they were carried, showing that the works might be easily completed if the money were forthcoming. We hope that an improvement in the exchequers of the companies concerned will enable them hereafter to proceed with the works and bring them to completion.

SCIENTIFIC AND PRACTICAL INFORMATION.

BLEACHING BY TURPENTINE.

It is well known that turpentine generates ozone, and the fact has been used for bleaching purposes. The turpentine is violently whipped by dashers and the ozone is blown from the generator into the vat containing the paper stock or other goods to be bleached. How far this operation is successful we do not know, and only throw out the suggestion for some one to give it a trial and report the result.

HARDENING BURNED STEEL.

For hardening the steel points of tools of boring machines, etc., when burnt, J. Jossi proposes the following method: 10 parts of tallow, 2 parts horn filings, 1 part sal ammoniac, 1 part pulverized charcoal, and 1 part soda are mixed together and placed with a piece of wood on the parts to be hardened, after they have been exposed to a cherry-red heat. The mixture dries under the influence of the heat, and the steel parts may then be hardened again in the usual manner.

ARTIFICIAL MILK FOR CALVES.

Successful experiments have been made in raising calves by means of a soup or milk prepared according to the recipe of Baron Liebig, which is as follows:

Seven pints of water and three and a half pints of milk are boiled with 10 ounces of wheat flour to an ordinary pap; three and a half more pints of milk are then added, with an ounce and a quarter of a potash solution consisting of two parts of bicarbonate of potash dissolved in 11 parts of water. The same quantity of bruised malt as of wheat flour is added to the hot pap, which is well stirred and allowed to settle for half an hour near the stove or other warm place, when it is boiled again and filtered through suitable gauze.

The calves are fed for about 6 weeks on pure milk, and gradually they are allowed less, some of the substitute being added. At last they are given about 7 quarts of artificial milk per day and no pure milk. After three months, only one half of this quantity is given, half a pound of linseed cake being added; in the fall some boiled potatoes are mixed in. The calves gain about two pounds in weight per day. A calf which was weaned on February 22 gained on an average 2·12 pounds per day. Should calves dislike to take the milk of the cow, the substitute is given immediately. No disadvantageous effects of feeding with this milk were observed. Diarrhœa did not occur at all. The milk was also applied to the raising of pigs, and was in their case useful in the cure of diarrhœa, which so often fatally attacks them.

NEW METHOD OF CLEANING GLASSWARE.

Dr. Walz sends us the following correct description of his new method of cleaning glassware, published on page 151 of our current volume: The vessel to be cleaned is filled, or, if large, rinsed with a moderately dilute solution of potassium permanganate, the contact of the liquid being prolonged till a film of hydrated manganic oxide has been deposited; the solution is then poured away, and the glass vessel rinsed with some strong hydrochloric acid. Chlorine is then formed, but not enough to cause inconvenience; and acting in the nascent state on the organic matters, it speedily converts them into substitution products, which are soluble in the slight excess of acid or water.

PRESENCE OF SILVER IN SUBNITRATE OF BISMUTH.

M. Ch. Ekin observes that this preparation often contains silver, of which, however, no notice is taken in most works on pharmacy. Having tested it for the purpose of detecting a silver compound (subchloride), he found some samples of the subnitrate to contain from 3·9 to 6·5 per cent of subchloride of silver; and in other samples he found metallic silver, but in small quantity.

KIRCHER'S REMARKABLE OBSERVATIONS CONCERNING THE SUN.

The great English philosopher Isaac Newton, and, in fact, all the astronomers from the middle ages down to the end of the last century, had a much more correct idea of the nature of the sun than was the case with William Herschel and his followers, who, in order to keep step with the current of public opinion of their time (which favored a plurality of inhabited worlds), tried to prove not only all the planets but even the sun itself inhabitable, at any cost, even at the expense of common sense. For that purpose Herschel invented the phosphorescent cool atmosphere which, from its under surface, gave only sufficient light and comfortable heat to the inhabitants on the solar surface, but from its upper surface projected radiations which, at a distance of over 92,000,000 miles, could develope, with the help of our atmosphere, the burning heat of our tropical zones. Notwithstanding that the idea was absurd in the extreme, and without any foundation on analogous facts positively known about the properties of matter and of heat, it was accepted on the authority of the elder Herschel, who (when we render him impartial justice) must be considered as only a successful telescope maker, and a very poor philosopher. This absurd doctrine about the nature of the sun is, even now-a-days, not expunged from our school books on astronomy,

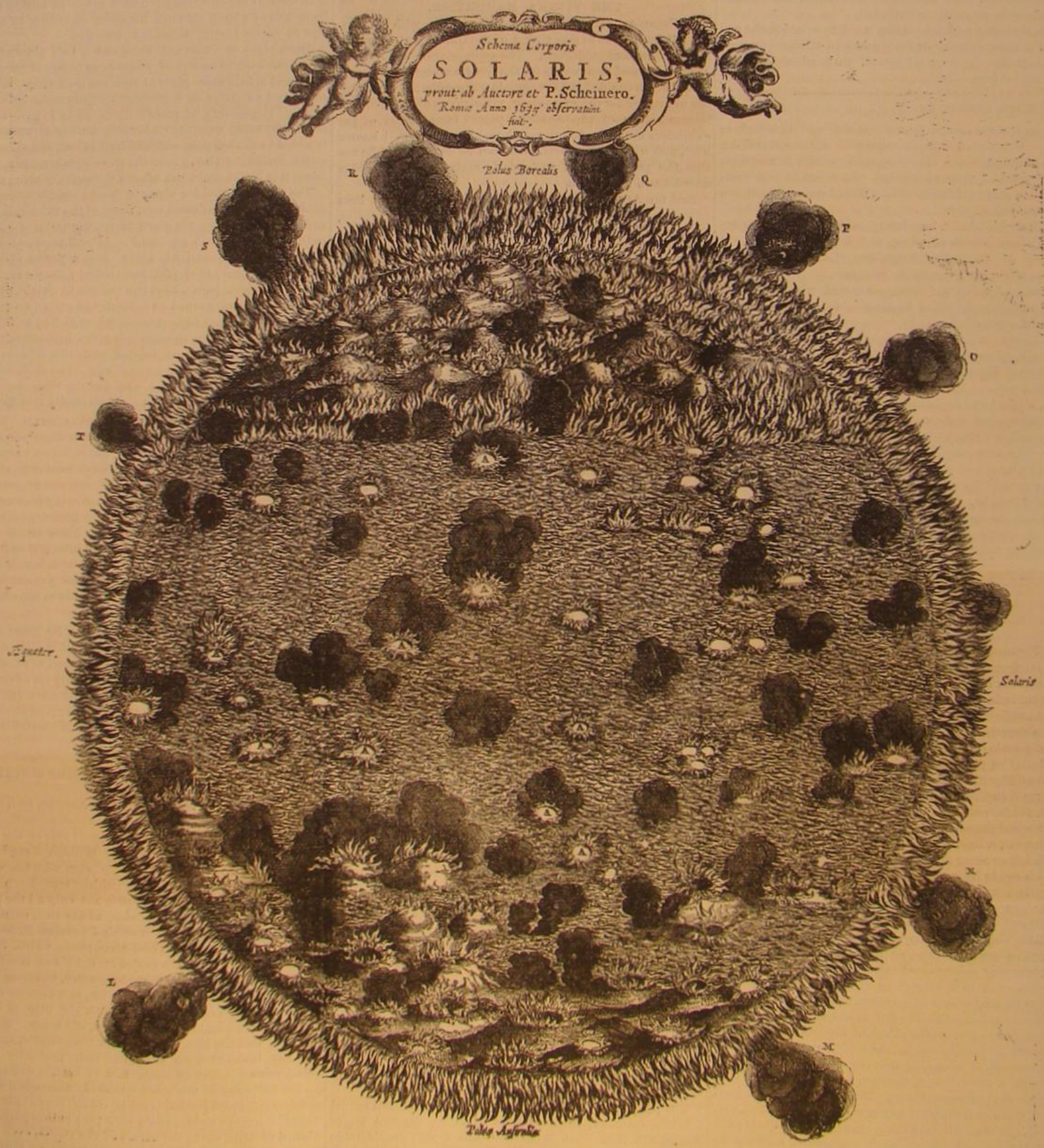
many of which still contain the following sentence: "The sun is a dark body surrounded by a luminous atmosphere."

Thanks to the revelations of the spectroscope, we know now that Isaac Newton was perfectly right when he estimated the temperature of the solar body to be many thousands of degrees. It is, in fact, so high that, according to his statements, we, with our most intense fires, cannot form any adequate conception of the same.

As a proof of the correctness of our assertion as to the opinions in regard to the nature of the sun, during the century preceding Newton, we publish herewith a reproduction of an engraving made more than two hundred years ago in a cosmographic work, written in Latin by Father A. Kircher, and published in Amsterdam, Holland, where a translation of this book into the Dutch language appeared in 1682. It consists of two folio volumes, and is illustrated by many woodcuts and engravings on copperplate. The work is, as all works of that time were, a curious mixture of truth and untruth, filling the reader, in succession, with admiration at the patience and sound judgment of the author and then with surprise at his credulity in recording evident errors as positive facts. The article on the sun, explanatory of the engraving which we reproduce, is one of the remarkable instances in which the author is on the side of the truth, and he even anticipates the modern ideas resulting from discoveries of two centuries later. We can only give an abbreviated translation as, like all old writings, it is too long winded for readers of the 19th century. He says, in substance:

"The great and good Architect of the universe, has given us an image of His Divinity in a body which causes all life, motion, and being, the sun, which (as a soul or mind of the universe) is, in the material world, the visible representative of the invisible God; by it He created light and order out of darkness and chaos, and revealed to man the majesty of the invisible power to which he owes his very existence." . . . . . "Notwithstanding that we see the sun daily, we must be amazed at its beauty, and notwithstanding that it is given to no man to obtain a correct knowledge of its nature, the question arises: What does that glowing substance consist of? To this I answer that *the sun is a fiery body condensed from a heavenly vapor*, out of which heat and light flow off to all things, as out of an inexhaustible fountain of fire; which heat and light, combined with the seeds of the earth, produce the wonderful variety of things which we daily see here below. The sun, then, *is a sphere, rough and uneven, consisting partially of liquid and solid matter*, which would appear incredible, if it had not been proved by the very excellent magnifying spyglasses, invented for the inspection of the stars. If such a glass is attached to the hole in a blind of a dark room, and turned toward the sun, an image of the same may be thrown on a white sheet; it will be seen that the surface of the sun is uneven, has shadows and lights, and is rough like the waves of an ocean, and that it varies and is not today as it was yesterday. All of which has been described by the celebrated Scheinerus. Sometimes also large spots, some of them dark, and some light, are seen, which last several days, sometimes disappear and reappear again after some days; these spots are especially seen at certain positions of the stars. All who have ever seen the large crucibles for the melting of metals, and noticed the surface of the white hot metal and the motions on its surface, can form a better idea of the appearance of the surface of the sun, whence sometimes smoke arises, as I have seen myself in Rome with Scheinerus, on the 4th of April, 1625, wherefore I have judged it appropriate to add here a picture of what I saw. That these images of shadows and *faculæ belong to* the solar surface is evident from common reason. We must then conclude that the sun is a heterogeneous fiery region, where changing spots, smoke, and *nebulæ* arise from the surface, now boiling up, then again disappearing, as in a fiery ocean agitated by constant motions and drift currents. All those who will further investigate these wonders of the sun will, without doubt, easily understand the origin of the comets." . . . . . "In order that the sun should better give its wonderful power to the other heavenly bodies, the Architect of Nature made it turn around on its axis, as recently demonstrated by the astronomers; while the earth is provided with a vapor region made from the *evaporations* from our earth, the rising of which moderates the too great heat of the sun, so as to give us a moderate amount."

We will not follow our author, the Reverend Father Kircher, any further, but only remark that his picture shows the dark sun spots, and the *faculæ*, marked A; the poles and equator are also indicated, by the Latin names; while however, the most remarkable of all are the protuberances, marked L M N O P Q R S T. It is not a little noticeable that he introduced them in the picture nearly two hundred and fifty years before the instruments, which proved their real existence beyond a doubt, were invented. On the whole we consider this picture as a very remarkable production for that time, in which even an attempt had been made to represent the so called willow leaf appearance of the solar surface, a discovery of modern astronomers, the production of which in so old a record of observation is, to say the least, a remarkable coincidence.



APPEARANCE OF THE SUN AS DRAWN BY FATHER KIRCHER IN 1682.

Correspondence.

Distinguishing Fibers in Mixed Goods.

To the Editor of the Scientific American:

Unquestionably the microscope is the best means of accomplishing the purpose of your correspondent, described on page 161 of this volume; it is the simplest, quickest, easiest and surest. All and each of the fibers named in the article are constructed—built up, so to speak—in different manners, so distinct from each other that a moderate magnifying power, say 400 diameters, of a decently good instrument will show at once what they are. Any one with a very little skill in manipulation can obtain the result. The differences have been described and figured in the books, but there is no need of books. Every one can obtain genuine fibers of either kind, with almost less trouble than referring to a book, for comparison with those found in the fabric, and the original comparison is of far more value than the authority of a picture. No chemical test is known to distinguish flax from cotton fiber, but their difference in the microscope may be seen at a glance. Jute fiber has more resemblance to flax, but can be distinguished with a little more study. The materials of paper may also be ascertained, in part at least, by the microscope; for example, your number dated March 15, is printed on paper containg no cotton or linen; it is mostly wood fiber with "pitted" and "scalariform" ducts, not peculiar to any kind of wood, with possibly fibers of manilla, esparto or ramie, of which I have not the means of comparison.

But the microscope cannot do every thing. There is a certain fabric in use purporting to be made entirely of cows' hair. The question came up: Is there any sheep wool in it? This could not be answered. For, while the bulk of each is easily distinguished, there are some hairs from each animal that cannot be known from the other. In this case, so far as is known, chemistry is equally powerless.

Boston, Mass. CHARLES STODDER.

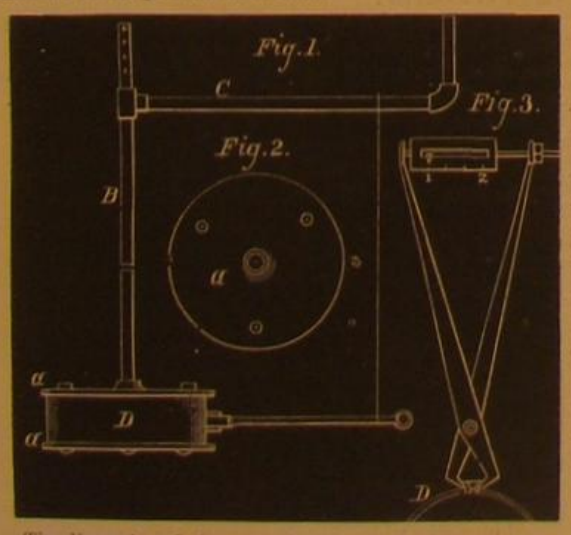
Bursting Strains of Cylindrical Boilers.

To the Editor of the Scientific American:

In the discussion of the boiler question in your issue of February 22, Mr. Creuzbaur is trying to show that there is no force tending to tear the shell at X X (in the diagram), except a vertical one, so long as the points remain the same distance apart, etc. Now they would not long remain the same distance apart, if something did not hold them there; and the very force which would spread them is what makes the extra strain that he overlooks.

But in all the diagrams the matter is placed in a false light. In a boiler the force is acting in all directions from center to circumference, where it is changed to the direction of the circumference. It evidently bears some relation to the force acting in the former direction. Now let us see what that relation is. The force acting from center to circumference tends to enlarge the diameter, and the shell or circumference resists that enlargement. As I said in a former communication, to enlarge the diameter 1, the circumference must be enlarged 3·1416; therefore the whole pressure in the ring (any width) is to that tending to separate the iron at any and every point as 3·1416 is to 1; for we cannot ignore the very foundation law of mechanics, that what we gain in velocity we lose in power, and *vice versâ*.

I think if any one has the desire to try an experiment and make known the results, it might be of much benefit to many, and perhaps lessen the number of boiler explosions. I inclose a rough plan of an apparatus which would if properly made, I think, give the true result.



The dimensions I give are, of course, not arbitrary; a machine of much larger dimensions would reduce the friction to a minimum, and give more accurate results.

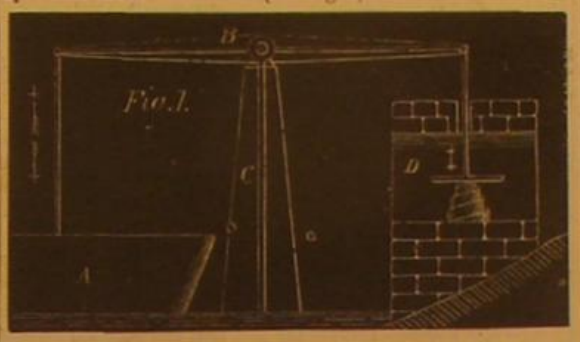
In Fig. 1 (elevation), *a a* are two metal disks, say a little more than 7 inches in diameter, faced true and smooth in the inside for about 1¼ inches from the outer edge; they are held 1 inch apart by three thimbles and bolts, as shown. B is a gas pipe 1 inch in diameter, with a line of holes at one end; a convenient length for the pipe would be about 27¾ inches to the first hole, which is the hight corresponding to 1 lb. of water. C is a feed pipe for filling B with water, which enters at the side to do away with the impact that would arise if the water entered the top of the pipe. D is a light metal strap or band, 1 inch wide and a little more than 22 inches long, bent into a ring, with two small lugs soldered on near each end, so that, when they are brought together the ends will overlap a little, making the ring 22 inches in circumference. These are to be held together by a nicely made double lever or tongs, Fig. 3. The tongs are to gripe the lugs close to the band, as shown. Let the two ends of the levers be proportioned as 1 to 7; put in a spring index between the long ends, as shown; screw it up to 1 lb., then the other end will be brought together with a force of 7 lbs. The levers with the index can be suspended from the feed pipe. The band, D, must be nicely fitted between the disks, so that it will move without friction, and a slight leak will not affect the result. The thimbles should be set near the inside of the band, so as to keep it in place. Now let water flow out of the feed pipe and fill the pipe, B, up to the first hole; and, if my theory be right, a little above that will move the index. By carrying the pipes high enough, or by re-adjusting the index, the true relation can be ascertained. C. P. EVERED.

Montgomery city, Mo.

The Ocean Tides as a Prime Motor.

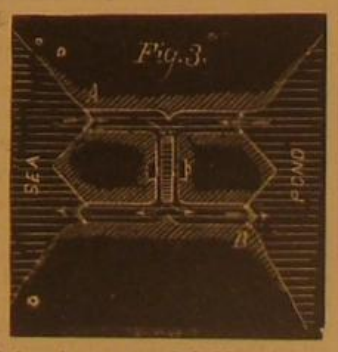
To the Editor of the Scientific American:

In an article on page 64 of the current volume of the SCIENTIFIC AMERICAN, "The ocean tides as a prime motor," you describe the enormous power of the tides, adding the remark that to utilize it constitutes a problem for the engineers of the future. I wish to communicate to you two methods to accomplish said purpose, which have been introduced and have, in some degree, been deemed satisfactory. The first is as follows (see Fig. 1):



The tide lifts the float, A, from which power is transmitted by means of the beam, B, pivoted on vertical standards, C, to the building or pillar, D. The power may be applied directly or, as has been proposed by some engineers, transferred to strong spiral springs, which may be secured in place and carried to the required situation for use at a distance.

Another method is the following (Fig. 2): A pond is built near the coast and is connected by a canal with the sea. An undershot water wheel is placed in the canal. The rising tide will turn the lower part of the wheel toward the pond, the falling tide towards the sea; because the level of the sea was higher than the pond in the first place, and lower in the second. This necessitates a peculiar construction of the wheel, as the paddles have to be placed radially, and a gear for reversing the direction of the power is required. To avoid this, the following construction was used (Fig. 3): Two parallel canals were made to connect the pond and the sea, and the wheel was placed in a third one, connecting the two others. The mill was erected on the islands formed by the canals. Four sluices, two for each canal, were built, the sluices of one opening towards the inside, those of the other towards the outside. The flood tide opened the sluice, A, at one end, holding it open, and it closed the other end and enter the pond through the lateral canal and sluice, B, moving the undershot wheel in the direction from the first to the second canal.



The ebb tide returned by opening sluice A, passing in the same direction through the connecting canal and through B to the ocean, turning the water wheel in the same manner as the flood tide did. This system requires only four well acting locks, which may be easily obtained by constructing a proportionately large pond. E. & E. S. EDWARD.

Dresden, Germany.

Psychic Force on the Slate.

To the Editor of the Scientific American:

I wish to invite the attention of scientific men to the phenomenon called spiritualism, as it has lately been developed here. Although somewhat ridiculous, yet it is wonderful; and if intelligent people will investigate it thoroughly, and discover the source of the mysterious power which some mediums possess, they will confer a boon upon mankind. I am not credulous, I do not believe it to be spirits, but I am at a loss to explain it. I will describe the apparatus so that all may experiment, but I understand that the medium power is possessed by but few; yet the reader of this, or perhaps some of his friends, may possess the power. Try it.

Cover a table with some fabric that will exclude the light from underneath, as it seems that darkness is necessary to success. Then provide an ordinary school slate with a lot of short pencils. Place a chair so that you can hold the slate under the table. Take the slate in one hand, hold it by the frame horizontally under the table. After having placed a piece of pencil on the slate, be sure the curtain is down to exclude the light. If you possess the medium power it will soon make itself evident by raps, or you will hear the piece of pencil fall on the floor, sometimes striking the table violently. When the pencil falls, replace it with another. If there is any demonstration, ask if there is a spirit present; if so, make it known by rapping on the slate. Three taps signify "yes;" two, "no;" one, "don't know." If the answer is yes, ask if it can write. If yes, then ask any question you wish and an answer will be written on the bottom of the slate; the pencil falls as soon as it has done writing. You can distinctly hear it writing, dotting the i's and crossing the t's. I have seen the above performance and have been allowed to hold one corner of the slate, and could detect nothing unfair on the part of the medium. I have held his arm just below the elbow, where I could detect the slightest movement of the fingers, and could discover none except when the pencils would fly violently off; then there was a slight twitch of one of the muscles, but I cannot see any possible way for that to be fraud. We guarded against everything in the way of fraud. Place a piece of pencil on a slate and hold it horizontally in one hand and try to throw it upwards without much effort.

Now the problem is: how is the writing done? If you have never seen this mystery, I advise you to do so and satisfy yourself before you express an opinion. The whole thing is ridiculous, I must confess, but the charm is the mystery, and the wonderful writing is in different styles of penmanship. If a lady spirit writes, the writing is peculiarly correct, punctuated, etc. Each individual spirit writes in its own peculiar hand writing, differing from others as we mortals differ in our writing. I could continue this communication to some length, but my object is not to relate my experiments but to have others experiment for themselves.

Chattanooga, Tenn. S. C. DODGE.

The Recent Boiler Explosion at Conshohocken.

To the Editor of the Scientific American:

In your issue of March 8, 1873, Messrs. I. Wood & Brother, of Conshohocken, Pa., publish a communication in which they seem to feel aggrieved that I should have spoken freely regarding the lamentable loss of life by the explosion of their boiler. It is of course exceedingly unpleasant to state the truth about a matter of this kind. I know that Messrs. Wood are exceedingly honorable men and would in no wise be guilty of doing ought that would imperil the lives of their fellow citizens or their employees. My motive was not to make an attack upon Messrs. Wood, or to accuse them of culpable carelessness, or to speak of them disrespectfully. It was only to call attention to the circumstances under which this boiler exploded, in order that men who employ similar means and appliances for power might not do as they have done.

In their communication to your paper, they claim that the boiler was good because it was old, and that it had had steam on it and been in use since 1854, a period of nearly 20 years. I do not think that a boiler is, like wine, improved by age. My experience tells me that no boiler should ever be in use more than ten years.

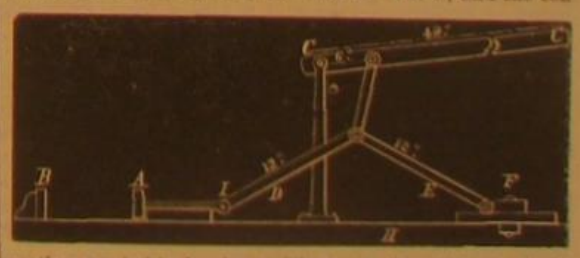
Messrs. Wood state that there was no steam gage attached to the boiler, it having been shut off for repairs. I do not think there is a mechanical engineer in the civilized world who would expect that a boiler nearly 20 years of age, with no steam gage upon it, would indicate pressure to the eye of the man attending it. I do not think that any cultivated engineer of experience could be found who would not most emphatically say that there was danger that the boiler of the Messrs. Wood would explode. W. BARNET LE VAN.

Philadelphia, Pa.

The Power of Compound Levers.

To the Editor of the Scientific American:

I would like to know what force one pound at the end of the lever, C, would exert on an object between the stationary block, B, and the sliding head, A, when the arms, D and E, are nearly straight, or are exerting their greatest force. The lever, C, is 48 inches; the fulcrum is at G, and the connecting arm is 6 inches long. The arms, D and E, are, 2 inches long, and E is stationary at F, on the bed plate, H, and D is connected at I with the sliding head, A. J. C. C.



Morenci, Mich.

REMARKS BY THE EDITOR:—The relation of the effort exerted to the resistance which can be overcome, varies with every change of position of the lever, up to a power which would break down any machine built of inelastic materials. See our reply to A. B., in the SCIENTIFIC AMERICAN of March 8, 1873.

Ignition by Superheated Steam.

To the Editor of the Scientific American:

In my communication published in your paper of February 8, I endeavored to lay before your readers some facts in regard to the use of superheated steam and its relation to fires,

I attempted to give a faithful statement of all the facts bearing upon that subject, and I am glad to see any corrections or additions which may be made to the same. The further light Mr. Miller (in your issue of the 8th instant) throws upon the subject is worth consideration. He points out that the lagging was well saturated with linseed oil, and that even some oil from greasy waste may have reached the felting. The engine had run for nearly a year, certainly for some weeks, with about the same quantity of oil in its lagging and felting, with no signs of fire or smoke, while six hours with the Miller boiler sufficed to set it on fire. The steam pipe of which Mr. Miller speaks was wound with yarn and felting, and covered with whitewashed canvas as far as the engine room, say within 18 or 20 feet of the throttle valves. Within the engine room it was first covered with a thickness of felting, and over that were the pine ribs to which the lagging was fastened; while, about the engine, the pine ribs were in contact with the metal. It is also to be observed that the close covering of a symmetrical pipe would prevent any circulation of air about the felting, while the lagging about the throttle valves was quite imperfect, especially at the bottom. Whether superheated steam, rather than ordinary saturated steam, caused this fire or even had anything to do with it is what we are endeavoring to discover. The conditions were in all probability the same, and what those conditions were I have endeavored to state; I have studiously avoided doing more than that.

And here it seems to me that Mr. Miller ought to have rested. Why he should pull the subject out of its legitimate bearings, I can hardly understand. If he chooses to set forth in your columns the superiority of his boiler over others, or the value of superheated steam, I can have no objection thereto, but I do protest against his using a report not his own, without the consent or knowledge of its owners, to further that object. Those experiments, Mr. Editor, were incomplete. The Miller boiler was in use but six hours, and other considerations had led us to refrain from publishing the report in order that the engineering and manufacturing community might not be misled by partial reports. Whenever we can speak intelligently and sincerely of the superiority of the Miller boiler, we shall gladly do so; but the report which Mr. Miller sent you has but little value in deciding that question.

A. F. NAGLE,
Providence Water Works. Mechanical Engineer.

The Nebular Theory and an Inquiry into the Reason of Kepler's Harmonic Law.

To the Editor of the Scientific American:

Having long been an interested reader of your valuable journal, and for many years devoted to astronomical study, I would beg a small space in your columns, in order to give what I think may be some reasons for a belief in the relations which may exist between what is known as the nebular theory and one of the laws of Kepler, known as his third, or harmonic, law.

In considering the nebular theory we are led to presume that the sun, as a gaseous body, may at one time have extended even beyond the present bounds of the orbit of the planet Neptune; and that other planets revolving far beyond his orbit, as yet undiscovered by our present telescopes, may have been first thrown off from the solar nebula during the earlier births in the family of our solar system. Be this as it may, we are acquainted with a sufficient number of the members of that family to answer our present purpose. According to the nebular theory, the solar system, including the sun, planets, planetoids and comets, originally existed in one body in a gaseous state, similar to the planetary nebula and extending at least beyond the orbit of Neptune, and perhaps much further, if we take into account some of the comets of long period. This gaseous body must have been very highly heated in order to maintain the more refractory substances in such gaseous condition. And, judging from our present knowledge, a portion of this heat would be subject to a continual diminution from the radiation of heat in space. A necessary consequence of this loss of heat would be a corresponding contraction of the gaseous body, and an acceleration in the axial rotation. And as the exterior, or outlying, portions of this gas would be more mobile, less under the influence of gravitation, and would less readily obey the tendency to accelerated rotation, a condition would eventually arise in which the tangential or centripetal force would become equal to the central or gravitating force. This condition once attained and the contraction of the central mass still continuing, such outlying portion would become detached and, possessing the tangential motion of the equatorial portion of the remainder of the mass, would start out on its orbit in the same direction and continue to revolve around such remaining mass as a planet. This planet, still remaining in a gaseous state, would be subject to the same conditions as the parent mass; receiving an axial rotation, taking upon itself the form of an oblate spheroid, obeying the law of gravitation, parting with a portion of its heat, undergoing contraction, and increasing in its axial velocity, until finally this same planet would, in a similar manner, give birth to a secondary planet, or satellite. This process would continue in both solar and planetary masses, so long as their external portions should be sufficiently mobile and the force of gravity overcome by the tangential force. Astronomical science contributes much evidence tending to show that our whole solar system has thus been evolved from matter once in a nebulous condition.

At first sight, the ring of Saturn might appear to form an exception to the above theory; but if we consider that, in that case the outlying enveloping portion, when detached, might have been much more uniformly distributed around that planet's equator; and thus continue to remain unbroken, subject, perhaps, at some future time, to be again subdivided into innumerable small satellites. What gives additional strength to this theory is the fact that these planets and satellites continue to move in an orbit around the equator of their parent, or very nearly so, and that is precisely the place, owing to the greater tangential force and the smaller amount of gravitation, from which such detachments should be expected to take place.

In seeking for a sufficient reason for the existence of Kepler's harmonic law, we have only to consider that it will be evident that, after the solar mass had parted with its loose outlying portion, it would be likely to be some time before it would again have contracted sufficiently to repeat the operation, especially if these detachments were assisted by some eruptive force, such as we find to be still existing in the sun. The contraction might be tolerably uniform, but, the detachments being in masses, would only take place as at so many successive stages. At each of these stages the tangential velocity would be greater than at the preceding stage, precisely as these orbital velocity of the planets and satellites increases in a certain ratio as they are near to the sun. We may note also in passing that these orbital velocities are in proportion to the masses and distances of their respective primaries.

Considering that there has been the same constant relation between solar matter and the forces (to which it has been subject from the earliest to the present condition of the sun) throwing off these detached masses at different stages of contraction, at tolerably related intervals, and at decreasing distances from the center of the mass: can there be any difficulty in accounting for the existence of Kepler's harmonic law? The question may be asked: Why has not the sun thrown off any other planet after Mercury, or Vulcan, if any such planet exists? To this it may be replied, that, as the central mass continued to contract, its density would continue to increase, a time would arrive when the tangential and eruptive forces combined would be insufficient to overcome the central or gravitating force, and, consequently, no more matter would be thrown off. Astronomers believe that that time arrived long ago, perhaps millions of years.

The spectroscope reveals the fact that the planetary bodies are composed of the same elements as the sun itself. Astronomers now generally believe that our moon has lost nearly all of its radiant heat. As her mass is only about one eightieth of that of the earth, it is no wonder that she should have cooled so much faster than our globe has. The masses of Jupiter and Saturn also, being much greater, will account for their cooling more slowly than the earth, and retaining to the present time more of their heat and gaseous condition, giving light to their satellites in addition to that which the latter derive from the sun. This condition of those planets will also account for the change of form which they have been seen to undergo, which could not happen were they as dense and as rigid as the earth now is. The later discoveries in astronomical science appear to contribute more and more evidence tending to confirm the nebular theory.

I know not whether it is yet an ascertained fact that the sun is still contracting from loss of radiant heat, but I firmly believe that, if not, it will be demonstrated in the future, when sufficient time has elapsed to make a comparison between the sun's distance and apparent diameter at one epoch with the same elements at another epoch.

To conclude, the science of astronomy is destined, in the future, to engage the highest intellects, and to command the exercise of the most abstruse methods of investigation and calculation.

E. H. PRICE, M. D.
Tamaroa, Ill.

The Duplex Telegraph Instrument.

To the Editor of the Scientific American:

In page 65 of the current volume of your esteemed paper, I find an article on the duplex telegraph instrument in England. You claim, in the article, this invention as an American one of some years standing. I take the liberty to bring to your notice the fact that Messrs. Siemens & Holske, telegraph engineers of Berlin, obtained in 1849 an English patent on the simultaneous telegraphing of a large number of despatches by means of combined wires. They improved that method in 1856 in such a manner that replies could also be sent, by which the method became practically important. The simultaneous telegraphing in one direction was not so much of a success.

In the summer of 1854, Professor Edland, of Stockholm, took up the same subject, and obtained the same result independently of Siemens and Holske, telegraphing (in August 1856) by his system between Stockholm and Upsala. In January, 1855, the line Stockholm—Gothenburg was worked on his system (see Poggendorf's "Annals of Chemistry and Physical Science," vol. xcviii, pp. 115 and 632).

I hope that you will accord a space in your paper to the vindication of the priority of a German invention.

Dresden, Germany. ERNEST SCHURMANN.

Fog Trumpet Signals.

To the Editor of the Scientific American:

My object in writing this is to present an idea for consideration in relation to the fog trumpet. It is a very useful instrument to the mariner in warning him of contiguity to land when other means fail; but though it has a voice (and a loud one) it has no speech, and this I propose to add.

Sounds of ascertained duration may be learned and be understood to represent the alphabet; our telegraph operators read by sound. You will at once see that I am indebted to that eminent man, Professor Morse, for this idea. Morse's alphabet, as everybody knows, is represented by dots and dashes. I propose to use figures instead of letters, the figure 1 for the dot and the figure 2 for the dash, and make the combination as follows, which can be altered to any extent: 1, 2, 11, 12, 21, 22, 111, 112, 121, 122, 211, 212, 221, 222, 1111, 1112, 1121, 1122, 1211, 1212, 1221, 1222, 2111, 2112, 2121, 2122. The last number in this series is —. — — and, if so arranged, will stand for z. The next thing is to apply to the trumpet a mechanical arrangement controlling the motive power that is used in the vibration of the trumpet's tongue. This will be no difficulty.

The object of this is to spell out the name of the locality for the information of vessels within hearing, Cape Race for example; the second word would be quite enough to let mariners know their position. There should also be power to use this valve by the keeper for the purpose of communicating with a ship at sea, and when this is done, the alphabet being known and a trumpet provided in every ship, communication between ship and shore and between ships at sea, in fog or in the night, would be greatly facilitated. I am inclined to believe that the steam whistle in steamers would answer the purpose, also that two telegraphic operators of experience could communicate intelligibly with each other at a distance by this means. I do not seek gain in this, but only to benefit humanity at large.

E. BRACE
St. John's, Newfoundland.

Uncontrollable Fires.

To the Editor of the Scientific American:

The article of P. H. Vander Weyde in the SCIENTIFIC AMERICAN of January 6, 1872, on the "Latent Heat of Dissociation," explains in part why great fires are so uncontrollable. It is there stated that, when steam is heated to 5072° Fah., it is decomposed into a mixture of oxygen and hydrogen gases, and about 8,000 units of heat are made latent; and when the gases again unite, which they will do when cooled by contact with colder substances down to a point below 5072°, the 8,000 units of heat will again become sensible, the process being analogous to that by which 962 units of heat are made latent when water is evaporated, the same amount of heat being again made sensible when the steam is condensed.

In great fires there is always a great quantity of water in the burning materials, and the heat is doubtless above 5072°. The result would be that the mixed gases would be driven out of the fire and would recombine as soon as sufficiently cooled, exposing any building or other object upon which they might strike to the heat of an oxyhydrogen flame.

Oshkosh, Wis. SAMUEL P. GARY.

Action of Glycerin on Strychnia.

To the Editor of the Scientific American:

I notice, on page 57 of your current volume, that P. Bert has found a remarkable property in carbolic acid, namely, that it will dissolve strychnia, and he recommends it as a test for that alkaloid. In last November, I had occasion to use strychnia with a solution of carbolic acid in its own weight of glycerin. I used one grain of strychnia in half an ounce of the solution. The mixture was clear; but after standing three or four days, the weather being cold, it looked creamy, and on the top there was a stratum of a reddish brown color of a quarter of an inch thick, which I attribute to "sulphoglyceric acid," as the alkaloid was a sulphate. By an examination with the microscope I find it to crystalize in long slender crystaline needles, somewhat like the barbs on a wheat ear, being tied together and branching out at an angle of about 80°.

I have not used carbolic acid as a test for strychnia, nor have I seen it so used, but I should be glad if this should awaken more research in regard to the feasibility of its being used for that purpose.

CLARENCE OWEN.
Bloomington, Ill.

The Million Dollar Telescope.

To the Editor of the Scientific American:

I fully concur in the idea advanced in the SCIENTIFIC AMERICAN, by F. H. R., with regard to the million dollar telescope, and you may count on me for at least three shares, and very likely, if I see it is to be a success, five shares. If times are hard, I will also be one of those to attend a meeting to help on this grand enterprise. If you see fit, make use of this in any way to agitate the subject.

STOCK HOLDER.

CENTRAL AMERICAN VOLCANOES.—A correspondent in Salvador, in Central America, under date of December 8, writes to the *Panama Record* as follows:—The volcano, which is some leagues distant from the town of Santana, has dried up a lake which for 500 years or so existed at the base of the craters; but although vast quantities of steam are ejected, and the trees lining the inside of the crater are scorched up and withered, as also are those to a limited distance near the top on the outside, no ejection of lava has yet taken place. The volcano of Isalco, which was active until quite recently, now shows no sign of life; and the supposition is that some strata which cut off the communication between the two volcanoes have burst through or fallen in, and so changed the channel of the fire.

A CORRESPONDENT, T. M., says: Cut your coiled paper collars into strips for tapers. They burn slowly and are not easily extinguished.

POST OFFICES were first established in France in 1464; in England in 1581; in Germany in 1641.

THE STRENGTH OF TIMBER.

BY JOHN ANDERSON, C. E., LL. D., F. R. S. E.

The strength of a piece of timber depends upon the part of the tree from which it is taken. Up to a certain age, the heart of the tree is the best; after that period, it begins to fail gradually. The worst part of a tree is the sap wood, which is next the bark. It is softer than the other parts of the wood, and is liable to premature decay. The deleterious component of the sapwood is absorbed if the tree is allowed to grow for a longer period, and in time the old sapwood becomes proper timber fiber similar to heart wood. Hence, the goodness of a tree, for timber purposes, depends on the age at which the tree was cut down. When young, the heart wood is the best; at maturity, with the exception of the sap wood, the trunk is equally good throughout; and when the tree is allowed to grow too long, the heart wood is the first to show symptoms of weakness, and deteriorates gradually.

The best timber is secured by felling the tree at the age of maturity, which depends on its nature as well as on the soil and climate. The ash, beech, elm, and fir, are generally considered at their best when of 70 or 80 years' growth, and the oak is seldom at its best in less time than 100 years; but much depends on surrounding circumstances. As a rule, trees should not be cut before arriving at maturity, because there is then too much sap wood, and the durability of the timber is much inferior to that of trees felled after they have arrived at their full development.

The strength of many woods is doubled by the process of seasoning, hence it is very thriftless to use timber in a green state, as it is not only weak, but it is exposed to continual change of bulk, form, and stability. After timber is cut, and before it is properly seasoned, the outside is found to crack and to split more than the inside of the mass, because it is more exposed to the desiccating effect of the surrounding atmosphere; but, as the outside dries, the air gradually finds its way to the interior. If timber is cut by the saw when green, and allowed to season or dry in a gradual manner, it is found to be the most durable. In the arts, however, artificial drying is often resorted to, as in the case of gun stocks. These are put into a desiccating chamber, where a current of air at 90° or 100° is passed over them, at such a rate as to change the whole volume of air in the chamber every three minutes, and it is found that a year of seasoning may thus be saved. The walnut wood is as good, after this process, as if the seasoning had been accomplished by time and exposure, and works more smoothly under the cutting instruments of the stock machinery.

Wood will always warp after a fresh surface has been exposed, and will likewise change its form by the presence of any moisture, either from that contained in the atmosphere or from wetting the surface. The effect of moisture on dry wood is to cause the tubular fibers to swell: hence it is that, if a plank or board is wetted upon one side, the fibers there will be distended, and the plank, in consequence, must bend.

The amount of the shrinkage of timber in length, when seasoning, is so inconsiderable that it may in practice be disregarded. But the shrinkage in transverse directions is much greater, and presents some peculiarities which can only be explained by examining the structure of the wood, as resulting from its mode of growth.

Mahogany is a beautiful, close grained wood, but is used not so much on account of its strength, but more frequently because of its non-liability to shrink, warp, or twist, and from the peculiar property of taking a firm hold of glue. In the last respect it is superior to any other wood. Mahogany differs greatly in regard to its closeness, hardness, strength, and beauty. That from Honduras, called "bay wood," is much inferior to that called "Spanish" mahogany, which comes from the West Indies; the former is much used in the construction of light textile machinery, but chiefly on account of its cheapness; and the latter is used for furniture or for other ornamental purposes. As regards strength, this wood is inferior to oak in all respects, and its great characteristic defect is unsuitability for exposure to the weather or, indeed, for any purpose where it is made alternately wet and dry. When so subjected, it rapidly decays, and loses all its good qualities.

Oak, taken as a whole, is one of the strongest and most durable of woods, and is especially adapted for exposure to the weather of a damp climate, and is indeed suitable for almost every purpose where the properties of strength, stiffness, and toughness, combined with endurance, are required. Its value for shipbuilding is proverbial, and in its employment for the staves of casks, for treenails, for carriage wheels, and for all such purposes requiring lightness and strength in combination, it is equally useful. From time immemorial it was esteemed the best timber for heavy roofs, and the condition in which some of these grand old roofs have reached our era fully attests the wisdom of the selection.

Clacking and Over-Reaching in Horses.

Common as are these two faults, they are frequently misunderstood. An over-reach is looked upon as an unavoidable accident, and clacking is treated by irrational alterations of the hind feet shoes. We couple them together because they present some common features. Both consist of interference with the fore foot by the hind one, both are due to some temporary defect in the action, and both can be prevented by altering the form of shoe. Clacking or, as it is sometimes called "forging" is the name given to the sound produced by the hind shoe striking the fore one in progression. It is usually heard at the trot, and seldom noticed in adult horses. It is most common in young horses out of condition and especially noticeable when they are tired. The noise is produced by the hind shoe striking the under surface of the fore one just behind the toe, not at the heels. When the blow has been repeated so as to leave an impression, the marks are found on the inner edge of the fore shoe. This is important, as it shows us that the length of the shoe is not at fault, and it suggests the removal of the part where striking occurs. Removal of this edge is equivalent to making a shoe concave instead of flat on the ground surface, and such a shoe is found to effectually prevent a recurrence of the objectionable noise. The ordinary hunting shoe, especially the narrow one made in a "cress," is the best possible form. For harness horses, where more substance is required for wear, the ordinary shoe seated on the outside instead of the inside is usually sufficient. A case may be met with in which this alteration is not effective. We must then alter the hind shoes, making them square at the toe, with two clips—one on either side—and set back a little on the foot. The wall at the toe should not be rasped off, but allowed to protrude a little. Too often the hind shoes are the first to suffer alteration, sometimes of a very objectionable kind; for instance, we have seen the toe of a hind shoe made diamond shaped and prominent, so as to come in contact with the sole of the forefoot instead of the shoe. This is a most irrational and somewhat dangerous expedient. It leaves the offending part of the fore shoe untouched, and favors the infliction of injury to the foot. Even when the hind shoe is only made short and placed back on the foot, there is a risk of the horn at the toe being unduly worn, and there is a shortening of the leverage of the foot which must more or less affect the powers of progression.

If a horse "clacks," rest contented at first with altering the fore shoes as we have described; improve his condition, and ride him up to the bit, but not past his pace.

"Over-reaching" is an injury to the heel of the fore foot. It is sometimes merely a bruise, but more often a lacerated wound, a small round portion of skin being left hanging, nearly detached from the heel. The offending part of the hind shoe is its inner circumference or edge, so that the injury must be caused by the hind foot being in the heel, and the skin caught as the foot is retracted. The inner edge at the toe of a hind shoe becomes very sharp after a few days' wear, and will cut like a knife. As in "clacking," the indication for prevention is to remove the offending edge. This cannot be thoroughly done with the file, but when the shoe is hot, the edge behind the toe can be cut out with the "fuller" so as to leave the shoe concave. As over-reaching is an accident peculiar to the gallop, it is well always to shoe hunters so as to guard against the occurrence. The neatest and best hind shoe for a hunter is made, like the fore one, in a "cress," and presents a concave ground surface and rounded edges.

When a heel is injured, it is always well to try and save the piece of skin. It should not be cut off until it is certain that it will not reunite to the tissues beneath. One good fomenting on reaching the stable is enough; after that use the simplest water dressing, and under no circumstances use poultices, which only increase the chances of a slough and retard the healing process. Should healing seem slow, apply a mild stimulant, such as a piece of lint wet with a mixture of carbolic acid, one part, to glycerin, twenty parts.

The Decay of Wood.

Wood, being vegetable matter, is of course liable to decay; but how to turn it to the best account with this known attribute to contend with may be worth inquiry. The closer the grain and the heavier the wood, the less liability there is to decay; but for building purposes, as at present carried on, light and open grained woods must be used. We cannot, in these times of excessive competition, go back to the old oak timbered and floored houses of our ancestors. It would, however, pay landlords to build solid, substantial houses, and let them ever at the present scale of rental. For instance, in digging away the foundations of the Savoy Palace, built upwards of six centuries ago the oak piles were found perfectly sound, as was the planking which covered the pile heads. But houses are built on a very different principle now, namely, to sell again, and perhaps again, before the permanent owner invests in them, and then a coat of paint and a judicious use of putty cover all imperfections.

The flooring boards, being kept in sheds, present quite a different appearance to the same quality of wood exposed on the quays. Putting on one side the question of expense, the practice of matting up the end of the piles, as practiced in the north of England, cannot be recommended. It certainly preserves the fresh appearance of the wood, and makes it appear as if just discharged from the ship; but it impedes the free circulation of air, and anything that does that is strictly to be avoided. Better by far have the wood shaken at the ends than sweating inside, with here and there places where the penknife blade sinks in with hardly any pressure.

The decay of wood arises from internal and not external moisture; hence the danger of shakes, as they admit it often to the very centre; and so long as free evaporation is allowed, decay will not very readily set in. It would be very absurd to say that no paint ought to be used in the interior of a house, but it is certain that a piece of wood painted on both sides will not last nearly so long as one not painted at all. The reason is evident. The paint effectually closes all the pores and prevents the evaporation of the moisture, which even the best seasoned plank will contain, and hence decay sooner sets in, in one shape or other. For the same reason wood painted on one side only will last longer than that painted on two sides. Thus in an old building, the wainscot, doors, windows, etc. will be found to be affected when the staircases will be sound, because never painted. The old houses in the quaint city of Chester prove the truth of this. Some years ago, a Liverpool builder who had some contracts there told the writer that the numerous exposed beams were generally sound, and they are all unpainted, but the inside work had apparently been renewed. The best that can be done, under all circumstances, is to give a coat of paint before leaving the workshop, and this is generally done, at least in the large establishments.—*Building News.*

Glacier Motion.

"In making some experiments on the freezing of water," says Mr. John Aitken, in *Nature*, "it was noticed that, after the same water had been melted and frozen a number of times, it generally burst the tube in which it was frozen." This phenomenon the author considers to be the germ of glacier motion, and he believes that the ice which has only been frozen once has more air in it than that which has been frozen and melted a number of times; as each succeeding freezing deprived the ice of a quantity of air or some other gases. The natural conclusion seems to be that ice with air in it is a viscous substance, adapting itself to the shape of a containing vessel, though pure ice does not.

In the detailed account of the experiments, we find that rods of snow ice, made in close imitation to the material composing glaciers, bent much more easily, when supported at the ends and acted upon by a weight suspended at the middle, than others made from ice from pure water. Small rods of snow ice, 2 inches in diameter, could be greatly distorted, but when it was attempted to bend them around a small cylinder, by the time the circle was half turned they broke, even under a pressure which they easily bore in the beginning. It was found that the bending of the ice had developed a lamellar structure in it, similar to that found in glaciers, which rendered the beams weaker on account of the cohesion of their particles along, the planes of lamination, rendered less. Hence, further experiment proved that, if a small portion of the circle was bent at a time and the pressure then removed, the particles evidently rearranged themselves; and by continuing the process, a ring of ice was produced from a perfectly straight beam. It is believed that these conditions of alternate rest and pressure, are, in all probability, those which exist in glaciers. After pressure has acted on one part of the glacier, bending takes place, so relieving the ice at that part from the pressure, which comes to bear on another portion of the glacier; and before the pressure again comes to bear on the first part, its strength and viscosity have been resolved by rest.

There are other causes which may assist in producing glacier motion; these are briefly enumerated by the author as follows: The sliding of the ice over its channel, this being assisted by melting of the ice where its rests on its bed; the melting point of the ice, in contact with obstacles, being lowered by the pressure of the mass behind; the melting in the body of the glacier, part of the water finding its way to the channel under the ice and part being refrozen; the crevasses in the glacier (due to the fracture of the ice) enabling large masses to move into different positions more easily, than if the ice were solid; and lastly, the old dilatation theory, which accounts for some of the pressure which causes motion.

Improved Paper Bag Machine.

The paper bag machine invented by Miss M. E. Towne, of Holyoke, Mass., and recently manufactured for the inventor by the Ames Company, is deserving of a more minute description than it has heretofore received. It is a handsomely ornamented structure about 10 feet long and 3½ feet high. The paper enters the machine from a roll, and is at first placed around a form, which can be adjusted so that a bag can be made of any width desired. The paper is worked along by a feeder, and the first process is to paste the bag lengthwise, which is done by a thin wheel rolling upon it, the wheel passing through paste in a dish slightly elevated from the machine. The paper then passes under a knife worked up and down by what is termed a continuous motion and stop motion, and a tucker catches the paper, holding it in position while it is being cut off. There are two small folders which work from each side of the machine, folding the bottom of the bag in the required form, and side arms to bring the paste to the center and paste the bottom of the bag. The bag then passes through a revolving press, which securely fastens the parts already pasted. The last tucker has an up and down motion, and places the last fold on the bottom of the bag, which is pasted by two more side pasters. The bag then passes through two more revolving wheels and is dropped completed.

Asbestos.

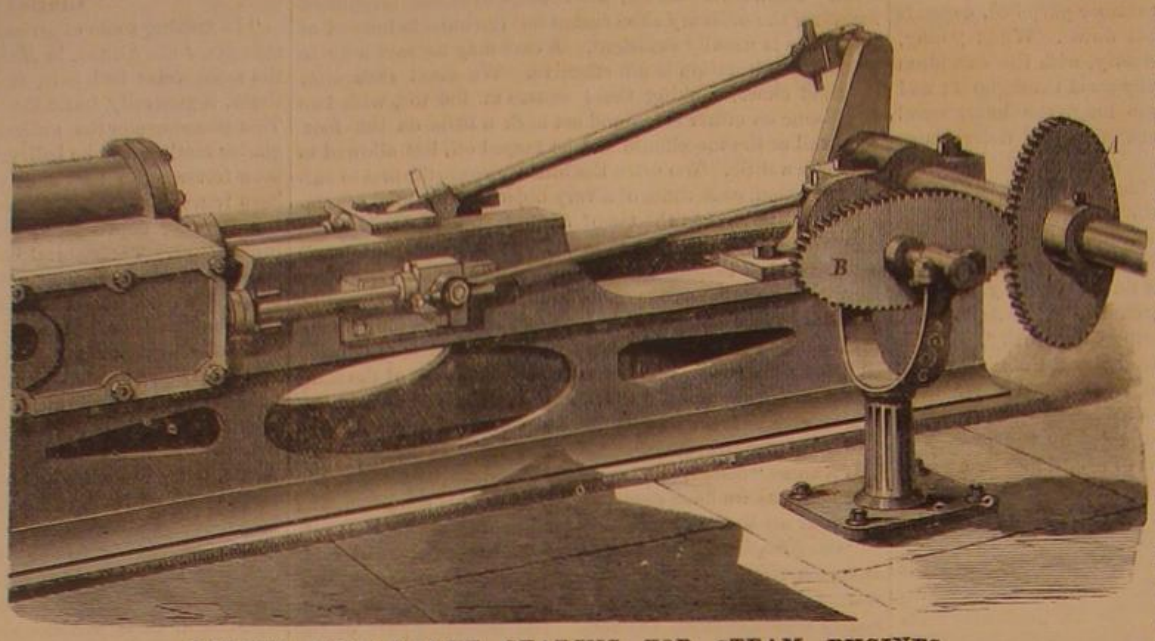
There are very extensive deposits of this important mineral within the limits of the United States, that found on the eastern slope of the Green Mountains and of the Adirondacks being of the best quality for fineness and tensile strength. The fiber of New York and Vermont asbestos varies in length from two to forty inches and resembles unbleached flax, when found near the surface, but when taken at a greater depth, it is pure white, and very strong and flexible. It is found also, in considerable quantities in the Tyrol, in Hungary, Corsica, and Wales.

MERCURIAL ointment is said to be one of the best materials known for preventing rust on gun barrels. It should be rubbed in thoroughly, both outside and inside, and well dried off, so as to leave but little on the surface. The quicksilver forms a thin film which protects the metal from moisture. The article may be obtained at any drug store.

NEW VALVE GEARING FOR STEAM ENGINES.

The invention herewith illustrated is designed as an improvement upon the mechanism generally employed in connection with the common or single slide valve in steam engines. It is proposed to so move the single valve by retarding and increasing its motion that the steam can be cut off at any point of stroke desired, and yet keep the port open at the exhaust end until the stroke of the piston is nearly completed. At this moment, the motion of the valve is quickened, throwing the other exhaust port wide open, almost instantly relieving the engine of exhaust steam. It is claimed that, by this means, a wider average port is obtained in a given time, or while the piston is moving a given distance, and that the cutting off is effected with a quicker motion than can be obtained by two eccentrics.

The desired object is, in this case, accomplished by means of the elliptical toothed gearing, A B, in our illustration, the wheel, B, being connected as shown with the valve. It will be observed that the varied motion is obtained as each toothed gear alternates from a large wheel to a pinion, twice in each revolution of the engine. By lengthening or shortening the crank on the small shaft, the valve is practically shortened or lengthened, and thus adapted to cut off at the desired point. The excessive compression or too early exhaust of steam when used expansively (due to the relative stationary position of the eccentric to the engine crank) is here claimed to be avoided, and the necessity of a cut off at the back of the valve (moved by an additional eccentric, thereby involving a loss of power) is also obviated. This gear can be fitted to any engine of the slide valve pattern in use.

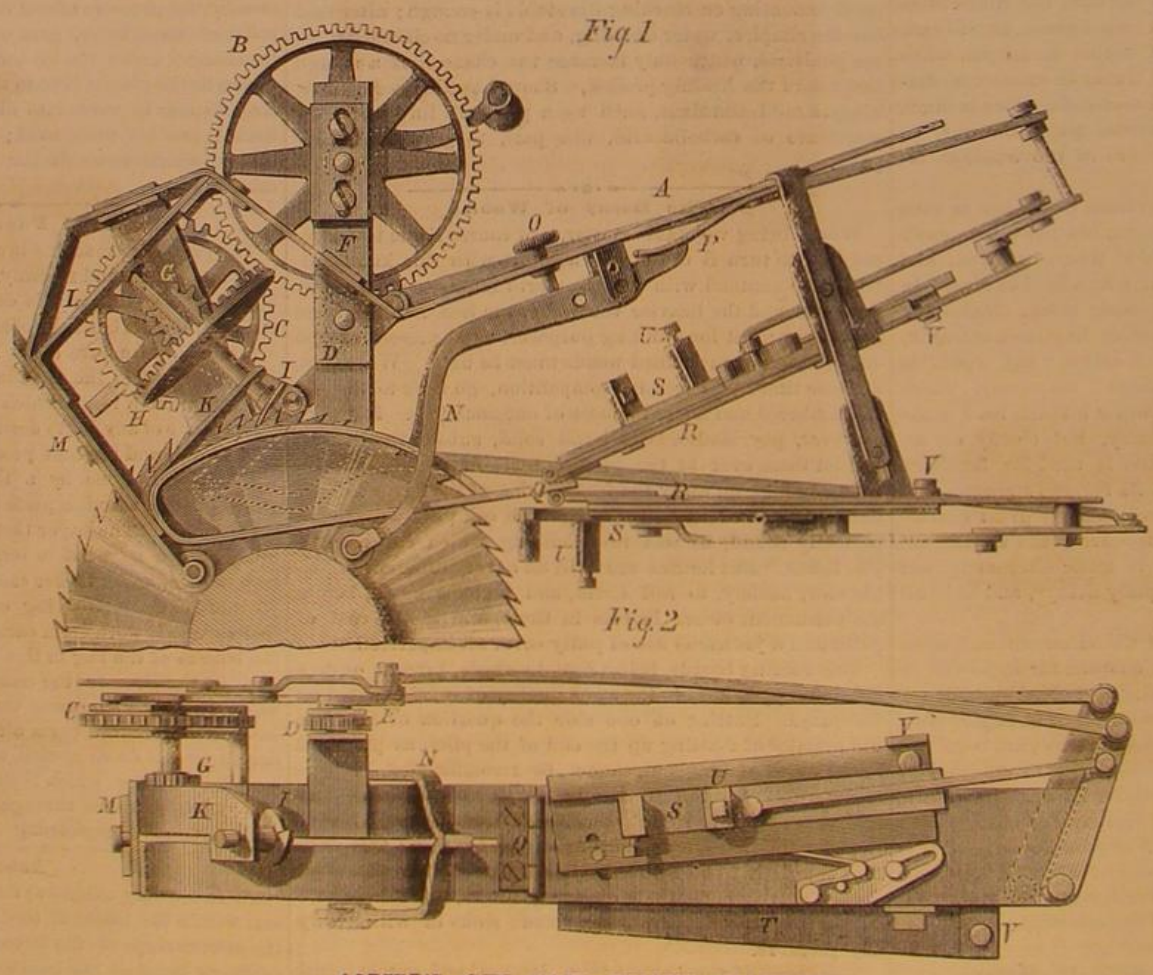


BACON'S NEW VALVE GEARING FOR STEAM ENGINES.

Patented October 15, 1872. Further information may be obtained by addressing the inventor, Mr. William S. Bacon, Sulphur Springs, Crawford county, Ohio.

GIN SAW FILING MACHINE.

We illustrate herewith a recently invented gin saw filing machine which, it is claimed, will fit and work well upon any form of cotton gin. A is the frame of the machine, and B the driving wheel, to which the hand crank is applied. C is a wheel acted upon by B, and D is a pinion under the latter. E is a crank on the axle of said pinion. F is the upright, with its brace attached to the upper and lower part of the frame, A. G is a small pinion which works in the horizontal cog wheel, H, on the upright shaft, which is placed at an angle of forty-five degrees, so that the feed wheel, I, may stand precisely with the pitch of the teeth. This shaft is held between the parts, K and D. The feed wheel, I, has a slit in the edge, the under lip of which is turned down so as to catch the next tooth at every revolution, thereby acting as feeder to the files. By suitably proportioning the above described parts, the files are arranged to have six strokes to each revolution of the driving wheel, B, and feed wheel, I.



ASBILL'S GIN SAW FILING MACHINE.

At the front of the machine is placed a sliding rest, M, the two small wheels at the lower end of which rest on the wooden cylinder of the saws when the apparatus is at work. N is a similarly arranged rear rest. On these parts, the whole weight of the machine is borne when it is adjusted to the saw. The front rest, M, is lowered or elevated by two screws in the slots. The rear rest, N, is depressed by the screw, O, and elevated by the spring, P. Q Q are the hinges, and R R movable plates attached thereto. S S are the file plates, T T movable or sliding spring plates, and U U file holders; V V are slides which serve to move the rear end of the file plates in or out from the center, thus giving the files a deeper or shallower cut on the teeth. The files are of the ordinary description used in handsaws, and are inserted in the file holders with the side screw against them and the top screw brought down upon their shanks, thus firmly securing them in their places.

In operation, the machine is set so as to allow the saw to come between the two halves of the frame and rest between the front wheels until the feed wheel, I, engages in the teeth. The front and rear rests are then regulated to take the whole weight, and so that the feed wheel has the precise range of the teeth. The movable plates are next adjusted until the files also have the range of the teeth, when they are firmly secured. The machine being steadied with the left hand, the crank of the driving wheel, B, is rapidly turned with the right hand, when the filing will proceed with great rapidity. The under file works upon the right side of the teeth and travels about ten teeth in advance of the top file, which operates on the left side. The operator stands with the points of the teeth toward him. The inventor claims that this device performs the work with neatness, uniformity, and lightning speed. He says that by its use a fifty saw gin can be filed within three hours.

Patented through the Scientific American Patent Agency, December 31, 1872. For further particulars address the inventor, Mr. Lewis M. Asbill, Charlotte, Columbia, and Augusta Railroad, Ridge Spring, S. C.

Red Cedar Hedges.

A correspondent, J. E. R., says that there is no timber for hedges comparable to the red cedar. It will do well in any soil with a little care at first. It is long lived, and grows very rapidly. To propagate it, gather the seed when ripe and prepare the ground as for drilling garden seeds. Plant the seed three quarters of an inch deep, slightly manuring the soil to force the growth at the start. The seed is abundant in Maryland, and our correspondent believes it will be valuable in many States where hedge trees are becoming scarce.

Sea Water for Extinguishing Fires, etc.

A correspondent, J. P., suggests that, in cities on the seaboard, large rafts might be arranged to rise by the power of the tides, and, in falling, be used to run light machinery and to force up sea water for washing streets and putting out fires. And in any inland city, where there is a flow of water, an iron tube might be arranged to catch the stream and turn it into an upright tube. The water would be driven upward *by its own momentum*, and a head would thus be created, varying in hight as the velocity of the stream, which could be used at discretion.

Observations on the Duration and Multiple Character of Lightning Flashes.

M. Arago has classified the different forms of lightning under three heads: 1st, linear zig-zag flashes; 2d, flashes appearing as a broadly diffused light (sheet lightning, heat lightning), and, lastly, the rarely occurring discharges which are seen as slowly moving balls of fire. The first form is due to the production in the atmosphere of a gigantic electric spark, and the majority of physicists and meteorologists suppose that flashes of the second form are due to the same cause, their light being seen either by transmission through or reflection from the clouds.

Professor O. N. Rood, of Columbia College, communicates to the *Journal of Science and Arts* an interesting paper detailing observations made by him on the nature of lightning flashes. The apparatus used was a small train of toothed wheels, driven by a spring so that it should be capable of rotating a circular pasteboard disk which was provided with four open sectors. On examining lightning flashes of the second form with this rotation apparatus, it was found that each flash consisted of a considerable number of isolated and apparently instantaneous electric discharges, the interval between the components being so small that they constituted a continuous act.

From the observations made, Professor Rood concludes that the nature of the lightning discharge is more complicated than has been supposed; it is usually, if not always, multiple in character, and the duration of the isolated constituents varies very much, ranging from intervals of time shorter than one sixteen-hundredth of a second up to others at least as great as one twentieth of a second; and, furthermore, a variety of the latter kind may sometimes be found in the components of a single flash.

In the examination of the spectrum of lightning by Dr. Vogel, a number of lines were identified as also occurring in the spectrum of the electric spark in the ordinary atmosphere, but what is remarkable; it was found that sometimes the spectra consisted of bright lines on a dark ground, while at others bright lines were traced on a less bright continuous spectrum, and, finally, sometimes a continuous spectrum destitute of lines was obtained. The discharges were principally of sheet lightning. Professor Rood considers that the continuous spectra destitute of lines were due to the prolonged constituents above referred to; and the occurrence of bright lines on a less bright ground, he refers to cases where instantaneous and prolonged constituents were noticed by himself, the normal spectrum of bright lines on a dark ground being produced by flashes more nearly instantaneous. It is also believed that zig-zag, heat, and sheet lightning are really identical, being in point of fact due to the same cause, but viewed under different conditions.

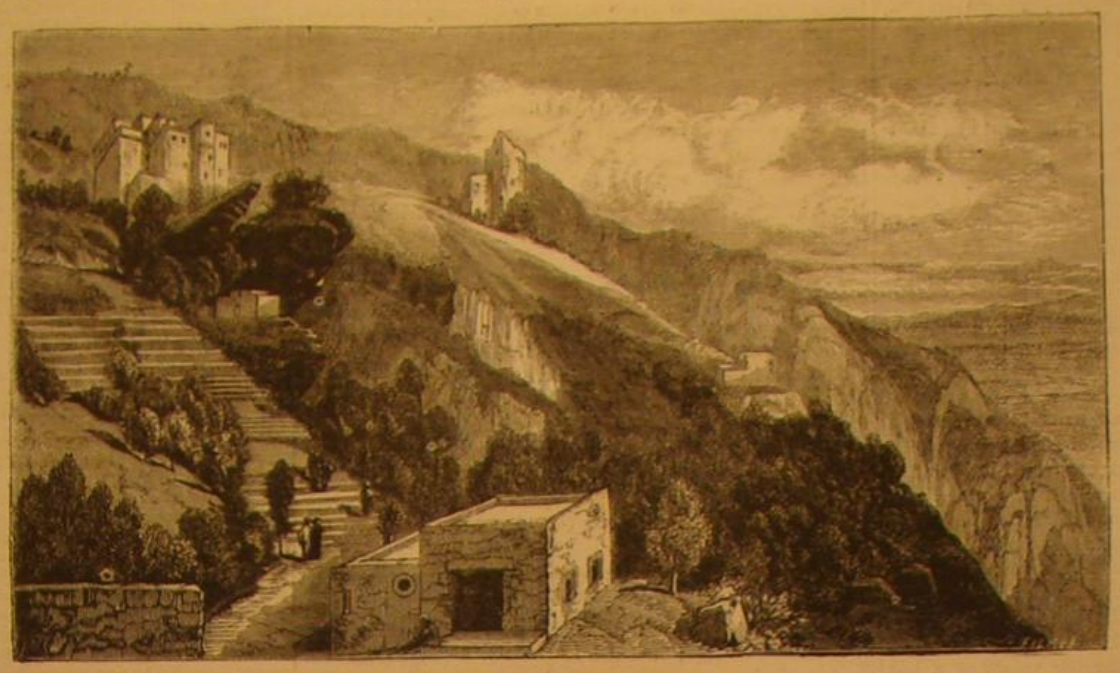
For the study of lightning flashes, the author recommends a black or gray opaque disk about 3·9 inches in diameter, with one open sector. The best form for the shortest and longest durations is that of a square, with sides of from 0·27 to 0·39 inch; for examining the multiple character of flashes, simply a long narrow sector of 1° or 2° is preferable. A spring rotation apparatus may be used, so as to admit of rotations up to 20 or 30 per second.

ACID in white lead may be detected by putting a small portion of the lead in a cup, pouring a little warm water over it, and stirring the lead in the water. Then add a few drops of a solution of iodide of potassium: and if the lead is acid, or contains acetate of lead, the water will turn yellow.

THE COFFEE GARDENS OF ARABIA.

Coffee is still cultivated in "Araby the blest," the coffee gardens there being on terraces which reach an elevation of about 3,000 feet. The soil is kept moist by means of small artificial canals, which are made to irrigate the whole by upper [illegible]ter falling from the [illegible]he trees to the lower terraces. [illegible]se trees here are planted so [illegible]age together that the thick fo[illegible] the shelters their roots fro[illegible] tropical heat of the sun.

Our engraving represents the famous coffee hills of Yemen, in Arabia, where Niebuhr states the berry was first cultivated after it was brought from Abyssinia by the Arabs, and where the ripened fruit, it is said, has a flavor and fragrance which it is impossible to transplant. For ages before its use among the western nations, coffee was raised on these hills. The fruit begins to ripen in February; and when the seeds are prepared, they are conveyed to the city of Beit al Fakih, where part goes to Mocha and the rest to European markets.

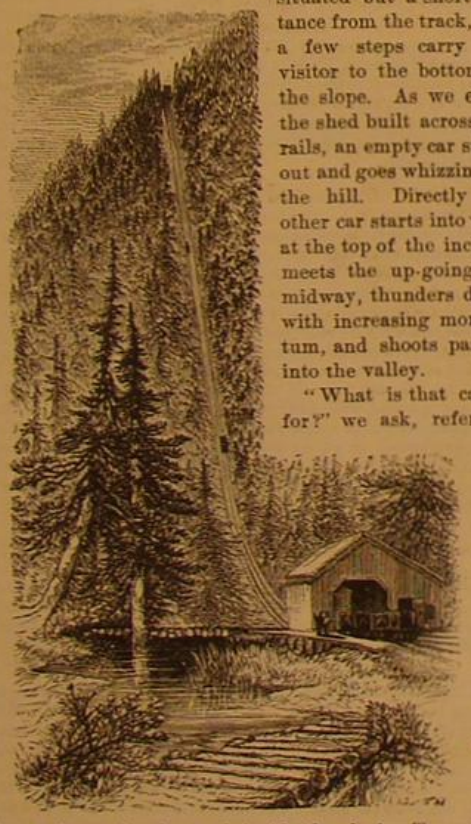


THE COFFEE GARDENS OF ARABIA.

It has been computed that the annual consumption of coffee is 1,000,000,000 pounds: and that, with the exception of bread, sugar, and tea, there is no product of more general consumption than this invaluable bean. When we consider how universally coffee is used as an article of diet throughout Turkey, Egypt, Arabia, Persia, and parts of India, besides the more moderate but equally general consumption in Europe and America, we shall find it difficult to overrate its importance, as vast multitudes of persons are engaged in its cultivation, transportation, and preparation for use in many quarters of the globe.

THE RALSTON INCLINED RAILWAY.

At the head of the Lycoming Creek valley, near Ralston, in Pennsylvania, is the inclined railway to the McIntyre coal mines, which serves to carry the coal from the pits to the railroad at the foot of the mountain. The lower terminus is situated but a short distance from the track, and a few steps carry the visitor to the bottom of the slope. As we enter the shed built across the rails, an empty car starts out and goes whizzing up the hill. Directly another car starts into view at the top of the incline, meets the up-going car midway, thunders down with increasing momentum, and shoots past us into the valley.



"What is that cavity for?" we ask, referring to a depression under the track inside the shed. The starter informs us that it is where the bumper goes in to let the car pass on, and just then, an empty car being hauled up from the siding, he pulls a signal wire communicating with the other end of the road. The stout wire cable in the middle of the track begins to move, and a heavy wedge-shaped mass of timber comes up from the cavity, broad end first, strikes the car with a shock that sends it some feet up the slope, and stops it on its return. It saves the trouble of hooking and unhooking the cable, we are told, and is much safer. When it arrives at the bottom of the slope, a spring changes the gage of the wheels; it then runs along a narrow track into the hole, and the car passes over.

At the invitation of the starter, we enter the empty car. The signal is given, and before our equilibrium is recovered from the jerk that nearly upsets us, we are rushing up the slope. The cable sliding over the rollers produces a whirring sound that makes our fierce motion seem all the fiercer, while the steepness of the descent and the absence of visible motive power combine to highten the effect of the ride. The mountain seems to grow beneath and above us, as the valley expands and deepens below. We stop on the verge to look down a thousand feet beneath; and then, jumping into a loaded car which comes swiftly by, we begin the descent. The speed is great, but there is no fear-inspiring rush, no blur of objects hurtling past. We look out into the valley; it rises slowly as we descend, and that is all. Not until we shoot through the shed and out upon the level, do we realize that our motion has been particularly rapid or peculiar.

THE BRIDAL VEIL, HAVANA GLEN, N. Y.

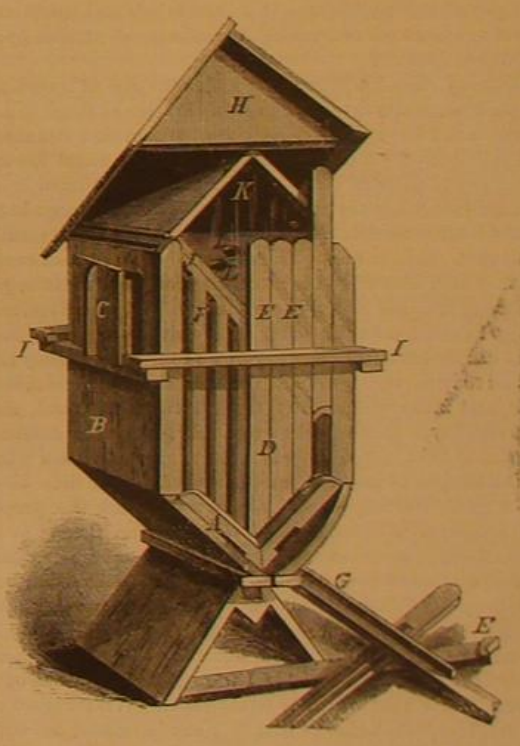
There are no portions of the country which offer greater attraction to the lover of the beautiful and the picturesque than the so called "glens," situate near the towns of Watkins and Havana, at the head of Seneca Lake, in New York State. These natural formations are cañons eroded from the rock by the action of water, and form a succession of ravines and gorges which, from their great extent, produce scenes of remarkable variety and grandeur. At times the bare cliffs give place to thickly wooded escarpments; vegetation creeps down into the gorge and throws a network of beauty and grace, festooning the sides of precipitous rock.

Our engraving represents one of the most interesting spots in the Havana glen, from a point where the strange geological formation is best apparent. The rock is moderately shaly, and has a strongly marked system of rectangular joints, dividing the cliffs into square towers and buttresses. When a portion of the precipice falls, it does not leave a jagged face but a mural surface, as smooth and even as a well built wall, giving the sides of the cañon an appearance of grand simplicity. The eroding current follows the lines of division, zigzagging at right angles rather than curving after the fashion of ordinary streams.

It seems hardly credible that such a vast gorge as that represented could be cut by the slender stream which showers a mist of spray, like the film of a bridal veil, over its cliffs. But there is no sign of fissure at the bottom of the glen, and a deep pond is there, which must, at some time, have been beneath high falls, the constant action of which hewed for it a basin in the rock. This pool begins at the foreground of our engraving, from which an idea may be obtained of the great ravine which the constant abrasion of the cascade—continuing perhaps for ages—has gradually worn away. The record of its work is but faint, for the frost has destroyed the water marks by breaking up the shale; and although the solid rock above would retain the imprint, the fragments at the bottom of the gorge show that it eventually becomes undermined and, toppling over, buries the marks out of sight.

THE HIXSON BEEHIVE.

Our engraving represents a new form of hive which, it is claimed, combines improved arrangements for permitting the examination of the bees and comb frames, and also for utilizing the animal heat of the insects for warming the honey and boxes. The construction is such that the objectionable space between the frames and sides of the hive,



which in winter affords passage for currents of cold air and in summer becomes choked with wax, is avoided.

The parts of the floor, A, are at right angles, and incline upon and from the center. In the removable sides, B, are openings, one of which is shown closed by the door, C. The side, D, and that facing it are composed of narrow vertical boards, E, all of which, with the exception of the middle one, are detachable. Each board is as wide as the distance from center to center of the comb frames, F, and is provided with a rib, G, on the inside, to fit into the space between said frames. By this means, a side is obtained which, while sufficiently light, is readily removable, piece by piece, when it is desired to inspect the interior of the hive. The sides are held together by the cap, H, and bars, I; and the boards, E, are further secured by metal plates arranged in their upper extremities, not shown in the illustration. The comb frames, F, conform in shape to the angle of the floor, slightly above which they are supported by stud pins. By similar means they are separated from each other, the interstices thus formed giving access to the bees. J is the honey board, receiving the square honey box, K, within the space occupied by the bees, so that it will be warmed in cold weather

by their natural heat. Entrance to the latter is afforded through the holes, L.

It is claimed that all the advantages of movable comb hives are here combined without the attendant defects. Ready access to the combs, when it is necessary to pry them straight, is gained by removing one or more of the detachable boards, an operation which, it is clear, will not *disturb* the bees as much as if the whole side were, as is usually the case, displaced. There are eight separate comb frames, each one of which, with its comb and bees, may be lifted out and transported to another hive without exposing the insects in adjoining portions except at the place of division. The inventor further states that the hive can be opened and closed without killing a single bee or causing a drop of honey to run, and that it has been proved excellently adapted for purposes of artificial swarming, dividing, equalizing, and other apicultural operations.

Patented through the Scientific American Patent Agency, September 24, 1872. For further information address Messrs. Hixson & Co., Gallipolis, Ohio.

New Relation between Heat and Electricity.

Mr. Frederick Guthrie, in the *Chemical News*, states that it is found that the reaction between an electrified body and a neighboring neutral one, whereby the electricity in the neutral body is inductively decomposed and attraction produced, undergoes a modification when the neutral body is considerably heated. Under many circumstances, the electrified body is rapidly and completely discharged, a fact proved to depend upon the temperature of the discharging body and its distance from the electrified one and the nature (+ or —) of the latter's electricity. The discharging power of a hot body diminishes with its distance and increases with its temperature. It also depends on the quality and not the quantity of heat radiated from it to the electrified body. It is necessary for the discharge that heat of intensity pass to the electrified body from a neutral body within inductive range.

It is shown that various flames, both earth-connected and isolated, have an exceedingly great power of discharging both kinds of electricity. As hot iron shows a preferential power of discharging — over + electricity, so it is found that white hot but isolated iron refuses to be charged with either + or — electricity. As the iron cools, it acquires first the power of receiving — and afterwards of receiving +. While white hot iron, in contact with an electrified body, prevents that body from retaining a charge of either kind of electricity, as it cools, it permits a + charge to be received and subsequently a — one.

A suggestion is made as to the existence of an artificial coercitive force, the presence of which, together with its diminution by heat, would explain much of the above.

Alcohol, Whiskey, Brandy, Wine and Ale.

Dr. Willard Parker, of this city, one of our oldest and most prominent physicians, in a recent address made the following statement concerning the effects of alcohol upon the human system:

For many years I was connected with the care of inebriates and paid particular attention to the character of those in my charge, and I have arrived at the conclusion that drunkenness is a disease. A man so affected cannot control his appetite, and must have drink regularly, and will have it at all hazards. A healthy man can refrain from drinking, but a diseased man cannot; and these men so addicted readily admit that. Men suffering from the disease have been cured and they will with tears in their eyes promise to abstain, yet on passing a liquor store they cannot help themselves, and will go in and have their whiskey. Now the question arises: What can be done? How shall we go to work? Society has been all the time trying to show what the use of alcohol makes us do, and many will reply it makes them feel good, and some will say it makes them crazy, drives them to desperation and to fight. Now let us drop that mode, and ask what does alcohol do to me, and not what it makes me do. That is the great starting point. We have to teach the people what alcohol does to them, and how it acts on them. It is as poisonous as arsenic or belladonna, and produces its deadly effect on those who use it; but then it is used in an adulterated state. Whiskey is a poison, but some believe and have the idea if we can get pure spirits that it is all right, but that is a mistake. Alcohol is poison, and the purer it is the more deadly is it in its effect, and if I were going to partake of it I would prefer that which is adulterated. With regard to ales and beer, it is believed that they are harmless, but with the presence of alcohol there is always danger. Those who partake of it become drowsy, and those who drink wines become stupid. In lager beer there is 3 or 4 per cent of alcohol, in ale 7 or 8 per cent; wine contains 23, gin 51 per cent, and brandy 53 per cent of alcohol. Even in cider there is 2 or 3 per cent of the poison present.

Ignition by Superheated Steam.

A correspondent, J. H., Jr., says that an engineer asserts positively that ignition can take place from steam pipes. He spoke of three instances where he knew it to be a fact. Shavings were set on fire, so that they blazed, at three different times. I told him I thought there must have been oil or other combustible matter mixed with them. He said there was nothing of the kind, nothing but dry pine shavings. The shavings were piled up against the pipes.

Professor E. S. Breidenbaugh, of Yale College, shows, by recent analysis, the very exhausting nature of tobacco crops in respect to soils. It appears that for every 1,000 pounds of tobacco grown, 102 pounds of the most valuable ash constituents of the soil are carried away.

Biogenesis.

Dr. William Roberts states that the results of over 300 experiments performed by him support the conclusion that the fungi, monads and acteria, which make their appearance in boiled organic mixtures, are not due to spontaneous evolution, but arise exclusively under the influence of pre-existing germs or ferments introduced from without. This method of experimenting consisted in exposing organic solutions and mixtures to a boiling heat in glass flasks, the necks of which had been previously plugged with cotton wool. The fluid or mixture in the flask may be exposed afterwards to the full influence of light, warmth, and air; and yet it remains perfectly barren. As evaporation takes place, no organic growth makes its appearance for even years; but if the plug of cotton wool be withdrawn for a few minutes or a single drop of any natural water, however pure or well filtered, be introduced, then all is changed. In a few days the clear solution becomes turbid with bacteria and monads, or a mass of mildew covers its surface and soon half fills the flask.

A plug of cotton wool acts as an absolutely impervious filter to the solid particles of the atmosphere, while it permits a free passage to the gaseous constituents. It is considered impossible to doubt that the biogenic power of the atmosphere resides in its dust, and not in its gaseous ingredients; but as to whether it be a specific germ or ferment, or what its nature is, no sufficient evidence has yet been adduced.

Death of Professor Torrey.

John Torrey, a most eminent botanist, died on March 10, at Columbia College, of which institution he had long held the botanical professorship. His first contribution to science was a catalogue of the plants growing within 30 miles of New York city; this was published in 1817, and was followed by the "Flora of the Northern United States" in 1824.

His learning was extensive and varied. In 1824 he was Professor of Chemistry at West Point, and he afterward held a similar appointment at the College of Physicians and Surgeons in this city. He was also chief of the Assay Office in the United States Sub Treasury. He was stricken by pneumonia at the age of 80 years. Columbia College is largely his debtor for his eminent services as a teacher, and for his fostering care of her interests.

Death of Professor Sedgwick.

The eminent veteran geologist, Adam Sedgwick, died on January 27, at Trinity College, Cambridge, England, at the age of 87 years. His contributions to the literature of his favorite science were exceedingly numerous and valuable, and make up a large amount of work even for a career so lengthened. He was elected to a fellowship of his college in 1810, and had won for himself a name in science while the youth Roderick Murchison was fighting battles in Spain. His services to the world of knowledge are everywhere known and valued. By his care and, to a great degree, through his generosity the collections of rocks and fossils under his charge at Cambridge have become the most complete of any now open to the student.

Extinguishing Fires by Vapors.

In our description of the Babcock self acting tank, published on page 143 of the current volume, it is pointed out that "the gas seems to interpose a wall of non-conducting vapor between the hoseman and the fire, which protects him from the heat." A correspondent, W. M., refers to Professor Tyndall's work, "Heat Considered as a Mode of Motion," in which the fact is stated that the arresting power of carbonic oxide to heat rays compares with the similar resistance of the air to such rays as 750 to 1; and carbonic acid compares to air as 752 to 1. The apparent wall of vapor is, therefore, a scientific fact.

A BILL was recently passed in Congress authorizing the President to cause such experiments to be made and such information to be collected as in his opinion may be useful and important to guard against the bursting of steam boilers, and requesting him to communicate the same to Congress. The sum of $100,000 is appropriated for the purposes of the act.

DR. D. T. SHUMWAY, in a recent paper read before the Massachusetts Dental Society, advocates the use of ivory points, instead of steel, in packing gold fillings. The advantages claimed for the use of the ivory are that the gold will have better cohesion, its softness is preserved, it better adapts itself to its position, and the filling wears better.

A COUPLE of immense wire ropes, each between three and four miles long, have just been completed by Messrs. J. and E. Wright, of the Universe Works, Birmingham, Eng. One of these ropes, intended for the Wapping tunnel of the London and Northwestern Railway, at Liverpool, is six thousand yards in length, 5½ inches in circumference, and is composed of six strands having ten wires in each. The wire is wound round a hempen core. The weight of the rope is 34 tuns. The second rope is for the Cowlan's tunnel, at Glasgow, is five thousand yards long, and weighs 25 tuns.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 18 to February 19, 1873, inclusive.

FINISHING TOOL.—H. E. Forrest, Boston, Mass.
GOVERNOR.—H. W. Gardner, Quincy, Ill.
JOURNAL BOX.—J. A. Montgomery, Millburn, N. J.
LOOM.—S. T. Thomas, Gilford, N. H.
PRINTING PRESS.—H. S. Bingham, Philadelphia, Pa., *et al.*
SEWING MACHINE.—D. McC. Smyth, Orange, N. J.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of New York.

TRADE MARK—J. L. SMITH *et al. vs.* REYNOLDS AND JACOBS.

[In Equity.—Before Judge Blatchford.—Decision July 21, 1872.]

The plaintiffs as owners of a trade mark for paints, consisting of the representation of a crown to be stamped or branded upon their goods, to wit: upon paint packages of all kinds, brought suit against the defendants, who also used the crown upon their packages. The court held the following points:

Causing the name of the firm which claims a trade mark and its place of business, to be recorded in the Patent Office is sufficient compliance with the first requirement of section 77 of the act of 1870, without specifying the names of those who compose the firm.

To designate "paints" as the goods for which a trade mark is to be appropriated is sufficient, without a more particular description.

The figure of a crown used as a trade mark for paints may indicate to buyers and dealers, by association, the origin and ownership of the goods, and is of itself a lawful trade mark.

The case of R. W. English, Comr's Dec. 1870, p. 142, and that of the Manufacturing Temple Company, *ibid*, 1871, p. 248, cited and approved.

Registering a figure as a trade mark for paints in general, without any restriction as to the kind, gives no title to it if the figure has been previously used, in connection with words or other figures, as a trade mark for any particular kind of paint.

A trade mark must stand or fall as a whole, and the registry of one cannot be sustained, like a patent, for a part of it, though void as to the rest.

It was shown on behalf of the defendants that the use of the crown on paint packages was not original with the plaintiffs, and the Court therefore denied the motion for injunction.

J. Hough, for complainants.
F. Blount, for defendants.

Recent American and Foreign Patents.

Improved Fire Kindler.

Montraville Gernsey, Middleburgh, N. Y.—In preparing this kindling, any desired quantity of ordinary charcoal is immersed for thirty minutes, more or less, in a saturated solution of chlorate of potash and nitrate of potassa, dissolved in water. The charcoal is then dried and then immersed in a saturated solution of resin in ordinary petroleum oil. This solution is prepared by heating the petroleum to a temperature of from 180° to 300° Fahrenheit, and putting into it resin until no more will be dissolved. The charcoal is then dried in any convenient manner until the petroleum is evaporated. The petroleum dissolves or cuts the resin and carries it into the pores of the charcoal, where it is left when the petroleum evaporates. The resin is readily set on fire by a match or piece of lighted paper, and the heat thus produced decomposes the chlorate and nitrate, and sets free large quantities of oxygen to support combustion, thus producing an intense heat, kindling the coal or wood fuel quickly and effectually.

Improved Window Shade.

Edward E. Johnson, Painesville, Ohio.—This invention has for its object to improve the construction of window shades, inside blinds, etc., which improved blinds shall be so constructed that any desired part of the window may be uncovered to admit the light. The invention consists in sections formed in the body of the main blind or shade in such a way that the said sections may be rolled up from their lower ends, or the blind and sections may be rolled up together.

Improved Millstone Balance.

George W. Wilson, Chebanse, Ill.—The importance of having the running stone of a grinding mill perfectly balanced is well understood. In this invention it is accomplished by means of a metallic riveted band and a series of adjustable grooved or ribbed metallic weights. The band is made by riveting together the ends of a piece of band metal. It is made larger in diameter than the stone, so that the weights may be inserted. The band is tightened around the stone by the weights. The latter are somewhat tapering in form, and are made circular on their outer and inner sides, so as to conform somewhat to the circle of the stone and the band. The outer or convex sides of the weights are grooved or ribbed, which prevents them from working out of their places. They may be placed in any part of the band, as may be required to balance the stone.

Improved Scissors.

John A. Correa, Green Bay, Wis.—The object of this invention is to provide means for securing the blades of scissors or shears together, so that they may be adjusted at pleasure to work tightly or loosely without the use of a screw or nut; and it consists in one or more cam wheels working in combination with the fulcrum pin. When the wheel is turned, an inclined plane bears against the upper edge of a slot and draws the pin upward and the blades together.

Improved Land Marker.

John Cuff, Emery, Ohio.—This invention has for its object to furnish an improved machine for marking the ground in cross-row for planting corn, by crossing the field in only one direction. The axle is made of such a length that the wheels may be at the distance apart required for the rows, so that the tracks of the wheels may mark the places for the rows in one direction. The wheels are rigidly attached to the axle so that they will revolve exactly together at a distance apart equal to the desired distance apart of the hills of corn. The cross blocks upon the two wheels are exactly in line with each other, so that the corresponding blocks of the two wheels may strike the ground at the same time and thus mark the cross rows. Arms are made of such a length that, when swung down into, or nearly into, a vertical position, the wheels will be raised from the ground, so that the machine can be conveniently turned or moved from place to place. By this construction, by moving a lever forward the wheels will be allowed to come in contact with the ground, and by moving the said lever rearward the wheels will be raised from the ground.

Improved Scraping Instrument.

Van Ness Davis, Stoneham, Mass., assignor to himself and Frank A. Davis, of same place.—The object of this invention is to furnish a tool or implement for scraping kitchen utensils, and cleaning deposits of burned gravy or other sedimentary deposits from the corners or angles, and also to be used in house cleaning; and it consists in a simple flat blade with the scraping edge at the end, and with a shank and handle.

Improved Tool Holder.

Levi L. Lamb, Chelsea, Mass.—This invention consists of a box handle for containing the tools and holding them for use, comprising a box and cover, which are pivoted together near the end for holding the tools for use, so as to open by swinging the cover in the plane of the top of the box and close by a reverse movement. The box and cover have each a jaw, between which the dovetail shaped heads of the tools will be secured, to be held for use when the box handle is closed, and opened to release the tools when the handle is opened. By the same operation by which the tool in use is released to be taken out, the box is opened to receive the tool to be changed and allow of taking out another, thus economizing labor and time. A spring catch is used to fasten the box closed.

Improved Beer Cooler.

John Chandless, New York city.—This invention relates to a new apparatus for cooling ale, and has for its object not to destroy the vitality of the ale while cooling it. A box or tank, of suitable size, is arranged to contain ice and water, and so serve as a refrigerator. A zigzag or coiled pipe is contained therein, its upper end projecting above the top and terminating in a funnel or enlargement. The lower end of the pipe extends through a side or the bottom of the refrigerator, and has a cock whereby it can be closed or opened. Being surrounded by ice water the pipe is necessarily cool, and will serve to cool whatever liquor may flow through it.

Improved Cultivator.

William T. Parker, Verona, Miss.—Two "scutic" plows are framed together, with the side pieces of the frame of the machine near the rear ends. The side pieces of the frame are jointed to cross pieces so that they can vibrate to allow the plows which are guided by handles to be brought toward or from the row, as may be demanded by the condition of it. The two sides of the frame are prevented from shifting forward or behind each other by suitable means. A vertical bar, rigidly connected to the side piece, rises from each, to considerable hight near the center, and, being connected by the cross bars loosely jointed to it, assists in keeping the frame in proper shape while allowing the plows to be vibrated. The rear support for the shaft to elongated vertically to allow the hight of the choppers to be regulated to the ground along which they run.

Improved Key Ring.

William T. Jenks, Toledo, O.—This invention consists in a key ring, formed, as to its main portion, of one piece of metal, bent into a circular form, with its ends nearly meeting, and, as to its supplementary part, of a pivoted clasp, which fits in a depression formed by notching said ends, so that it will perfectly coincide with the inner and outer edges of the ring, and thus form smooth or continuous surfaces.

Improved Seed Planter.

Thomas C. Garlington, La Fayette, Ala.—The improvement in this invention consists in the use of stirrers which are made like augers, to the shafts of which are attached fingers, which are made of the same curve as the thread of the auger like part, so that they may clean themselves as they revolve. To the upper ends of the shafts is attached gearing, so that the stirrers may be driven by the advance of the machine.

Improved Wash Boiler Attachment.

Richard B. Hart, Salado, Texas.—This invention has for its object to furnish an improved steam washing device. In using the machine, the clothes to be washed are arranged loosely upon a false bottom around tubes. As the water begins to boil, the hot water and steam are guided by funnels into the tubes, up which they are forced into the horizontal pipe and are projected through small pipes upon the clothes. The water passes down through the latter, carrying the dirt with it, through the holes in the false bottom and through the holes in the rims of the funnels back into said funnels, and thus the circulation is continued until the clothes are clean.

Improved Stove Grate.

John R. Stone, Round Grove, Kansas.—The grate is suspended at one end by a yoke extending down through the top plate and having notches above the plate to be engaged by vibrating buttons, the ends of which swing into and out of the notches, as required for shifting the yoke high or low. Near the other end it is mounted on the end of a crooked lever, extending through a hole in the side of the fire box, which serves as the fulcrum of the lever. Outside of the fire box is a pawl, pivoted to the lever a short distance from the side of the fire pot, and engaging with the notches in the stove side plate above the lever. By shifting this pawl from one to another of the notches, the grate can be raised or lowered.

Improved Harness Maker's Gage.

Dewitt G. Garlock, White Cloud, Kansas.—The object of this invention is to furnish improved means for cutting leather and similar material into strips; and it consists in the screw for moving the head and handle of the gage. A slotted bolt is made to slide on the gage bar, the end of which enters one of a number of holes in the wheel when the gage head is adjusted, and thereby holds the screw and head stationary. This bolt is confined to the under side of the bar by means of a slot and screw and the box through which the bolt passes.

Improved Car Coupling.

Casper S. Bigler, Harrisburg, Pa.—This invention has for its object to furnish an improved car coupling which will enable the attendant to couple the cars after they have been run together, and to uncouple them while under strain, so that the attendant may be in no danger while coupling and uncoupling the cars. The draw hook is connected with the body of the car in the ordinary manner, and should be of such a length that there may be a space of an inch and a half, more or less, between the hooks of adjacent cars when their bumpers are in contact. In the body of the hook is formed a long slot, through which passes one end of the link which is dropped over the hook of the adjacent car to effect the coupling. A pin passes down through the slotted body of the hook and through the link to sustain the draft strain. The lower part of the pin, against which the link rests when sustaining the draft strain, is made tapering. The upper part of the pin may have a screw thread cut upon it, so that it may be moved in and out by turning it. The taper of the pin enables it to be readily drawn out even when the coupling is under strain, so that the link may be slipped forward and raised over the hook of the adjacent car without moving the engine and cars. This construction also prevents the cars from becoming accidentally uncoupled, as the link will not rise over the hook of the adjacent car when it can slip back in the slot.

Improved Process of Polishing Wood.

Christian Seebach, New York city.—This invention consists in the application to wood surfaces, which are to be polished with shellac and varnish of a preliminary coating formed of plaster, paint, and turpentine. The invention thus provides a means of closing the pores of wood preparatory to polishing. For a first coat, paint mixed with plaster of Paris and turpentine is laid on and smoothed down with a rag. When dry, a coat of shellac is applied, which, after being rubbed down in the usual manner, is covered with varnish and polished.

Improvement in Propulsion of Cars.

Raphael De Leidi, Brooklyn, N. Y.—This invention relates to a new arrangement of means for propelling vehicles in either direction over a given track; and consists in making the track of jointed sections, which are pivoted to supports in such manner that, by alternately inclining the several sections in opposite directions, the load supported on the track will be caused to travel from one section to the other until it arrives at its destination.

Improved Animal Trap.

Emile Achilles Cordeiro Da Silva, New York city.—The object of this invention is not only to provide an efficient trap for catching rats and other animals, but to make a trap which shall be self-setting, and consequently always ready; and it consists in a box, of oblong or other form, a portion of the top of which is pivoted to the sides, and nearly balanced on its pivots with an inclosure or bait chamber above said top, and with one or more inclines by means of which the animal is enabled to reach the top of the trap.

Improved Bale Tie.

Peter K. Dederick, Albany, N. Y.—The essential feature of this invention is a metal tie piece for the fastening of a wire band, so contrived that the longitudinal strain of the band causes the tie piece or plate to fasten the band by securing it between said plate and one or both of the taut portions of the band.

Improved Eccentric Fastening for Boxes, etc.

William Youngblood, Brooklyn, N. Y., assignor to Rosabelle Youngblood, of same place.—This invention consists of a circular disk or button catch, of metal or any other suitable substance, pivoted at its center to the side or top of the box or other thing to be fastened, and having a circular groove in the face fronting the box arranged eccentrically to the pivot, so that the hook or hasp of the box cover which drops into it through a radial notch will be pulled down and fasten the cover down tight when the catch is turned. The said radial notch is arranged where the groove is furthest from the center pivot.

Improved Medical Compound.

Joseph Geemen, New York city.—The object of this invention is to provide a remedy for rheumatism and kindred diseases; and it consists in a compound composed of prunes, oil of cedar, chloride of sodium, sal niter, and juniper berries. These substances are thoroughly mixed together by adding cold water and combining them so that the salts named will permeate the whole mass.

Improved Gas Lighting Torch.

Charles H. Roberts, Troy, N. Y.—This invention is an improvement in gas lighting torches, and consists of a tube provided with perforations and a cup shaped end and attached to a staff, so as to conduct a stream of gas from the burner to the wick of a lamp or taper which is attached to said staff.

Improved Hat and Coat Hook.

Charles G. Cole, Bennington, Vt.—This invention relates to a new hook for clothes or other purposes, which is made of one single piece of wire or band of metal, and which has fastening points formed at its ends, so that it can be secured in wood without any other fastening device, rendering the cost of manufacture very small.

Improved Swing.

Edward A. Tuttle, Williamsburg, N. Y.—This invention has for its object to furnish an improved swing for children, which shall be so constructed that the seat of the swing, throughout the whole extent of its vibration, may be close to the ground, thus obviating the danger of injury from an accidental fall from the swing.

Improved Hat and Coat Guard.

Sumner N. Robbins, New York city.—The object of this invention is to supply to the public a device by the use of which the annoying change or carrying off of hats, overcoats, satchels, etc., may be effectually prevented. The invention consists of two U shaped metal hooks, which are connected by a small lock applied to one of them, and are adjusted to the brim of the hat or garment. A short guard chain may further connect the two hooks, to be placed around any fixed body, such as overcoats, satchels, umbrellas, or other objects.

Improved Valve for Gas Regulators.

John C. Sarsfield, New York city.—This invention has for its object to furnish an improved self-acting valve for regulating the pressure and flow of gas as it passes from the meter to the burners, to cause each burner to give the proper amount of light, however many or few burners may be burning, and it consists in a tubular chamber, designed to be connected with the gas pipe leading from the meters to the burners. The chamber consists of two parts which are screwed together. The flanged end of a tube has a screw thread cut upon its outer surface to screw into a screw thread cut in the inner surface of the mouth of the main part of the tubular chamber. The hole through the flanged end of the tube is closed with a valve, which rests upon the outer or forward side of the said flange, and the forward end of its stem passes through a guide hole in an arm formed in the cap part of the tubular chamber. The other end of the valve stem passes into the tube and has one end of a coiled wire spring attached to it. The other end of the spring is attached to a cross bar which rests in notches formed in the edge of the open end of the tube. In the edge of the open end of the tube, midway between the notches, are formed two other notches, which are made deeper and wider than the first notches, so that, by raising the cross bar out of the latter, it may be changed in its position and thus change the tension of spring.

Device for Converting Circular into Reciprocating Motion.

Luther Dame, Newburyport, Mass.—The object of this invention is to convert circular motion into reciprocating by means of a simple device which works without jar or noise, producing only a very slight degree of friction. It consists of a hollow cylinder with a longitudinal slot, into which a cylindrical core is closely fitted, gliding therein by means of a bolt connected with the core and running in the slot, applied eccentrically to a face plate or shaft turned by a crank or other suitable arrangement. The mechanism is simple, not liable to get out of order, and has but little friction. We think the invention well adapted for driving light machinery. We shall probably present an engraving of it in an early number of the SCIENTIFIC AMERICAN.

Improved Boring Machine.

Isaac Cory, Dalton, Ind.—The object of this invention is to produce a boring machine whereby trees whose sap is to be obtained in the manufacture of sugar, turpentine, resin, or for other purposes, can be conveniently tapped; and the invention consists in applying a rotary tool or auger to a movable frame, which can be fed against the tree while the auger is being rapidly revolved by hand or other means.

Improved Lantern.

Seymour Hughes, Jersey City Heights, N. J.—The object of this invention is to simplify the construction of lanterns, and to reduce the expense of making the same, and of keeping them in repair. The improvement consists in constructing the crown or upper metal portion of the lantern with a view to allowing the ready removal and insertion of the glass, which may be simply a common lamp chimney.

Improved Screw Propeller.

Martin M. Wilson, Honey Grove, Texas.—This invention consists in means for guiding pivoted propeller blades so that they can open and close readily and uniformly. It also consists in a new mode of applying a spring thereto so that the obliquity or resistance of the blades will be automatically graduated. When the vessel is loaded and the resistance on the blades is increased and a finer pitch required, the spring will contract in proportion to the resistance, and the pitch will be changed as demanded by the amount of the load, and the slip will be proportionately lessened. At the same time, the propeller will have the same effect upon the engine as a marine governor to regulate its speed. The tension of the spring will be varied as required by an adjusting nut. This arrangement of variable blades and a spring is claimed to afford a gain or saving of power, and consequently of fuel, under any circumstances, whether the boat is light or loaded. These variable propeller blades are applicable to vessels of all kinds using screw propellers, whether for canal, river, lake, or ocean navigation.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents.*

This 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?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

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.

Rejected Cases.

Rejected cases, or defective papers, *remodeled* for parties who have made applications for themselves, or through other agents. Terms moderate. Address MUNN & Co., stating particulars.

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.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, for full particulars.

Design Patents.

Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

Foreign Patents.

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. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. 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 MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

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.

The patent may be taken out either for five years (government fee or $20) 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.

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 full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 26, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

A copy of the claims of any patent issued since 1836 will be furnished for $1.

When ordering copies, please to remit for the same as above, and state name of patentee, title of invention, and date of patent. Address MUNN & Co., Patent Solicitors, 37 Park Row, New York city.

MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an honest opinion. For such consultations, opinions and advice, no charge is made. Write plain: do not use pencil, nor pale ink. Be brief.

All business committed to our care, and all consultations, are kept *secret and strictly confidential.*

In all matters pertaining to patents, such as conducting interferences, procuring extensions, drawing assignments, examinations into the validity of patents, etc., special care and attention is given. For information, and for pamphlets of instruction and advice

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Edge Tool Makers' Grindstones, Mitchell, Philadelphia, Pa.

Buy Gear's Improved Variety Moulding Machine. Ware Rooms, Boston, Mass.

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Agents wanted to sell Territory in the States of Ohio and Michigan, for one of the best things ever invented. Address R.S.G. Jock box No.17, Seneca Falls, N.Y.

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Damper Regulators and Gage Cocks—For the best, address Murrill & Keizer, Baltimore, Md.

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Parties desiring Steam Machinery for quarrying stone, address Steam Stone Cutter Co., Rutland, Vt.

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Key Seat Cutting Machine. T.R.Bailey & Vail.

Tree Pruners and Saw Mill Tools, improvements. Send for circulars. G.A.Prescott, Sandy Hill, N.Y.

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.

Five different sizes of Gatling Guns are now manufactured at Colt's Armory, Hartford, Conn. The larger sizes have a range of over two miles. These arms are indispensable in modern warfare.

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Gauge Lathe for Cabinet and all kinds of handles. Shaping Machine for Woodworking. T. R. Bailey & Vail.

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All Fruit-can Tools, Ferracute, Bridgeton, N.J.

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

Always right side up—The Olmsted Oiler, enlarged and improved. Sold everywhere.

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Hydraulic Presses and Jacks, new and second hand. E. Lyon, 470 Grand Street, New York.

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Spur and Bevel Wheels and Spindles, of great durability, cast to order by Pittsburgh Steel Casting Co. All work warranted.

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Arrangements are being made to manufacture a small oscillating engine for the use of farmers and others requiring a little power, but whose limited means and knowledge of the Steam Engine prevent them from buying the more expensive and complicated machines. Agents are wanted now to sell models made under the same patent. E. P. Ryder, 19 Ann St., New York.

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A Superior Printing Telegraph Instrument (the Selden Patent), for private and short lines—awarded the First Premium (a Silver Medal) at Cincinnati Exposition, 1872, for "Best Telegraph Instrument for private use"—is offered for sale by the Mercht's M'f'g and Construction Co., 50 Broad St., New York. P. O. Box 6963.

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Steel Castings "To Pattern," from ten lbs. upward, can be forged and tempered. Address Collins & Co., No. 212 Water St., N. Y.

Notes & Queries

A. P. asks how to temper steel dies and punches.

F. E. C. says: How can I make translucent cloth for hotbed frames?

E. F. S. asks how to prevent soft metals such as tin, lead, etc., from clogging files.

W. M. asks: When and where were bolting machines first introduced for bolting flour?

S. A. L. asks: What kind of leather is generally used in making blacksmith's bellows?

M. C. asks: Can a card be saturated with phosphorus and preserved for use, and will it be flexible?

P. R. R. asks: Can any of your readers describe a process for tempering steel springs by compression?

A. L. asks: What is the best wood to make insect cabinets of, and what is the best form for the same?

W. H. H. asks: Can you tell me how to make a pickle for taking sand off castings, such as small gear wheels, etc.?

J. F. A. wishes to know with what material he can coat the inside of tin cans, to prevent ink and other fluids from being affected by the tin.

E. D. R. asks: What is the best method of mixing fresco colors, and what ingredients are used to make them flow freely and cover well?

C. M. asks: How can the glue joint between the back and sides of a violin be undone without injuring the instrument or spoiling the varnish?

E. B. asks for a recipe for making dextrin or a substitute for the same, say 50 lbs. at one time. He wants to use the dextrin for sticking purposes.

W. S. B. asks: What is meant by summer and winter strained lard oil? What process does the lard go through to keep it from congealing?

C. B. asks if there is any method of toughening or preparing wax for flower making so that it will not be liable to soften in warm and harden and crack in cold weather.

J. D. asks for a recipe for a waterproof liquid cement, to be used for putting patches on bags, in the place of thread. It would be very useful to thousands of farmers.

G. M. D. says: How can I mark or print letters and figures on metal that has been finished and plated with silver? I have seen such work, but cannot tell how it is done?

A. P. asks: Will the power of a 10 horse engine drive a machine or machinery 100 feet away from the engine as easy as it would 10 feet away? The machinery is to be driven by a belt or belts from the line shafting.

N. J. J. asks: What kind of fish would be best to raise in a lake one mile in diameter? The water is eight feet deep, and the lake has no visible inlet nor outlet. The water is at all times bright and clear and has an agreeable taste.

J. R. says, in regard to R. and W.'s query about the balance wheel: Supposing that W. is right, will he be kind enough to explain the action of the gyroscope governor, illustrated and described on page 134 of the current volume of the SCIENTIFIC AMERICAN?

C. E. C. says: Can some one give instructions for annealing gold so that it can be conveniently worked into rings, drawn into wire, etc., without cracking? I am often troubled with gold coin and good scraps, which are as brittle as cast iron.

J. C. K. asks: What is the best preparation for setting the thimble skein on axles? I use the dregs of paint heated over a slow fire to the consistency of a batter. Is there anything better? In large wagon factories, how do they cut out the hub for the thimble box?

G. D. N. asks: Is there any work published treating wholly or in part upon electro-magnetic motors? Where can it be obtained? Is vulcanized rubber or dentist's hard rubber a conductor of electricity? What is the necessary size of a battery to ring a bell? It must be active for a month.

P. L. says: We use equal parts of first quality clay and ground brick in the manufacture of our retorts for distilling phosphoric acid; and yet they sometimes crack over the heated furnaces. We manufacture them in a warm room, fire the kiln with care, and subject all to the same charges, heat of flame, etc. What is the cause of our trouble?

D. H. E. says: I have lost the sliding weight to my platform scales, commonly called the P. The lever is graduated from 0 to 100 lbs. In half pound notches, and there are additional weights, 100, 200, 300, and 400. There is a cup at the end to put shot in to keep the balance; but it has been emptied also, otherwise I could easily put on the platform U. S. standard weights and make my new lead P of the right weight. Please tell me how to get it to the proper weight.

H. A. B. asks: What proportion of burnt clay should be mixed with quick lime to form a hydraulic cement? The lime is to be measured before slacking, the clay after grinding. Should the clay be burned in a very hot fire and how long should it be exposed to the heat? Of soft magnesian limestone and American chalk, which would make the best lime, and what would be the relative quality of each?

J. R. has read Professor Young's lecture on our present knowledge of the sun, and asks for explanation on the following point: The professor asserts that a contraction of the volume of the sun, equal to 200 feet of its diameter, would account for all the heat it gives off. "If we freeze a pail of water, it gives off heat while it is freezing, but the thermometer will indicate no fall of temperature, until it is all frozen." The greatest density of water is at a temperature of 39° Fah.; and if it becomes colder, it expands, in contradiction to the fact quoted by Professor Young. How is this?

J. R. asks: What are the limits of expansion in an engine provided with an ordinary D valve in the steam chest? The admission of steam is cut off by a plate valve (sliding over the opening which admits the steam into the steam chest). The D valve is connected in the same way as in an ordinary engine; the plate valve, however, is worked by a crank pin of a wheel which makes twice as many revolutions as the shaft of the engine. The main valve has 1-16 of an inch lead and ¼ inch outside laps. The steam port and the said opening are ¾ of an inch wide and both valves have 2¾ inches throw.

D. F. says: We use what is called a gas pump in our oil well to draw gas up through the large casing between it and the tubing. What will be the difference in the amount of vacuum created by a ten inch cylinder and by a fourteen inch? They are piston pumps. How many lbs. per square inch would the vacuum be for each pump? They would both be acting on a tight vessel.

T. K. B. says that polished steel becomes in a manner scaly, after being hardened, by the cold air striking it. "I use soap to coat the steel with, still it does not overcome the difficulty perfectly. I am told there is a liquid for coating steel, while heating it, in such a manner that the cold air does not strike it. I would be obliged to you or some of your readers for a process better than the soap."

Answers to Correspondents

T. P. says: In your answer to F. E. D. as to fitting up cones so that the band will be equally tight on all the pulleys, you say that the sum of the diameters of all the pulleys will be the same. In my experience I find that steps in cones made all the same will not do. Please explain. Answer: For crossed belts the sizes will be the same. This is what we there stated. Read the reply more carefully.

M. J. B. says: Please state which is the most perfect book on mineralogy, and where it can be obtained. What is the price of it? Answer: Get "Dana's Mineralogy" of your bookseller.

E. A. P. sends a description of parhelia and asks for explanation. Answer: This phenomenon was explained, on page 132 of our current volume, as due to floating crystals of snow or ice in the air; and the same explanation would apply in the present case. The prismatic effects at noon were probably not so fine as they would have been with the sun nearer the horizon.

A. G. F. says: I have occasion to run a hydraulic press at a distance of 250 or 300 feet from the power which runs the pumps. Can I not dispense with the shafting, place the pumps near the engine and use an enlarged pipe for connecting the pumps with the cylinder of the press, without material loss of power? Can I use a pipe 250 or 300 feet long, and if so, what should be the relative increase of size of pipe for 300 feet over the size required for 10 feet? Answer: You can dispense with the shafting and set your pumps near engine, using a pipe to conduct the water. You need not increase the size of the pipe. The supply of water is so small that an enlargement of the pipe is unnecessary for so short a distance as 300 feet.

J. F. C. says: 1. What convexity should a pulley have to allow a belt to run and adhere to its best advantage? 2. Is it best to run a thin and broad belt or a thick and narrow one? 3. Is it best to run one broad belt of sufficient capacity to convey the power of the engine; or would it be better to divide it and run two of half the width each? Answer: 1. One half inch to a foot in breadth of face. 2. A thin belt up to a breadth which will render it unmanageable. 3. That would depend upon the amount of power to be transmitted. For a thirty horse power engine, we should use a single belt of full width, if certain that it would be kept properly laced or otherwise well secured to take even strain across its full breadth.

A. T. Z. says: I have a turbine water wheel of 16 horse power driving a run of stones. Upon the top of the upright shaft of water wheel was a pinion 16 inches diameter and 2 inches pitch, with iron teeth, driving one of 2 feet diameter with wooden teeth on the stone spindle, giving proper speed to stones, but making a jarring noise in the teeth and shaking the building. Thinking the pitch too large for the diameter of wheels, I made, very correctly, new patterns, with 1¼ inches pitch and the same diameters as before, but found them work no better. Can wheels of above sizes be made to drive a run of stones and work smoothly? If so, what is the cause of the trouble with mine? Answer: We are inclined to think that your trouble is due to want of proper balance of your turbine. Wheels of the sizes mentioned can no doubt be made to run smoothly.

W. H. M. asks: If a pump of 2 inches diameter has a stroke of 3 feet, what amount of water in cubic inches does it draw, and what is the rule for finding the same? Answer: To find the area of a circle, multiply the square of the diameter by the decimal .7854 To find the cubic contents of the cylinder, multiply the area by the length. In your example 2×2×.7854×36=113 cubic inches of water and a little over, for each stroke.

H R. asks: Can you inform me of what materials the elastic rollers used on printing presses are made? Answer: Glue and molasses. Increase the quantity of glue to make a stiff roller; you will need this in hot weather.

M. M. T. asks how glass becomes porous, if it ever is so. Answer: All glass is more or less porous Some coarse bottle glass is so much so that it will not insulate for electrical purposes.

J. F. C. says that G. T. P. can make the best red sealing wax by mixing 1 lb. shellac, 1 lb. Venice turpentine, ½ lb. chalk and ½ lb. English vermilion.

H. P. has an aquarium made of a wooden frame and glass sides, and wants a cement to make it water tight. Answer: Mix equal quantities of dry white lead and red lead in a paste with mastic varnish. Use as soon as mixed.

W. E. A. says: I have a plan for taking water through the surface condenser of a marine engine by which the motion of the vessel is made to perform the duty of the circulating pump now used. Is there, to your knowledge, any thing of the kind in use? Answer: The plan has been often suggested and more than once tried in various forms. Success has not been met with in any case in such a degree as to lead us to anticipate its general adoption.

C. E. C. asks how to mend rubber boots. Answer: See page 165 of our volume XXVI.

J. H. W. says: I have seen it stated somewhere that the workmen in deep mines were entirely unaware of the occurrence of the severe shocks of earthquake which were felt last fall in California; and, as so many theories have been promulgated to account for these phenomena, I have been expecting some of the scientists to base—if this statement be correct—a more probable theory upon it. If true, it would indicate, of course, that these disturbances are created upon or very near the surface, and the old doctrine of internal commotion (gaseous or otherwise) causing upheaval of the crust, a doctrine still held by many, would be untenable. Answer: The statement that the workmen in deep mines were unaware of the shocks and undulations taking place on the surface would require the concurrent testimony of numerous witnesses before any scientific men would put any confidence in it. It sometimes happens that, owing to great geological faults and fissures, the earthquake waves are not propagated over small districts of country: they remain like islands in the raging sea. This fact has several times been noted, but in such cases there is no motion either on the surface or in mines. That there should be wave motion on the surface and none at a moderate depth below, is in the highest degree improbable; on the contrary, animals living in caves and holes are the first to perceive the shock, and often give note of an approaching earthquake by rushing to the surface.

J. E. M. asks: Does heat or cold affect the power of a magnet; also whether the movement of a piece of steel would be more rapid towards a strong magnet than towards a weak one, provided the same piece of steel be placed at the same distance away from each? I think that the stronger magnet would attract a larger piece of steel than the weaker one; but under the above named conditions, the movement of a piece of steel would be just as rapid towards the weaker as towards the stronger one. Am I right or wrong? Answer: Alternations of heat and cold, sudden contraction or expansion, and percussion are decidedly injurious to the strength of a magnet; and we should say that a powerful magnet would attract a given piece of steel towards it more rapidly than a weak one. Better try the experiment.

F. G. asks: How can I make a good and cheap electric battery? Answer: You can buy a battery cheaper than you can make one, but if you wish to try your hand at the business, we can recommend what is called Daniell's pattern as being easy of imitation. Make yourself a copper cup of the capacity of a pint measure, and a second cup, holding a gill, out of sole leather. In the copper cell, put a mixture of eight parts of water and one of oil of vitriol, saturated with blue vitriol, and pour some of the acid water without the copper into the leather cup. Cast a solid cylinder of zinc and amalgamate it; plunge this into the inner leather cup and connect it by a copper wire soldered to it with the outer cups. Several of these cups would constitute a battery. Now read about it in your school philosophy, and you will learn what further to do.

H. R. asks: 1. Is there any glue or substitute for the same that will stand exposure to wet weather? Answer: Take caoutchouc, 15 or 20 grains, chloroform, 2 fluid ounces; dissolve and add ½ ounce powdered mastic.

M. H. asks: What is the best way to fasten felt or any similar material to zinc? Answer: Try painting the zinc with a thick coat of white lead; let it dry and then use stiff hot glue.

F. W. D. says: Please enumerate the various colors of which white is composed, and the order in which they must be painted upon a circular disk, so that, when properly revolved, it will present a white surface. Answer: Divide your disk radially into five equal parts, and paint each of these with the seven colors of the solar spectrum, namely, violet, indigo, blue, green, yellow, orange, red. Put these colors on radially. Paint a black bull's eye in the center of the card, and blacken the circumferential edge. Revolve rapidly, and you will see only a grayish white instead of the colors.

F. C. asks if the borax treatment for preserving meat is detrimental. Answer: No.

J. H. J. Your plan for steam engine is old. Water colors are used for theatrical scenes.

A. P. should send his volumes for binding to our office. Charge, $1·50 per volume.

A. C. asks: 1. Who designed and built the Thames tunnel (England)? 2. Who designed and built the Great Eastern? Who launched her? Answers: 1. Sir Mark Isambard Brunel. 2. Isambard Kingdom Brunel, son of the former. Built by John Scott Russell & Co.

Z. asks how to preserve natural flowers with wax. Answer: Take paraffin, melt it and dip the flowers in very carefully.

D. F. T. says, in reply to O. K., who asks if it is advisable to drive a 4½ feet millstone with a quarter twist belt from the driving shaft to spindle: From experience, I should say no, unless you use a long belt. Your belt should be 9 or 10 inches if you want it to do any work. [In our reply to O. K., we originally advised a long 8 inch belt. The figure was by mistake, printed 5 inches.—EDS.]

J. B. T. asks for a recipe for bluing gun barrels. Answer: See page 10 of our volume XXV.

W. T. B. says in answer to D. F. W., who asked how to cut a crack in a bell clean, to stop the discordancy: I have used a circle of common soft Russian stove pipe iron, running at a velocity of 5,000 revolutions, to cut teeth in a large saw. I could do it very quickly, but the under side of the saw was so hard that it could not be filed. It would cut the whole length of a twelve inch flat file in 1¼ minutes.

J. W. K. encloses a mineral specimen found in limestone, and a black mineral, and asks what they are. Answer: The black mineral is very soft bituminous shale. The other is flint.

B. O. M. asks how to bronze cast iron brackets. Answer: Read Byrne's "Practical Metal Worker's Assistant."

C. S. asks: Will you please send me the name of any work treating in detail on the construction of balloons? I wish to know of what quality of silk, the kind of varnish, formula for cutting the segments, etc. If it is feasible, I intend to construct a balloon capable of carrying 30 lbs. of apparatus, and make continual record of atmospheric phenomena, with the rise of a captive balloon at an elevation of 3,000 feet. Answer: General instruction in regard to form and material, cutting, varnishing the silk, with formula for weight in relation to bulk, etc., will be found in the article Aerostation in Good and Gregory's "Pantalogia," also, but not so full, in Vol. I. Partington's "Philosophy"; also in article Aerostation in Encyclopedia Londonensis; the last, perhaps, is the best. See also Simpkin's "Aerial Navigation," London, 1845; Wise's "Aeronautics," an American publication, and Glaisher's "Up in a Balloon." All of these books are probably in the State Library at Albany. Experiments with captive balloons sustaining self recording meteorological instruments would be full of interest. We fear, however, that the first heavy gale would sweep them away.

W. G. C. asks: Would it take more power to prevent water escaping by a ¼ inch hole at the bottom of a pipe, 6 inches in diameter and 100 feet high, filled with water, than it would require to prevent water escaping by a ¼ inch hole at the bottom of a pipe, ¼ of an inch in diameter and 100 feet high, similarly filled? Or, again, would it require a different power to prevent water from escaping from a ¼ hole at the bottom of a pipe 100 feet high, and tapering in its diameter from 4 inches at the top to ¼ of an inch at the bottom, the pipe being full of water? Answer: The required force would be the same in each case, as the pressure of a liquid at an orifice is proportional to the head of water above it, and bears no relation to the size or form of the containing vessel.

M. R. asks: 1. Will a horse pull a heavy load up hill easier on low or on high wheels, and why? 2. Weight of vehicle being the same, which pulls easier, a load divided over 4 wheels or over 2 wheels, and why? Answer: 1. Within ordinary limits, a horse should pull the heavier loads with high wheels, because in running over an obstacle, as at A, the larger wheel distributes the forward effort to better advantage, in "prizing" itself and load over it, than does the smaller wheel. Should the horse be attached directly to very large wheels, by short traces or chains, there would be a tendency to raise him from his feet, and thus to prevent the effective application of his strength, which might, in extreme cases, more than compensate for the anticipated gain. 2. On soft ground, 2 wheels would cut in more than 4, the same load being carried, and thus would require more effort. On hard roads, we should expect 2 wheels to do best, as the weight of 2 wheels and their friction would be avoided.

H. B. J sends a mineral. "I took it from a lump of quartz which was full of small seams and pieces. The specimen was originally larger than an egg. Is it copper?" Answer: It is a valuable copper ore, containing about sixty per cent of copper, the rest being sulphur and iron.

E. C. D. sends us a stone, and asks what it is and if it is an indication of coal in the vicinity. Answer: The specimen is carbonaceous shale, but it does not promise the existence of coal in the neighborhood, neither does it decide against it. A fragment of rock gives no evidence one way or the other, as the same rock is found both above and below the coal measures. The geological sequence of the strata must be observed.

I. P. H. sends us a mineral specimen found in hematite. He asks what it is, and if it will affect the iron in the blast furnace. Answer: It is an infusible argillaceous rock, and will simply increase quantity of slag.

C. G. C. encloses two samples of minerals and wishes to know what they are called in geology and of what they are composed. Answer: Both specimens are feldspathic products, the soft, pliable one being kaolin, much used in porcelain manufacture.

H. D. asks: 1. What is caustic ammonia and how is it prepared? What is the expense of it? 2. What is the cheapest way to manufacture hydrogen gas for balloon purposes? Answer: Caustic ammonia is the aqua ammonia of the druggist, and costs from ten to twenty cents a pound according to purity and concentration. It is manufactured by heating quick lime and sal ammoniac together and absorbing the gas in water as it comes off. The cheapest hydrogen upon the whole is made by acting upon scrap iron or zinc by dilute sulphuric acid. We advise our correspondent to read up on both these questions in almost any elementary treatise on chemistry.

T. H. P. says: Last spring we put up a small 7 x 12 engine, the boiler being an upright one, 6 feet high and containing 37 flues. We fed with cold water until winter, when the freezing of the pipes caused us to adopt another plan. We then placed our feed barrel below the level of the engine bed, and run the exhaust into the barrel to heat the water. This works very well so far as heating the water is concerned, but it has the disadvantage of collecting the tallow used for lubricating the cylinder; and after passing through the pump, it is forced into the boiler. We use neither filter nor mud drum. What would be the best way of cleaning this grease out of the boiler? How would it answer to use lye and convert it into soap, and then blow it off? If this would answer, how much ought to be used? What would be the best method of cleaning the feed pipes, which are coated inwardly with greasy matter? We want to use the boiler for about 6 weeks more, only. Answer: Try using crude mineral oil for lubrication, as recommended recently by one of our correspondents in this column. If that does not answer, we should use a worm heater. We should suppose that economizing in the use of tallow might give good results in more ways than one.

J. T. B. asks: 1. What is the proper rule for determining the sectional area for the rim of a fly wheel suitable for any power of engine? 2. What is the rule for determining the sectional area of a lever crank of any length, suitable for any given power or pressure on piston? 3. What is the rule for sectional area of an engine bed suitable for any pressure on piston, and any length of crank? Answers: 1. Answered in article on fly wheels, on page 177 of this issue of the SCIENTIFIC AMERICAN. 2. Multiply the pressure on the crank pin by the distance from the center of pin to point at which the thickness is required and by 17; divide the product by 100,000 times the square of the depth in a line perpendicular to both the lines of the shaft and of the crank. The result is the probable thickness of web with which a crank will just break. To be safe, take a pressure on the crank pin at least six times as great as the anticipated pressure. 3. Multiply the area of piston by the steam pressure and divide by 3,000. The quotient will be the least allowable sectional cross area of the bed.

C. S. C. sends a mineral specimen and would like to know its value and what it may be used for. Answer: It could be used in making brick and coarse pottery.

E. P. C. encloses four mineral specimens for examination. Answer: No. 1 is indurated clay. No. 2 is the same, but purely argillaceous. No. 3 is compact limestone. No 4 is siliceous limestone, containing minute crystals of pyrites. You have been boring through the Trenton or Lower Silurian limestone and entered the calciferous formation. You must be very near the granite or underlying rocks. If you do not strike water the moment you reach these, you should give it up. We presume the strata in your region dip southeast; but not knowing their precise disposition at Wequiock, it would be idle to prophecy at this distance. Keep on till you touch granite.

E. B. asks: 1. If the spectrum of iron shows 65 lines, does this indicate that iron consists of sixty five terrestrial elements? 2. Can it be ascertained what particular line the color substance of flowers and leaves will throw in a spectrum, by burning leaves, etc., in a fresh state? Answer: 1. It is generally supposed that the number of lines and their position in the spectrum is characteristic for each metal. All of the iron lines belong to iron, the potassium lines to potassium, etc. The number and location vary for each metal. There are only 65 terrestrial elements, all told, and iron is one of them. 2. The absorption bands produced by the coloring matter of plants have been studied and described by different authors. When the leaves are burnt, the coloring matter is destroyed, and the lines on the spectrum are there produced by the mineral constituents of the ashes.

H. N., Jr., asks: What will remove red ink from writing paper? Answer: The red ink is readily removed by hydrochlorite of soda, which can be purchased under the name of "Javelle water." Chlorine water and a solution of bleaching powder will also destroy the color.

J. H. S. asks: Where can I find a reliable mechanic's companion? Answer: See our advertising columns.

H. A. W. says: In this county, Edgecombe, N. C., there are many locations in which accurate surveying cannot be done in the ordinary way with a compass, on account of the great variation of the needle, due to local causes. These difficulties are most generally met with in the neighborhood of marl beds; and a variation of one half degree in stations but a few yards apart is not unusual in attempting to run lines in close proximity to one of these beds. With only one exception, I have always found marl in locations where the needle was seriously affected. This is a flat sandy country, and no iron ore was ever found in it, to my knowledge. The true explanation of this variation of the needle is of practical importance to the people of this section. Marl is of great value as a fertilizer for our lands; and if the fact could be established that the mineral deposits, causing this variation of the needle are found in all marl beds in this section, and only there, then much trouble and expense incurred in looking for marl deposits might be saved by the use of proper instruments. Answer: The deviations of the needle, are some times due to magnetic currents in the earth, but more generally to deposits of iron. Any marl that acts on the needle in the manner described must contain considerable iron, or there may be beds of iron beneath it. It is not probable that a "diviner's rod" or any kind of instrument can be devised for pointing out marl; but in mineral explorations for iron the magnetic needle has been successfully employed by Major T. B. Brooks, of Michigan. This explorer, who has had great experience in the use of the compass, thinks that the thickness of rock or earth which covers the iron deposit may be determined by using a dip compass and solving the triangle thus observed. While the deviations of the ordinary needle compass are so great as to interfere with the accurate running of lines, the solar compass, invented by Colonel Burt and used in all the western surveys, can be employed.

W. M. K. says: It is a well known fact that musical notes are produced by the regular vibrations of the air, so many vibrations in a given time producing a given note; and the higher the number of vibrations in a given time, the higher will be the note produced. These notes of different degrees of hight and duration, combined and arranged in certain ways, compose music; and these vibrations acting on the nervous system through the organs of hearing are capable of producing various emotions. As these effects are produced by vibrations acting on the nervous system, would not the same results be obtained by electric shocks acting on the nervous system and corresponding in number and arrangement to the vibrations of the air? Has the subject been experimented on, and with what results? Answer: In the mechanism of the ears, there are a great number of nerve filaments which traverse the organ and are known under the name of Schultze's bristles. These slender threads catch waves which come to them with the rapidity of rifle bullets and render the vibrations fit for reception by the brain. There are 3,000 bristles, each one of which has its own pitch and is thrown into vibration when the proper note reaches it. It does not follow that electricity could be interpreted by the same apparatus, unless sound was produced. Electric shocks are one thing, sound waves are quite another, and there is probably no analogy between them.

C. E. says: Will some surveyor, civil engineer, or astronomer please inform me through your columns the difference (by actual observation) between true north and magnetic north, for this year, in the city of New York? The variation changes from year to year, and day to day, and our correspondent can determine it for himself with a theodolite according to instructions given in books on surveying.

W. C. A. says: When it is stated that a book is 8vo., how am I to know length and breadth in inches, thus impressing upon my mind the size of the book? Answer: Usual 8vo size is 9½x6 inches or a little less. Royal 8vo. is about 11x7, but it may be a little smaller or a little larger.

G. B. L. asks: 1. Are inserted teeth, for circular saws for sawing logs into lumber, better than solid teeth? 2. Can the number of teeth in the saw be diminished, say to one fourth or one sixth of the number generally used, with good results? 3. When the lower half of a cylindrical boiler only is exposed to fire and the lower water gage is half the radius above the line of fire surface, is there danger of explosion should the water fall below the lower gage, unless it falls below the line of exposure to fire? In other words, can water be converted into an explosive gas, under the circumstances described, the heat being transmitted to the water line through two or three courses of brick? Answers: 1. Inserted teeth are largely used and, properly constructed, are found advantageous in ordinary work. 2. We are hoping to obtain the results of experiment on this point, and are as yet unprepared to give a satisfactory answer. 3. No.

D. M. C. says, in reply to H., whose horses are troubled with corns: I am a horse shoer and have had some experience with corns in horses' feet, and think the cause is the shoe bearing too hard on the heel. I treat them with the best success by taking a farrier's knife, and cutting them out, as deep as possible, without cutting to the quick; then, holding the foot upside down, I put in a few drops of turpentine, holding it a few minutes to soak in. Then I take oakum soaked in tar and fill the hole, to keep out dirt and gravel. Fit the shoe with a stiff heel, so that it will not bear on the heel of the foot. Corns seldom trouble after being treated in this manner, and soon disappear entirely.

H. S. T. replies to A. H. S., who enquires for a rat and mouse proof filling for his walls: I have seen dry saw dust used with every success; the vermin soon get disgusted in trying to get through it. It is also the best thing that can be used to guard against cold.

A. W. T. says, in reply to H. J. H: To give metal articles a lustrous black coating. The inside bottom of a cylindrical iron pot, about 18 inches high, is covered half an inch thick with powdered bituminous coal. A grate is then put in and the pot filled with the article to be varnished. The lid is then put on and the pot heated over a coke fire. When the bottom of the pot has been heated for fifteen minutes, the coal has been mostly converted into coke. The pot is then removed from the fire, and, after standing ten minutes, it is opened for evaporation and the articles will be found coated as desired. This coating will stand considerable heat, and disappear at beginning of redness. It is adapted for iron, steel, tinned iron, brass, zinc and pottery. Smaller articles like hooks and eyes may be coated by heating them, in a sheet iron drum like a coffee roaster, with small pieces of coal until they present the desired appearance.

W. G. W. says that S. W. P., who enquires on page 154 about learning phonography, should go to the fountain head for the surest instruction. The inventors' own pure and simple system is the easiest to learn, the most reliable in reporting, and is unmistakably legible in every word. His name is Isaac Pitman, Paternoster Row, London, and his books can be obtained through any bookseller. "The system is taught in my neighborhood very successfully, and is being introduced into the junior schools as an eminently useful educational auxiliary."

B. G. replies to J. S. L., who wants to know how to have good water in his well: I have the best pump water in the neighborhood; my plan was the following: Empty the well, suspend (by a string) a coarse canvas bag, with three or four good sized lime stones and one or two lumps of charcoal in it. Have the string long enough to nearly reach the bottom of the well. In a week or two, take out the charcoal, throw back the lime stones into the well with five pounds of soft coal. Put a round or square wooden shoot up at the back of the pump; carry the shoot up higher than the pump for free ventilation. If the pump is out of doors, put a "tee" on top; if under cover, a fine wire gauze will do. J. S. L. can cover up his well, and I think he will have no more trouble in getting a drink of good water at home.

W. T. B. says, in answer to D. H. S., Jr., who asked how to remove the taste of smut from wheat: To remove taste and smell from smutty wheat, dry your wheat thoroughly, so that the dust of the boll, when broken, will not adhere to the grain. Then run it through your smutter, and back your bins, and, if the air does not purify it in a few days, sprinkle on as much water as you need to toughen the hull of the wheat before grinding, adding one part bromo-choralum to twelve parts of the water.

W. T. B. says, in answer to O. K., who asked if a burrstone could be driven with a quarter twist belt direct from shaft to spindle: I have used the quarter twist belt direct from shaft, for running millstones, successfully. But for 4½ feet stones, I used a twelve inch belt, which I think small enough for the capacity of that sized stone, namely, 25 bushels wheat or 50 bushels corn per hour. The distance between shaft and spindle was twenty feet.

J. M. says that D. can color his extract of lemon with tincture of curcuma. The tincture can be made by putting 1 ounce pulverized curcuma in one pint alcohol; mix, and it is ready for use, but it becomes stronger by standing. Half an ounce of the tincture is sufficient to color one quart of the extract of lemon.

P. A. B. says, in answer to F. C: Heat your screw driver to a cherry red heat, to two inches from the end. Dip in cold water one inch, then rub the point on a piece of brick or anything that will make it bright. When the color at the point comes to a light blue, dip in water.

N. J. F. says, in reply to P., who asked how to make Grecian paintings: Mix equal parts balsam of fir and common turpentine (both should be colorless); shake well and put away in a warm place for a day or two, shaking occasionally. Select a photographic portrait with clear lines and soft shadows, put it into water for a few hours, when the photographic print, if mounted, can be removed from the card. Wipe the paste off carefully and wash well. Then to each side and to the top and bottom, paste strips of paper; the edges should lap very little. After the paste has dried and the strips adhere firmly to the photograph, place the latter in the center of a frame or stretcher, to which paste the other ends of the strips of paper. This suspends the photograph in the center of the stretcher. Then with a large soft brush dipped in spirits of turpentine, moisten the back of the photograph and immediately pour on the varnish above described; rub it with the finger over the entire surface of the back and continue to do so till the picture is seen as distinctly on one side as on the other. Then put away to dry where no dust can mark it. When perfectly dry, prepare a pallet of oil colors mixed with poppy seed oil (to prevent drying too rapidly). Then on the back, lay the hair color smoothly over the hair, the flesh color smoothly over the entire face, excepting the eyes and lips; over the eyes put pure white, over the lips the proper shade of red. Paint the drapery according to fancy, allowing for the colors to sink in drying. When perfectly dry, if cracked, go over again with the same colors and shades; if not cracked, paste (with common flour paste) smoothly to a piece of card board; press till dry, then sponge the face, and, with a little clarified linseed oil on the tip of the finger, go over the picture. Prepare a pallet of colors for the finishing touches. Deepen the shadows, raise the high lights, put a natural flush on the cheeks, paint the pupils of the eyes the proper color, put in the light with pure white, deepen the shadows and raise the lights of the hair. Give a few spirited touches about the lips and mouth, touch up the drapery, and you have "a thing of beauty" which will be a "joy forever." I neglected to mention that the background should be painted on the back of the picture and the whole surface of the back covered with color before it is pasted to the card board.

A. S. says, in answer to S.'s question of making sulphate of nickel: Dissolve metallic nickel in a glass flask nearly filled with a mixture of 8 parts of water and 1 part of sulphuric acid; set the flask in a sand bath apply moderate heat until a more or less dark green solution has been obtained, which, after settling and clearing, should be decanted off in a porcelain evaporating dish. Set the dish into a sand bath, apply moderate heat and evaporate slowly until a thin skin is formed on the surface of the fluid, then remove the dish from the sand-bath and let it rest undisturbed in a cool place for 24 to 48 hours, during which time crystals of sulphate of nickel will be formed on the sides and bottom of the dish; pour off the mother lye from the crystals, and put the latter in a glass or porcelain funnel provided with a paper filter through which the last portions of the mother lye may pass and the crystals dry. Preserve the crystals in a well closed glass or stone ware vessel. Sulphate of nickel by itself, without being combined with other salts, will not make a good plating solution. Another mode of preparing sulphate of nickel is by dissolving metallic nickel in diluted sulphuric acid by the action of a galvanic battery.

J. D. H. says: It seems clear to me that the answer to "J. L. B.'s" question, why a glass jar on a wet cloth may be filled with hot liquids without breaking, is simply this: The water in the cloth retards the heating of the bottom of the jar and thus obviates that sudden unequal expansion of the parts of the jar which would otherwise take place. Would not setting the jar in a vessel containing a little water answer the same purpose?

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Our Present Knowledge of the Sun. By G. W. T.

On a Method of Supplying New York City with Salt Water. By J. P.

On the Transplanting of Trees. By A. K. S.

On Distinguishing Fibers in Mixed Goods. By C. S.

On the Government Works at Hell Gate. By M. G.

On the Collection and Reduction of Photographic Wastes, such as Silver and Gold. By C. L. L.

On Boiler Strains and Perpetual Motions. By J. C.

On the Laundry. By J. K. D.

On the Cause of the Gulf Stream and other Ocean Currents. By J. P. W.

On Positive and Negative Forces. By E. B.

On Phonography and Phonotypy. By E. B. S.

[OFFICIAL.]

Index of Inventions

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February 25, 1873,

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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:

24,199.—GAS REGULATOR.—E. H. Covel. May 14.
24,200.—HYDROCARBON APPARATUS.—E. H. Covel. May 14.
24,227.—CULTIVATOR.—R. M. Melton. May 14.
24,531.—GAS RETORT.—W. Beaument. June 11.
24,548.—HAY MAKING MACHINE.—J. C. Stoddard. June 11.
24,864.—RAILROAD FROG.—G. P. Sanborn, W. Mansfield. June 18.
25,014.—CUTTING WOODEN WARE.—G. R. Hay. July 23.
25,199.—FEEDING PAPER.—R. M. Hoe. August 6.

EXTENSIONS GRANTED.

23,053.—ELECTRO-MAGNETIC FIRE ALARM.—M. G. Farmer.
23,097.—CHAMFERING BARRELS.—H. Littlejohn.

DESIGNS PATENTED.

6,436.—OTTOMAN.—C. J. Conradt, Baltimore, Md.
6,437.—OTTOMAN.—J. D. Ladd, New York city.
6,438.—CHAIR FRAME.—E. Seymour, C. E. Shattuck, Clinton, Iowa.
6,439.—FONT.—A. E. Van Wert, Binghamton, N. Y.

TRADE MARKS REGISTERED.

1,142.—EYE SALVE.—W. T. Blow, St. Louis, Mo.
1,143.—PEARL WHEAT.—J. B. Clow, Allegheny City, Pa.
1,144.—HARNESS COMPOUND.—S. E. Cox & Co., N. Y. city.
1,145.—PICKLES AND SAUCES.—Crane & Co., N. Y. city.
1,146.—CUTLERY.—N. Joseph, San Francisco, Cal.
1,147.—SALVE.—G. Long, Keytesville, Mo.
1,148.—BAKING POWDER.—Moody Bros., Indianapolis, Ind.
1,149.—PLOWS.—E. Remington & Sons, Ilion, N. Y.
1,150.—GIN.—W. P. Sanger, New York city.
1,151.—PILE REMEDY.—M. H. Stoner, Skaneateles, N. Y.
1,152.—PRINTED PUBLICATIONS.—D. Williams, N. Y. city.

SCHEDULE OF PATENT FEES:

On each Caveat.....$10
On each Trade-Mark.....$25
On filing each application for a Patent (17 years).....$15
On issuing each original Patent.....$20
On appeal to Examiners-in-Chief.....$10
On appeal to Commissioner of Patents.....$20
On application for Reissue.....$30
On application for Extension of Patent.....$50
On granting the Extension.....$50
On filing a Disclaimer.....$10
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On an application for Design (7 years).....$15
On an application for Design (14 years).....$30

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TWENTY-SEVENTH ANNUAL STATEMENT

OF THE

Connecticut Mutual LIFE Insurance Company,

OF HARTFORD, CONN.

NET ASSETS, January 1, 1872,.....$30,745,877 24

RECEIVED IN 1872:

For Premiums,.....	$7,715,067 88	
For Interest and Rents.....	2,039,353 16	
		$9,754,420 99
		$40,500,098 23

DISBURSED IN 1872.

To POLICY-HOLDERS:

For claims by death and matured endowments,..	$2,211,991 56	
Surplus returned to Policy-holders,.....	2,906,213 09	
Lapsed and surrendered Policies,.....	678,809 91	
		$5,797,014 56
EXPENSES: Commissions to Agents,..	$586,403 12	
Salaries of Officers, Clerks, and all others employed upon Salaries,.....	63,496 86	
Medical Examiners' fees,..	15,142 00	
Printing, Stationery, Rent, Advertising, Postage, Exchange, etc..	69,226 45	
		734,268 43
TAXES, AND PROFIT AND LOSS,		289,153 98
		6,820,436 54
		$33,679,661 69

BALANCE, NET ASSETS, DECEMBER 31, 1872.

SCHEDULE OF ASSETS:

Loans upon Real Estate, first lien, value,....	$17,652,992 12
Loans upon stocks and bonds, value,.....	298,503 28
Premium notes on policies in force.....	8,800,037 92
Cost of Real Estate owned by the Company,	1,139,972 47
Cost of United States Registered Bonds,....	1,630,536 50
Cost of State Bonds,.....	813,900 00
Cost of City Bonds,.....	2,136,995 00
Cost of Bank Stock,.....	80,205 00
Cost of Railroad Stock,.....	26,000 00
Cash in bank, at interest,.....	1,034,250 53
Cash in Company's office,.....	26,782 23
Balances due from agents, secured,.....	39,386 14
	$33,679,661 69

ADD:

Interest accrued and due,.....	$975,580 29	
Market value of stocks and bonds over cost,.....	214,457 52	
Net premiums in course of collection,.....	88,012 71	
Net deferred quarterly and semi-annual premiums,.....	28,428 92	
		1,256,479 44
Gross assets, December 31, 1872,.....		$34,936,141 13

LIABILITIES:

Amount required to reinsure all outstanding policies, net, assuming 4 per cent. interest,.....	$29,050,000 00	
All other liabilities,.....	747,053 00	
		$29,797,053 00
Surplus, December 31, 1872,.....		$5,139,088 13

Increase of assets during 1872,.....		$2,957,739 47
Ratio of expenses to receipts in 1872,.....		7.53 per cent.
" " " "	1871,.....	8.12 "
" " " "	1870,.....	8.55 "
" " " "	1869,.....	8.45 "
Policies in force, Dec. 31, 1872, 62,868, insuring		$181,896,167 00

JAMES GOODWIN, President.
JACOB L. GREENE, Secretary.

FOR SALE—For half the cost—A complete set of Blanchard Plow Handle Machinery, consisting of Lathe for turning them, by pattern; Bending Machine and 40 forms, which bend 4 handles to each form—besides a Machine for Smoothing. Also, have for sale a Hub Boring Machine. Is self-centering and rapid working. Has never been used. Enquire of S. N. BROWN & CO., Dayton, Ohio.

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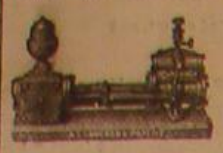

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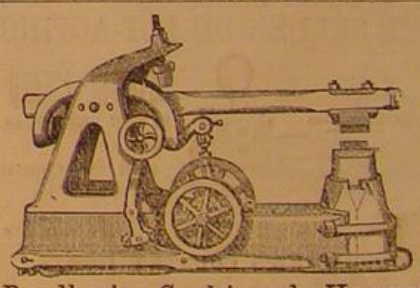

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SCIENTIFIC AMERICAN

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

Vol. XXVIII.—No. 14. [NEW SERIES.] NEW YORK APRIL 5, 1873. [$3 per Annum, IN ADVANCE.

REVOLVING STEAM ENGINE.

The steam engine represented in our illustration is of an entirely novel form, and possesses the peculiarity of a cylinder which revolves with the flywheel. It is claimed that the device is both efficient and desirable, while it is clearly compact and simple in construction.

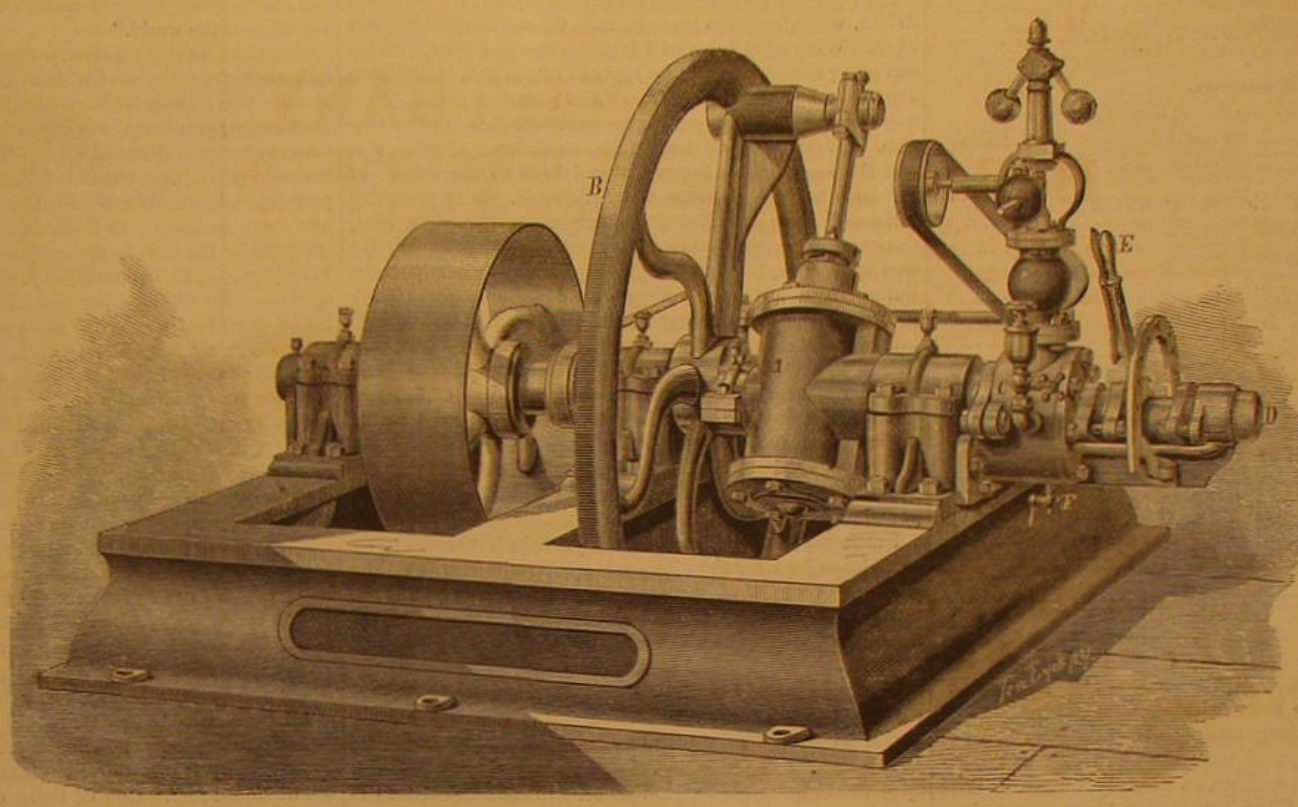
A is the steam cylinder, and B the flywheel. The steam chest is at C, and the exhaust extends through to D. E is the reversing lever, and F a cock for discharging condensation. The invention is so clearly shown that further detailed reference is deemed unnecessary.

The piston rod, it will be noticed, is attached directly to the wrist pin, consequently all the friction of slides, cross heads, and connecting rods is done away with. The motion of the cylinder is produced by placing it at half stroke on one side of the flywheel center. The journals are cast solid upon the cylinder, and both the latter and the flywheel revolve upon their own axes. The valve is stationary and placed upon the exhaust pipe. The steam passes under the face of the valve and then out of the pipe. The valve seat is movable, and if necessary both it and the valve can be removed for repairs by simply taking off the cap over the end of the chest. Within the latter, the steam port is always exposed to the steam. The crank pin has an oscillating motion of about $\frac{1}{16}$ of an inch to a six inch stroke and, it is claimed, is thus prevented from heating.

The lever is situated upon the exhaust pipe and is attached to semi-circular leaves, answering for a link. By turning it in one or the other direction, the engine can be reversed or started ahead; or by moving it up or down to the proper places, the lap of the valve can be altered while the engine is in motion.

The inventors state that they have had one of these machines in constant use for six years. Its cylinder is 3×6 inches, and it makes one hundred revolutions per minute, driving three printing presses. It has been ascertained by experiment that an engine with a cylinder $6\frac{1}{4} \times 8$ inches gives, by dynamometrical test, 14 horse power, 55 lbs. of steam, and 120 revolutions. Attached to a 24 inch burr millstone and a corn sheller grinding corn, a machine of the above dimensions under 55 lbs. of steam, made 250 revolutions per minute, with 430 revolutions of the stone. The detailed results given are very satisfactory, indicating large economy of fuel, although the boiler employed was of a disadvantageous form.

Patented through the Scientific American Patent Agency by Scott and Morton. For further information in regard to purchase of engines, etc., address Peter Black & Sons, manufacturers, Hamilton, Ohio; or in relation to rights, etc., address the patentees at the same place.

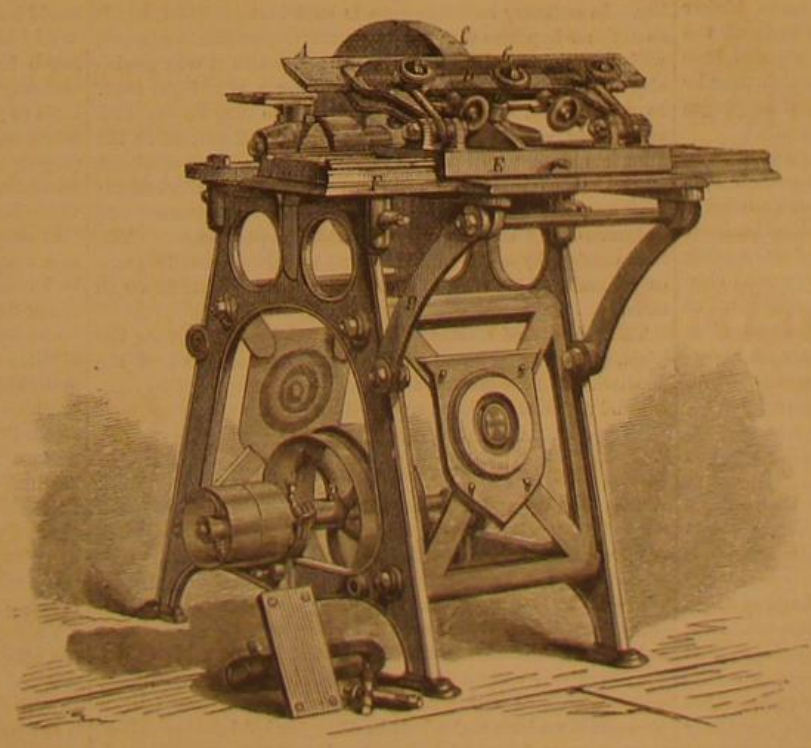


SCOTT & MORTON'S REVOLVING STEAM ENGINE.

REVERSIBLE REST SINGLE WHEEL GRINDER.

In the machine here represented especial attention has been paid to providing a convenient and easily adjustable rest upon which to place the work, and also to supplying an accurate method of grinding long knives or other straight edges with emery wheels.

In the cut, A represents a knife being ground. B B are braces supporting an extension table, and C is a Tanite emery wheel. The knife is held in a clamp, D, which is adjustable by hand nuts and bolts to thick or thin, wide or narrow, blades. The angle at which the edge of the blade is ground is regulated by the hand bolt, G. E is the carriage or slide which is passed to and fro in front of the wheel, C, on the shears or bed, F. This machine is furnished with two small rests having each a surface 4 by 8½ inches, also with a large rest or table 8½ by 20 inches in dimensions. These surfaces are faced with accurately ground reversible plates of saw steel, and either rest can be brought to either edge of wheel at or below the center, or raised, if desired, 8 inches above the center of the arbor. They can also be adjusted on either side of the wheel at such point as is desirable. The general design of the machine, combining metal where strength is required, lightness where extra metal would be useless, and artistic taste with utility, will commend it to all mechanics.



THE TANITE CO.'S REVERSIBLE REST SINGLE WHEEL GRINDER.

When the knife-grinding attachment is removed, the table rest forms a true surface for holding gang or mulay saws while grinding the teeth either to sharpen or "gum" them.

The machine is very handsome in appearance, and the high standing of the manufacturers is a sufficient guarantee of its efficiency. For further particulars address the Tanite Company, Stroudsburg, Pa. See advertisement on last page.

Scientific Research versus New Inventions.

At the recent meeting of the American Institute of Mining Engineers, Boston, Mass., Professor R. W. Raymond made the following remarks:

"I suppose we shall be told that mining and metallurgy are not sciences, but arts; and that we who pursue them occupy a place a grade below that of the disciples of scientific research, the seekers after truth as truth, *for its own sake*. Gentlemen, I would do no injustice to any form of science, physical, mental, or moral. But it should be borne in mind that the absolute truth is what we never can attain; our utmost investigations give us only the truth as it is related to man. And it is truth for man's sake that we seek.

"It was my good fortune to be present at the farewell banquet given to Professor Tyndall by the scientific and literary men of New York, and attended also by a host of guests, comprising an unequalled array of the scientific and literary men of the United States. Aside from the relations between religion and science, which received perhaps an undue share of attention from the orators of the evening, the principal stress was laid on the great value of scientific research, as distinguished from mere invention or applications of natural laws to useful ends. It is announced that Professor Tyndall has generously devoted to the encouragement of the former the entire profits of his American lectures. Far be it from me to detract one iota from the praise which is due to the earnest, honest, and disinterested inquirers who have made the secrets of nature available for the use of man. But when so much emphasis is laid upon that kind of physical investigations which promises no immediate benefit, as if it were a higher kind; as if truth lost something of its dignity when conjoined with utility; as if it were aristocratic to deal with abstractions, like atoms and ether, but vulgar to find out things that it happens to be worth money to know; then I feel justified in vindicating the dignity of the craft of those who work for money and for man.

"For what is the significance of the statement that a discovery is 'worth money?' Merely this, that it lessens human toil, refines or enlarges the product of toil, transfers toil from the ruder muscular sphere to the sphere of mind, which is the sphere of machinery. A machine, a mechanical or a metallurgical process, is the incarnation of the spiritual power, the symbol of man's control over nature, and every new one lifts us higher in the scale of potency, making the race more and more dominant over its circumstances. The money that a discovery is worth constitutes the general estimate of the good it will do. This estimate may be erroneous, the world may be short-sighted in the measurement, but the element of utility is not therefore an unworthy one. 'Not as the servant of Mammon,' says Professor Tyndall, 'but as the supporter and enlightener of the mind of man, would I have you take science to your bosoms.' Very good; but minds supported and enlightened in that way will certainly make money, that is, they will save labor, or do more work with the same labor. The fact is that it is impossible to prevent science from being useful to mankind, unless it be locked up in the bosom of the student. This would be strictly seeking truth as truth, seeking merely for the sake of knowing; but our great philosophers would scorn such

selfish isolation. To know truth that we may tell it, apply it, make it fruitful, is the key note of science; and the truth about ores and minerals, fire clay, fluxes, and blasting powders is as worthy of knowledge as the atmosphere of a fixed star."

Scientific American.

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VOL. XXVIII., No. 14. [NEW SERIES.] *Twenty-eighth Year.*

NEW YORK, SATURDAY, APRIL 5, 1873.

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THE INTELLECTUAL ENJOYMENTS OF SCIENCE.

Those who, for several years past, have been advocating the more generous introduction of scientific training into our schools and colleges, at the expense, if necessary, of giving less attention to philological studies, have, as a main argument, insisted on the greater utility of the knowledge of scientific truths as compared with the knowledge of the ancient Greek and Roman authors, so liberally imparted to our college-going youth. They have pointed out the glorious results with which science has enriched human society in the nineteenth century, and the comparative sterility of the so-called classical studies; they have pointed out the success in practical life of those men who have received a scientific education, while those whose whole training was merely philological have, in many cases, been starving for want of capacity to earn an honest living by useful practical labor, either mental or mechanical. In short, they have confined themselves to the task of praising science from a mere utilitarian point of view, forgetting that it may have higher claims, not only equal to those on which the friends of the old and time honored custom of studying the classics base their defense, but even surpassing anything which may be asserted in favor of the effect of studies of the dead languages and literature on the development of the human mind.

The higher classes of society, especially in England, consider labor, if not directly degrading, at least below their special domain. They are apt to regard that kind of knowledge which is merely useful and such as men in practical business are in need of as without interest; and in place of attempting to acquire, for instance, so much knowledge of light and electricity as to be able to understand some optical apparatus or the electric telegraph, they prefer to concentrate their attention upon the writings of Virgil or the poems of Homer. A knowledge of Latin and Greek is supposed to be about the highest enjoyment reserved fo a man of high culture, for the reason that these studies are pursued, not for a secondary, base, utilitarian purpose, but out of pure love for what is beautiful and true.

Those lovers of science who feel and know that in the study of God's handiwork, Nature, there is much more enjoyment, beauty and truth than in the study of literature, which is a mere human production, have therefore recently been raising their voices so as to persuade the most cultivated classes, if possible, that the pursuit of scientific studies is at least as much worth their notice as the pursuit of philology; that that they should not abhor a chemical laboratory, or philosophical cabinet, as dull and dry; that there are fascinations hidden in these sacred precincts of science, which have only to be tested, with the purpose of impartial investigation, in order to be appreciated. This order of defenders of science have found a powerful advocate in Professor Tyndall, who, in his recent lectures, so often insisted that the classes of people for whom he spoke "should take science to their bosoms, not as the servant of Mammon, but as the supporter and enlightener of the mind of man." And the effect of his often repeated appeals has been something marvelous; people of high standing in society, and of corresponding cultivation of mind, who have been accustomed to occupy themselves in their spare hours with reading poetry and works of fiction or, at the very best, the so called classics, have furnished their libraries with works on science, and are studying optics, the polarization of light, etc.; and some have even gone so far as to buy, in place of useless ornaments, prisms, microscopes, and polariscopes, and are delighting themselves and their friends with the revelations made by those instruments, which seem to give us additional organs of sense.

We make no objection to Professor Raymond's remarks (republished elsewhere in this number) made lately before the Institute of Mining Engineers at Boston, and again taking up the defence of scientific pursuit from the utilitarian point of view; we wish only to defend the position of Professor Tyndall, who in aristocratic England has, by his social status, during his whole life been compelled to appeal to the feelings of the higher classes in regard to that which is worthy of their attention, and who by his untiring efforts has elevated the standing of science and of the men of science, in the eyes of the rulers of society and of the whole world, to a hight never before reached.

PILE DRIVING AND THE LAWS OF IMPACT.

A subscriber propounds the following question: "A pile driver, weighing 2,500 pounds, falls through guides 25 feet high. With what force will it strike the last blow, friction not being considered?" The reply to this is that the striking force may be any amount from 2,500 pounds upward. The question, as asked, does not give sufficient data for its solution. When a heavy body falls, an amount of energy is stored up in it which is proportional both to the weight of the body and the distance fallen through. It is generally estimated in units called foot pounds. In the given case, the energy accumulated in falling, or the work done on the ram by gravity, is equal to $2{,}500 \times 25 = 62{,}500$ foot pounds. Before the ram can be stopped, an equal amount of work must be done in retarding it, since it is a well ascertained law of nature that the energy stored in a body while putting it in motion, is precisely equal to that which it gives out in resisting arrest. This amount of work, 62,500 foot pounds, can be done either by a force of one pound acting through 62,500 feet, by 62,500 pounds acting through one foot, or by any force acting through such a distance that the product of force into distance shall be equal to 62,500 foot pounds.

Before we can answer the question asked, therefore, we must know how far the pile moves while resisting the falling weight. Again, if we were told the mean resisting power of the pile, we could calculate precisely how far it would be driven by the last blow. Were the ram to strike the pile after falling $23\frac{1}{2}$ feet and to come to rest at 25 feet, the mean force exerted would be $62{,}500 \div 1\frac{1}{2} = 41{,}666\frac{2}{3}$ pounds. Were the pile driven 3 feet at the last blow, the ram still having a total fall of 25 feet, the mean pressure would be $62{,}500 \div 3 = 20{,}833\frac{1}{3}$. If the pile moved but an inch, the force developed would be $62{,}500 \div \frac{1}{12} = 750{,}000$. In actual practice the pressures would be less than those calculated, because part of the work done would be expended in crushing the head of the pile, and in overcoming the friction in the guides. Our figures are maximum values, which may be approached but never quite reached.

Knowing the distance moved by the pile under the last blow of the ram, and calculating, as we have done, the mean resistance offered by it, it is customary, with some engineers, to take one eighth the latter figure as the safe load which can be put on that individual pile without danger of its sinking. In ordinary soil this rule is sufficiently correct, but it sometimes happens that a heavy pressure, suddenly applied, will move a pile almost imperceptibly, while it will gradually sink to an indefinite distance under a very light load. In other cases, as along our docks, a pile may be set with apparently very feeble carrying power; and yet, after the mud has become well packed about it, and has been rendered somewhat compact and adherent by the superincumbent pressure, the pile will carry a heavy load. Experience and judgment only can be safely trusted in such cases. The load carried by a pile in the stiffest soil has been, in some cases, made as great as 80 tuns, but a usual load is 20 or 25 tuns.

The velocity of striking is calculated by multiplying the hight of fall by 64·3 and extracting the square root of the product. The coefficient, 64·3, has been determined by careful and a thousand times repeated experiment.

WATER AS FUEL.

"On Monday and Tuesday afternoon," says the San Francisco *Alta*, "a large number of citizens, by invitation, visited the brass foundery on Fremont street, for the purpose of witnessing some experiments with a new fuel recently invented. They were shown into that portion of the establishment occupied by the furnaces, and in one corner found a brick furnace, some eight feet long and six feet high. On the top of this was an iron tank holding about ten gallons, which was filled with crude petroleum. From this tank a pipe about an inch and a half in diameter led into the side of the furnace. A small jet of oil, not larger than a small goose-quill, was permitted to flow out of this tube; a light is placed beneath this jet, and it immediately ignites. Another pipe, about an inch in diameter, leads from a steam boiler stationed some fifteen feet away. This pipe leads a small jet of steam upon the burning oil, and the moment the steam strikes the oil the oxygen in the water is set free and ignites with a tremendous roar, generating in a very few moments a most intense white heat.

"From this small source the entire chamber of the furnace, which is some two feet by five feet, is filled with a flame so brilliant and dazzling that one cannot gaze on it for more than a moment at a time. This flame possesses all the heat of an oxyhydrogen flame, and beneath its fierce power the hardest metals melt in a few moments. The inventor of the apparatus by which the elements of heat, which nature so generously provides, can be utilized is a very modest man, saying that he did not want to bring his discovery before the public until he had fully demonstrated that it would do all he claimed for it. He says that the cost of his furnaces will be only a nominal sum that will be within the reach of every one who owns a quartz ledge, while the amount of oil consumed in twenty-four hours will not exceed ten gallons, at a cost of two dollars.

"The inventor has every confidence in his discovery, and declares his ability to furnish fuel for a voyage of one of the Panama steamers to and from Panama for the insignificant sum of $200, while the entire quantity will weigh not to exceed twenty-five tuns. He further says that, at an expense of five dollars per day, he can run furnaces that will smelt one tun of ore every thirty minutes. If only one half of what is claimed can be accomplished, the discovery will prove of incalculable advantage to the mining interests of the Pacific coast, and will create a revolution in steam travel throughout the world."

REMARKS BY THE EDITOR.—There are, in the above article, a number of points upon which we propose to make a few comments: Many attempts have been made to construct furnaces for burning petroleum, but none of them have gained enough favor to be universally adopted. There are a few establishments in the country where it is claimed that the fuel is crude petroleum, but authentic reports of the economy of the furnaces are wanting. In Paris an ingenious contrivance was invented by the well known philosophical instrument maker Wiesnegg, which, in a small way, yielded good results. The appliance for distributing the oil consists of a pipe with branches and of a grooved grate along which the oil flows after dropping from these tubes. A wrought iron cistern contains the supply of petroleum, and is connected with the distribution by an india rubber tube. The grate is placed vertically; the air, being admitted between the bars, supplies the oxygen for the combustion of the petroleum vaporized by the heat of the fire. The petroleum is supplied to the grate a little in excess of the requirements of the furnace, and the surplus drops into a receiver and is volatilized by the heat of the furnace and the vapor is consumed. No blast is necessary. A somewhat similar contrivance was suggested by Deville for use on locomotives and on steam ships. This savant was employed by the French government to conduct a series of experiments looking to the employment of petroleum as fuel. Samples from all parts of the world were tested and the heating effect was determined by the number of kilogrammes of water that could be raised from zero to one degree centigrade by one kilogramme of oil. A trial was made by Deville upon locomotive engines arranged to permit the use of liquid fuel. One of these consumed about thirteen pounds of oil for every eleven hundred yards of distance traveled; while the coal burning engines of the same class required for the same work more than twenty pounds of solid fuel. The Deville furnaces for burning petroleum have been tried in this country, but little is known about them and it is a question whether, at the present low rates for crude material, they could not be advantageously introduced for many purposes. Deville and Wiesnegg accomplished the combustion of petroleum by introducing the oxygen of the air through peculiarly constructed grates. Neither of them could have been so unphilosophical as to try steam, for they would have known that, in order to generate the steam, so much fuel would be required as to take away the entire economy of the application. One furnace would have to be built to generate the steam to carry on the combustion of the petroleum in the second furnace. We have here again the perpetual motion of combustion lurking in the minds of the careless spectator, and there is something so captivating in the thought of burning both water and petroleum as fuel that everybody is at once ready to adopt the new invention as a wonder of the age. We do not say that water cannot be burned; every scientific man knows that it can, but we assert that cannot be burned economically. In order to bring water to the condition of fuel, other fuel must be consumed. If this result is attained by means of a galvanic battery, zinc and sulphuric acid are the fuel; if by a magneto-electric machine, the machine must be driven by a steam engine. If steam is burned in a grate by coals or by petroleum, we must first use fuel to get the steam. It generally happens that the original fuel burned costs more than the fuel produced by the water, so that there is a clear loss. If the two fuels have the same value, the process is not economical, as the cost of machinery and the wear and tear of manipulation must be taken into consideration; and what would be the use of transforming one fuel into another which is no better?

This water burning business has become a nuisance that can only be abated by the dissemination of correct scientific principles. Pumping water into a reservoir by a costly engine in order that it may drive a small wheel at the bottom is fully as economical as any of the contrivances for burning water with which we are acquainted.

CHEMISTRY IN LEIPSIC.

The university of Leipsic possesses one of the finest and best equipped laboratories in Germany, with no less a person than Professor Kolbe as lecturer on chemistry. Recently a thick octavo volume of nearly 700 pages has been published, giving a detailed account of the original investigations made in that laboratory for the past six years. The results of

nearly, or quite, all of this work were published to the world from time to time as each investigation was completed. but the collection of them together in book form impresses us with the magnitude of the work, and shows how much can be accomplished in a single institution. Of course, many of these investigations are the direct product of Professor Kolbe's fertile brain, and equal results cannot be expected everywhere. But some results like these, though fewer in number and of less importance, ought to be produced in a dozen of our highly endowed American institutions, where to-day the dust lies deep on long unused apparatus.

It may be objected that these investigations have neither lead to startling discovery, nor brought in much money to the investigator. But science can point out so many occasions where the pursuit of knowledge for her own sake has benefited the world at large, that this charge will not avail much among the thoughtful, and especially among intelligent capitalists and inventors. From the time when Priestley discovered oxygen or Liebig prepared chloroform, to the time when Hoffmann discovered the beautiful aniline dyes that bear his name, the most valuable and beneficial chemical inventions have sprung from the study of science for her own sake. Nature can be compared to the wary heiress, who repels each suitor who, as she thinks, is courting her for her money, and bestows her heart only on the true lover who, ignorant of her wealth, adores her for herself alone; and like the cautious heiress too, she often disguises herself as a pauper to test the devotion of her followers. On the other hand, the fortune seeker, who marries the milliner's apprentice in the expectation that she will turn out a millionaire in disguise, deserves the disappointment; and science often thus disappoints her mercenary followers.

SINGULAR CAUSE OF FIRE.

The works of the Rubber Cloth Company, at Naugatuck, Conn., were destroyed by fire several weeks ago under the following singular circumstances: The building, an old one of wood, was 100 feet or more in length. The cloth is prepared by treatment with alcohol and linseed oil, and, during the operation, is passed over wooden rollers and extended along, for fifty feet or more, into a smaller vulcanizing chamber some thirty feet in length, where it is hung in folds from the ceiling to be dried and heated. The heating is done by steam pipes. Electrical sparks had often been noticed in passing the cloth along over the rollers. On the morning in question, which was exceedingly cold, the sparks had been observed to crackle louder than usual. A snow storm was in progress at the time. The workman, who was engaged in hanging the folds of cloth in the vulcanizing chamber states that suddenly there seemed to come from his hands a sheet of electrical fire, there was an explosion, the whole place was instantly in flames, and himself and others had to run for their lives. The building and contents were soon destroyed. The theory is that the fumes of alcohol and oil formed an explosive gas in the apartment, which the electrical sparks ignited, just as gas ordinarily is fired by electricity.

New works have been put up and the rolling machines have been connected by conducting wires with the earth. We are indebted to Mr. Allerton, the manager of the company, for these particulars.

VESUVIUS.

About two thirds of the way up the side of Vesuvius, stands a small building, plainly visible from the Naples side of the bay. During cloudy and wet weather, it is shrouded in the dense veil of smoke which settles around the summit; and in times of eruption, the fiery streams seem to encompass it and flow far below its level. In this structure, thus dangerously located, Professor Palmieri, a well known Italian savant, has established an observatory and, with marvellous intrepidity, has remained at his post watching the convulsions of the volcano at times when his house stood between torrents of liquid fire, the heat from which cracked the windows and scorched the solid stone of the walls.

The knowledge obtained at so great a risk has been recently given to the world in an ably written volume, which contains *data* calculated to be of invaluable assistance in the future investigation of volcanic phenomena. Professor Palmieri considers that, to a certain extent, eruptions may be predicted, a belief which he bases upon late observations that the central crater commences the agitation, which is then followed by a series of light convulsions which terminate in the grand outbreak. This concluded, the volcano becomes again quiescent. A vivid impression of the enormous force developed during an eruption is conveyed in the fact that on April 26, 1872, the volume of smoke, ashes, lava fragments and bombs projected upwards from the crater attained the hight of no less than 4,365 feet from the edge.

It is difficult to convey an adequate idea of the appearance of Vesuvius when thus convulsed. It was our fortune to witness the eruption of 1868, which, in point of magnitude, was probably little inferior to that of last year. Pictures of the phenomenon invariably exaggerate it, as they depict a steady column of fire of a hight equal to or greater than that of the mountain. As the latter is over 3,000 feet above the sea level in altitude, the impossibility of a fiery pillar of such proportion is obvious. Red hot stones are occasionally, as we have above stated, thrown to greater hights; but such is by no means of common occurrence. By day, an unceasing flow of white smoke rises like a gigantic plume from the crater, and is visible for miles distant; while at night, the base of the column becomes radiant with a lurid glare. During the hight of an eruption, the smoke is ejected in greater quantities, and the summit of the mountain belches fountains of flame. The latter, however, are by no means continuous. The volcano will often remain quiet for hours and sometimes days, often causing it to be believed that the convulsions are over. Then all of a sudden, the smoke clouds will thicken, a rumbling becomes heard, and a great jet of fire rises for a short distance above the crater and instantly falls back. At the same time, stones and red hot *scoriæ* rise high in the air and add, by their fall, to the noise of the commotion. This goes on at varying periods, sometimes ceasing immediately and again continuing for a day or more. There is a prevalent though mistaken idea that lava, at the time of these great outbursts, pours in rapid torrents down the declivity. In times of repose, it is very seldom that the streak of light due to the red hot mass is seen on the mountain side; though when an eruption first begins, probably after night fall, a jagged lurid line will be remarked reaching below the crater. This extends as the convulsion progresses, and, after several weeks, it expands into several dull red streams reaching down a distance perhaps of two thirds of the slope. The onward movement of the lava is very slow, and of course it is totally unlike the molten rivers represented in popular prints. Its surface soon cools sufficiently to permit of being walked over, though a stick thrust a few inches down becomes quickly charred.

The danger to the villages at the base of Vesuvius does not lie so much from stones or ashes being heaped upon them, as we have recently seen it stated, but from these descending lava streams extending down far enough to reach populated portions. In regard to the mountain throwing ashes, such is often the case when the wind is high; but the quantity ejected is never enough to cause apprehension. The substance which buried Pompeii and Herculaneum, which seems to be nothing more than fine dry pumice, must have been the result of an eruption to which modern convulsions furnish no parallel. We have seen ashes carried to points several miles distant from the volcano; but, during the entire course of the eruption, the aggregate depth to which they fell could not have exceeded from one eighth to one quarter of an inch. The substance was in black friable grains somewhat resembling gunpowder, but very unlike the material which entombed the Roman cities.

Professor Palmieri has produced a very instructive work on Vesuvius. Now, we would suggest that he supplement his efforts by turning his investigations from an intermittent to a constant volcano—from Vesuvius to Stromboli. The latter, situated on an island in the Mediterranean, is in perpetual eruption, and the light from its summit serves as a well known beacon to sailors. For how long the phenomenon has existed, history does not state; but it seems to us that much valuable cosmical knowledge might be gained from the results of such continuous volcanic action.

THE GREEK NEW TESTAMENT.

The manuscript copies of the Greek New Testament, written before the art of printing was discovered in Europe, are known to differ among themselves in many small points, such as one or two letters in the spelling of a word, which frequently changes the meaning of the word. After the Testament was put in print, in the sixteenth century, different manuscripts were compared with the printed text, and the variations from it noted. The further this comparison, or collation of manuscripts, was carried, the greater was the number of variations discovered; and soon, alarm was excited for the safety and integrity of the text itself. The collation of manuscripts, however, still went on, until a mass of "various readings" was secured, numbering many thousands and constituting in textual criticism what a body of observed facts does in physical science.

About one century ago, Dr. John J. Griesbach began to apply these "various readings" to the actual correction of the text; doing it however in a cautious and sparing manner, yet going far enough to show that the text might be both preserved, and purified and established, by the proper application of scientific principles in the use of the observed facts. But the opinion continued to prevail that the genuine text was to be arrived at by the agreement of the greatest number of readings. As the modern manuscripts far outnumber the ancient ones, this was equivalent to settling the text on their authority, as though, the further you go in time from the original autographs, the nearer you must thus become in fact to the very words and letters in which those autographs were penned. Considering the liability to error in copying, the truth is indubitably in the opposite direction. The nearer we can go to the first century of the Christian era, during which all those autographs were written, other things being equal, the nearer we must get to the actual readings of the autographs themselves.

When our common English version was first put in print, in 1611, the oldest Greek manuscripts available to the translators were written as late as the tenth century. Since their day, manuscripts have been brought to light, and many of them printed, dating back to the middle of the fourth century, and from that point down to the tenth. Two eminent scholars, Dr. S. P. Tregelles, of England, and Dr. C. Tischendorf, of Germany, have also each devoted thirty years to the collection of readings from the ancient manuscripts, and the practical use of them in revising the text. In addition to the testimony of the ancient manuscripts thus secured, they have also developed other principles of criticism, and reduced them to practical rules, so definite in their application that, in most cases, the revised texts of these distinguished scholars entirely harmonize.

Thus through the medium of textual criticism, and by the patient and intelligent application of its principles during long years of toil, we now have the text of the Greek New Testament restored essentially to its original purity, and established on a firm and scientific basis.

Previous to the tenth century, the manuscripts were written in capital letters, and without a space between the words. The three most important and valuable of them are the Sinaitic, the Vatican, and the Alexandrian, many of whose various readings are given by Tischendorf in his Leipsic edition of the English New Testament. The Sinaitic manuscript, critically marked *Aleph*, written about the middle of the fourth century, was discovered by Tischendorf, February 4, 1859, in the convent of St. Catharine, on Mount Sinai, in Arabia, and published by him in facsimile in 1862, and in the common type in 1865. It contains the entire New Testament, and is deposited in the Imperial library at St. Petersburg. The Vatican manuscript, marked B, also written about the middle of the fourth century, has been published only since 1857. It is in the Vatican library at Rome. The Alexandrian manuscript, marked A, written about the middle of the fifth century, was first published in 1786. It is in the British Museum, at London. The Ephraim or Royal Paris manuscript, marked C, of the fifth century, and the Cambridge manuscript, marked D, of the sixth century, are next in value.

As specimens of various readings: In Matt. 7:14, *Aleph* and B have *OTI*, "*because* strait is the gate," putting it on the same ground as the preceding motive for "entering in at the strait gate," and *OTI*, "*because* wide is the gate," etc. But later copyists dropped the *O*, and made it read *TI*, "*How* strait is the gate." In Luke 13:24, *Aleph* and B have *ΘΥΡΑΣ*, "door," corresponding with "the door" spoken of in verse 25. But later copyists changed three letters and made it read *ΠΥΛΗΣ*, "gate," as in Matt. 7:13, 14. The doxology to the Lord's prayer is not found in any of the oldest manuscripts in Matt. 6:13; just as all omit it in Luke 11:4. But in later times, the prayer, having come into general use in the church service, was closed with the doxology, and with that addition was copied into the later manuscripts of Matthew.

In 1862, and 1865, the American Bible Union, of New York city, published a first, and a second revision of the English New Testament, under the direction of Dr. T. J. Conant, following the revised Greek text, so far as it was then settled. That society is now preparing a third revision, from the completed text of Tregelles and Tischendorf, in the current English of the present day. The Canterbury diocese, of England, is also employing revisers for a similar purpose; but they propose retaining the antiquated English of the common version, except where it cannot be readily understood.

CONTAGIOUS AND INFECTIOUS DISEASES.

Dr. Symes Thompson, a well known English physician, recently lectured on the above topic in London; and from his discourse we glean the following:

It is considered a settled fact that diseases of a contagious nature are caused and spread by influences largely within the sphere of human government and control. Every form of infectious fever has its idiosyncrasy. Enteric fever and cholera tend chiefly to disseminate themselves through water, passing into the wells and fountains of daily supply, and at times traveling from house to house in the milk cans of easy conscienced diarymen. Scarlet fever hibernates in a drawer and, after long months, comes forth with some old and cast aside garment, to be thrown with it around the throat or head of some new victim, and so start thence upon a fresh career. Typhus fever crawls sluggishly from hand to hand and mouth to mouth and is immensely sociable in its spirit, languishing away when condemned to solitary confinement. Typhoid fever generates itself where filth, overcrowding and impure habits of life prevail; and relapsing fever glides in the track of privation and misery.

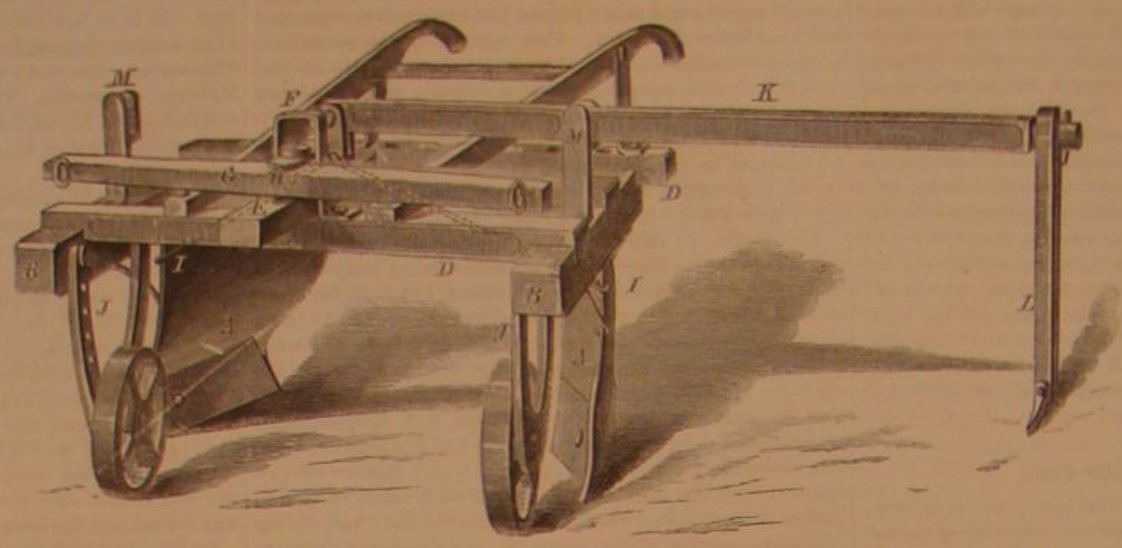
The means now known of controlling these evil ministrants are, in the main, careful isolation of the sick, the preservation of the water from which daily supplies are derived in uncontaminated purity, the uninterrupted ventilation alike of hospitals and dwelling houses, the immediate removal from the vicinity of active human life of all excretions of the sick and the destruction of their morbific influence by mixing them with antiseptic and disinfecting agents (such as carbolic acid, sulphuric acid, chlorides of lime and zinc, permanganate of potash, and charcoal), temperate living, avoidance of any kind of excess, and above all the cultivation of an intelligent familiarity with natural laws.

In regard to antiseptics and disinfectants, Dr. Thompson states that it should be understood that agents of the character of carbolic acid are properly antiseptics, and operate mainly by arresting the process of fermentation and decomposition, while agents of the nature of Condy's fluid (permanganate of potash), chloride of lime, and especially charcoal, are disinfectants, and act by absorbing the noxious products of decomposition. This he showed by experiment, a few drops of carbolic acid causing a cessation in the evolution of gas bubbles from a fermenting solution of sugar; and the violet color of Condy's fluid was instantly discharged when combined with water in which was a trace of sulphureted hydrogen. The lecturer also exhibited the remains of a rat which had been placed in a jar of charcoal six years ago. Only the bones and a few hairs were to be seen; and although the jar had been covered with but a piece of paper, throughout the lengthened period of decomposition, no trace of disagreeable smell was at any time emitted.

NITRIC ACID IN SPRING WATER.—The water supplied to the city of Munich, Ger., contains nitric acid and saltpeter. Professor A. Wagner states that the amount of water used by the city in one year, by the ordinary water pipes, contains saltpeter, sufficient to make 18,106 cwt. of gunpowder.

CORN PLOW AND MARKER.

The invention illustrated herewith is an improved machine for furrowing the ground for cultivating or preparatory to planting. The standard posts of the plows, A, are pivoted to the under sides of the beams, B. The latter are held in position by the cross bars, D, in which several holes may be made to receive the connecting bolts, so that the plows may be adjusted either wider apart or closer together as desired. E is the tongue which passes through the keeper, F, attached to the cross bar, D, and is loosely bolted at its inner end so as to have vertical but no lateral movement. This construction relieves the horses' necks from having to support any weight, and at the same time leaves the plows free to follow the surface of the ground. G is the double tree to the bolt of which is pivoted a double plate, H, which extends through the tongue keeper, F, and above and below the tongue. To this are secured the draft bars, I, indicated by dotted lines which communicate directly with the plows. The small gage wheels shown are pivoted to the V shaped standards, J. In the forward arms of the latter are a number of holes by means of which the position of standards and wheels may be altered so that the latter may be adjusted to cause the plows to work at any desired depth of ground. The handles are supported by a round, and also by braces on the rear cross bar. They may be inclined to allow the operator while guiding the plows to walk at the side of the row of plants being cultivated.



MEIXELL'S CORN PLOW AND MARKER.

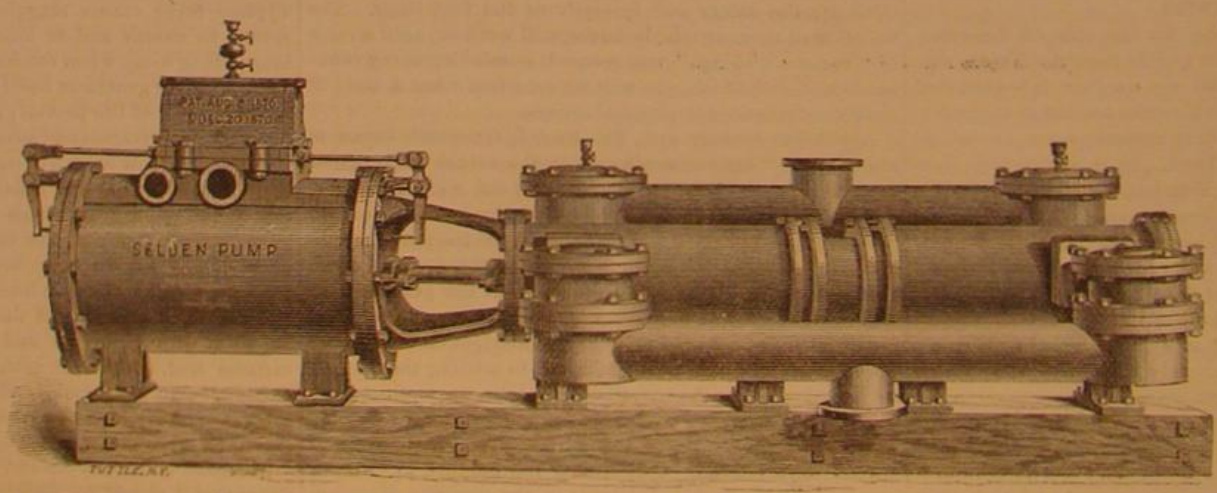
K is a long bar pivoted as shown to the tongue, so that it has a free vertical, but no lateral movement. At its outer end is swivelled a bar, L, at the extremity of which are hooks or prongs which drag along the ground. To the beams, B, are attached brackets, M, to receive the bar, K, and hold it always at right angles to the machine. The above arrangement, which constitutes the marker, may be turned to one side or the other, as the apparatus passes back and forth across the field.

Patented through the Scientific American Patent Agency, October 22, 1872, by Mr. George W. Meixell, of Hecktown, Northampton county, Pa., from whom further particulars may be obtained.

AN IMPROVED FORM OF THE SELDEN STEAM PUMP.

This machine is a recently modified form of a well known and efficient steam pump, especially applicable to the purposes of mines and water works, and arranged with particular reference to pumping water containing dirt or gritty matter.

The portions in the illustration to which attention is directed, are the device for operating the slide valve of the steam cylinder and the arrangements of the water valve chambers. It will be noticed that the valve rod emerges from both ends of the chest and at its outer extremities is connected with the short arms of levers which are pivoted to brackets on the cylinder heads. To the lower and long arms of the levers, two small rods are suitably connected, which pass into the steam cylinder. Against these the piston at either end of its stroke strikes, thus actuating the levers, and through them the slide valve. This movement is evidently positive. It is stated that the pump will not stop so long as there is steam to drive it, while there is no point at which its motion can be arrested without leaving the steam ports fully open, and thus insuring its operation as soon as steam is admitted. The advantage of this arrangement, apart from its efficiency and simplicity, also lies in the fact that the steam and water cylinders of the longest stroke pumps can be located very near together, just leaving room to pack the glands, and ensuring compactness and strength. It is claimed that the valves will discharge water of condensation without choking, and that the pump will operate with water as steadily and reverse as promptly as with steam. We are also informed that it will run under water, in case of flooding of a mine or similar casualty.



AN IMPROVED FORM OF THE SELDEN STEAM PUMP.

The combination of the two pump cylinders with the plunger between them, the latter connected directly with the piston rod, is generally understood and indeed plainly indicated in the illustration. The water valves are, it is claimed, made so large that, by lifting from three eighths of an inch in the smaller sizes to one and a quarter inches in the larger sizes of pump, they will give the full capacity of the suction and discharge pipe. We are assured that their action cannot be heard, even with the ear upon the chamber, when working under a test pressure equal to 350 feet. The point in the construction of the valve chambers to be noted is that the upper and lower chambers are cast in separate parts; and having the plate upon which is the valve seat between them, the whole being securely bolted together, should any accident occur to the seat plate it can be readily taken out and repaired or renewed, without loss of any other part. The valve seat is made of the best composition and attached to the plate, and may be replaced in a few minutes by removing the cover.

The water cylinder being some one and a half or two inches larger than the plunger gives the pump an advantage over the piston pump in raising gritty water, as the surfaces are not in contact, and are therefore not exposed to grinding and consequent leakage. The machine is designed to be placed directly at the bottom of the mine, so that it obviates the expense of the pipes, etc., attendant upon the use of a pump on the surface. We learn from the manufacturer, Mr. A. Carr, of No. 43 Cortlandt street, in this city, that a sample pump of this description has been forwarded to the Vienna Exposition, and also that he is in receipt of orders for the machine from Germany.

Slates.

A fine, sound texture is the most desirable among the properties of a slate, for, the expense of slating being very greatly increased by the boarding whereon it is placed, if the slate absorbs and retains much moisture the boarding will soon become rotten. But a good slate is very durable. Its goodness, says the *Building News*, may readily be judged by striking, as a piece of pottery is struck. A sonorous, clear, bell-like sound is a sign of excellence, but many pieces of the slate should be tried before such a conclusion is arrived at. Port Madoc slates have a sharp, clear ring, and the slates, though much thinner than Bangor, will bear throwing on the ground without fracture, while the latter often break in the mere handling. The color also is some guide, the light blue sort imbibing and retaining moisture at a far less degree than the deep black blue sort. The feel of a slate is also some indication of its goodness. A good one has a hard and rough feel, while an open and absorbent slate feels smooth and greasy. The best method, however, of testing the quality of slate is by the use of water in two ways. The first way is to set the pieces to be tried edgewise in a tub of water, the water reaching about half way up the hight of the pieces. If they draw water and become wet at the top in six or eight hours, they are spongy and bad; and as the water reaches less up them, so are the slates the better quality. The other method is to weigh the pieces of slate and note their weights. Let them then remain twelve hours in water, and then be taken out and wiped dry. Those that on re-weighing are much heavier, than they were previous to their immersion, should be rejected. Where the character of a slate quarry is not known, these experiments should always be made.

Improved machinery has of late years been invented for sawing and smoothing the slabs of slate. One is a machine for hollowing out blocks for sinks, etc., by means of cutters secured to the ends of revolving shafts. Mr. Matthew's apparatus for cutting and dressing slate consists of a frame provided with arms, cutters, toothed wheels, etc., in such a way that the cutters may be raised by a lever and let fall again with a sudden blow, and this in such a manner as to work the slate out into either plain or fancy surfaces. Besides, billiard tables, pavements, cisterns, walls, partitions and numerous other articles connected with the building and furniture trades are now, and have for some time past been, made of this substance.

New Magneto-Electric Machine.

We have had an opportunity of witnessing the trial of a magneto-electric machine, which appears to be likely to give satisfactory results, says the *Engineer*. It consists of a row of modified horseshoe electro-magnets, surmounted by another row of inverted similar electro-magnets, the poles consequently being face to face, but of course separated by a space. In the central space there revolves a drum carrying the armatures, one armature being supplied to every pair of magnets. The armatures are simply rings or hoops of soft iron, surrounded by a number of helices containing wire. The ends of the wires of each helix are brought down to the shaft of the drum, each insulated from the other, and thence the currents are collected in the usual way. Pieces of iron attached to the poles of the magnets partly embrace without touching the armatures. In the machine in question there were three armatures, one of which was sufficient to excite all the magnets by means of the induced current, as above described, and the other two were sufficient to provide a powerful current, which gave an excellent light in one of Mr. Ladd's lamps. The power required to drive the machine was about 3½ or 4 horse.

Water in Kansas City.

A correspondent of the *Evening Post* says: "There are few instances of more rapid growth in the marvelous settlement of the great West than that of Kansas city, the extreme frontier town of Missouri. In 1865 it had five thousand inhabitants. Today it has forty-two thousand. It is the central point of a spider's web of railroads running to the utmost extremities of the land. Nine railroads come together here, over which fourteen different companies run their trains. These are coming and going all the time—to the lakes, to the Ohio, to California, to the Gulf of Mexico.

"The town is exceptionally well built of brick. The streets are wide, though all up and down hill, and handsomely laid out, and are well lighted with gas. Three or four daily papers keep the town informed of what is going on.

"Among the many causes for amazement that the stranger in one of the Kansas city hotels will have, during the first twenty-four hours of his sojourn, not the least staggering will be the sight of the water with which he is expected to perform his ablutions. He takes up the ewer and pours out a fluid as black as ink. He cannot believe his eyes. It is an absurd mistake somehow, an accident, and he rings his bell. Quickly comes a negro, who assures him that this is the regulation water of the establishment, that everybody washes in it, that there is no other than it but well water, which is so hard that it is impracticable for washing altogether.

"The water has come from the clouds in the form of rain, and been collected in cisterns. Now the fuel used by the people of Kansas city is a soft bituminous coal, furnished abundantly at from $3 to $5 a tun, which fills the air with sooty flakes and coats the house tops with a black deposit. The rain water takes this up before running off into the cisterns, and holds it in solution, necessarily assuming its hue.

"Every effort has been made by intelligent and far-seeing capitalists to secure water, but in vain. Upon the assurance of a geologist of good standing that the drip of the land from the Rocky Mountains promises water at a considerable depth, the Kansas city railroad company bored for it, at a point near Kit Carson, and did not get it fourteen hundred feet below the surface. There they stopped. They have not relinquished the hope of finding water, however, elsewhere."

We wonder if some of the ingenious readers of the SCIENTIFIC AMERICAN cannot discover some plan of clearing the Missouri, which flows near Kansas city, and thus solve the water problem. If not that, they can certainly invent stove attachments for consuming smoke, so that the small supply of water enjoyed will no longer be filled with soot.

THE first public library at Athens was founded in the year 526 B. C.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations in the following notes (in which approximate places only are given), and for most of the observations, I am indebted to students. M. M.

Spots on the Sun.

A large group of spots can be seen at this date (March 15) near the center of the sun. It can probably be seen with the eye, protected as it always should be by smoked glass. The two principal spots of the group are of intense blackness. If this is the return of the cluster seen in February, it has changed its configuration.

Position of Planets for April, 1873.

Mercury.

Mercury can be seen at this date (March 15) shining beautifully bright in the evening twilight. It does not reach its greatest elongation from the sun until the 18th, when it sets at 7h. 43m.

On the 1st of April it rises at 5h. 48m. A. M., and sets at 7h. 4m. On the 30th of April it rises before the sun, being at that time on the other side of the sun, and sets at 4h. 32m. P. M.

Venus.

On April 1st Venus rises at 6h. 54m. A. M., and sets at 9h. 56m. P. M. On April 30 Venus rises at 4h. 58m. A. M., and sets at 7h. 46m. P. M.

At this time (March 15) Venus can be seen with the naked eye in the day time. When viewed through a glass, it presents the appearance of the moon as seen just before the first quarter.

Venus will not reach its greatest brilliancy until the 29th of March, and can be seen on that day with the eye, at about half past two in the afternoon, on the meridian at an elevation of 71° in this latitude.

Mars.

Mars sets at 7h. 18m. on the morning of April the 1st and rises again at 9 in the evening. On the 30th it rises at 6h. 26m. P. M., and sets about 5 in the morning.

Mars is becoming conspicuous now (March 15) in the late evenings, being known by its ruddy light. On the 1st it will be near the star α *Libræ*, but is moving westward among the stars, and will be further from it on the 30th.

Jupiter.

Jupiter rises on the 1st of April at 2 in the afternoon, and sets at 4 in the morning. On the 30th it rises a few minutes after noon and sets a few minutes after 2 in the morning.

On February 17th the 1st satellite of Jupiter was seen projected upon the planet, and also the dark shadow of the satellite. The satellite appeared like a snowy white disk upon the brilliant surface of Jupiter, while the shadow was an irregular dark spot, following the little moon it its transit.

On the 25th of February the second satellite was occulted, that is, Jupiter seemed to pass over it and hide it from us; on the 11th of March the first satellite was lost sight of in the same way. It was five minutes from the time when Jupiter's limb was seen to touch that of the little moon until the planet had completely hidden it from view.

These phenomena can be seen with a glass of moderate power.

In an occultation the little moons grow dimmer and dimmer as the great planet sweeps across them. In a transit the satellite seems to glide on to the disk.

Saturn.

On the 1st of April Saturn rises about 9m. before 3 in the morning and sets a little after noon. On the 30th it rises at 1 A. M. and sets at 10½ in the forenoon.

The apparent diameter of Saturn is increasing, but it is not well situated at present for observations.

Uranus.

On the 1st Uranus rises about 17m. after noon and sets before 3 in the morning. On the 30th it sets at 1 in the morning and rises at 10h. 25m. in the forenoon. It is among the stars of *Gemini*.

Neptune.

Neptune rises on the 1st at 6h. 26m. A. M., and sets at 7h. 26m. P. M. On the 30th it rises at 4h. 37m. A. M., and sets at 5h. 35m. P. M.

Auroras.

Auroral streamers were noticed on February 21, February 25, and March 10.

THERMOMETER AND BAROMETER.

At 7 A. M.,	February	23,	thermometer.....	—12·°5
"	"	24,	"	— 5·5
"	March	2,	"	— 0·5
"	"	5,	"	—13·5
"	"	6,	"	—16

The highest barometer, March 6, 7 A. M... 30·52 inches.

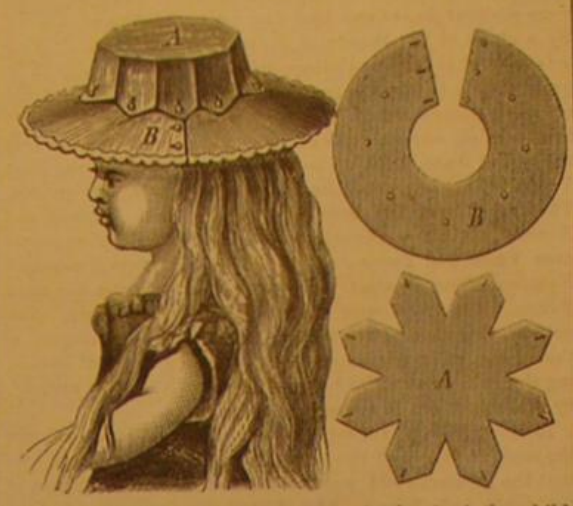
New Determination of the Velocity of Light.

M. Fizeau communicates to *Les Mondes* the results of a series of very elaborate experiments made with a view of the most accurate determination of the velocity of light. The source of the ray was a jet of oxyhydric gas, and the distance between the two stations, as found by careful triangulation, was 33827·1 feet, with a probable error of 0·001.

Six hundred and fifty satisfactory observations were made, the mean of which, multiplied by the index of refraction, 1·0003, gives 185,368 miles per second as the velocity of light to an approximation of 0·003. This result agrees with that determined previously by Foucault, and also confirms the value of the parallax of the sun (8″·86) obtained by Leverrier. M. Fizeau considers that, with stations separated a distance of 12 miles, the velocity of light could be determined to an approximation of 0·001.

CHILD'S HAT.

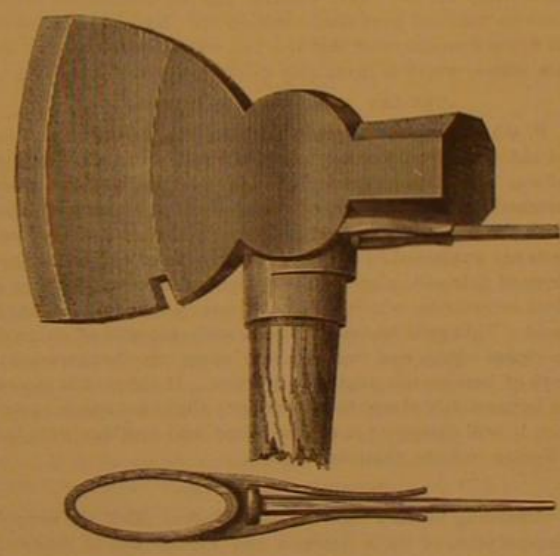
Mr. S. B. Pratt, of Boston, Mass., is the inventor of the novel form of child's hat represented herewith. The crown, A, is made of a single piece, somewhat in the shape of a star, and provided with a number of button holes by which it is attached to buttons on the rim. The latter is simply a circular piece, cut as shown at B in order to give it the necessary conical form. The arrangement of these two parts of



the hat when put together is seen on the head of the child in the engraving, and needs no explanation. When soiled, it is only necessary to unbutton the crown from the rim and wash the fabric in the ordinary manner.

NAIL DRIVING HATCHET.

Every one who has ever experienced the peculiar misery of fingers pounded while vainly endeavoring to hold a nail in an awkward position with one hand, while driving it in by means of a hatchet or hammer in the other, will welcome this invention with delight. All others, who have not undergone such affliction, will require but one trial to cause them to institute anxious inquiries for just such a device as we now illustrate.



It is nothing more than an ordinary hatchet, to the collar of which are secured two springs, the bases of which are at such a distance apart as to hold the head of a nail between them, while the outer ends grasp the body. A single blow starts the nail into the wood, when the hatchet is detached and the driving home proceeds in the ordinary manner, everything being done with one hand. To Mr. S. Daugherty, of Belle Vernon, Pa., is due the credit of this invention, which was patented, through the Scientific American Patent Agency, September 10, 1872.

WASHING MACHINE.

Mr. Samuel Berry, of New York city, has recently patented the ingenious laundry convenience shown in our engrav-

ing. The device consists in a tub or box, the bottom of which is made corrugated. A circular brush fits loosely within the tub, and is movable by the lever handle represented. A close fitting cover, held down by a bar and loops, covers the receptacle. The clothes are thoroughly washed by placing them between the brush and corrugated bottom, and rotating the former.

Economic Value of Science.

It is noticeable that scientific subjects have received more attention from the newspaper press of late than formerly. This is partly owing to the efforts of scientists towards popularizing their respective specialties, as exemplified in the recent course of lectures in this country by Professor Tyndall. But there is another and more potent reason for it. In the scramble for wealth or the conveniencies of life, the utility of knowledge is esteemed more than its speculative quality of abstract truth. It is becoming more generally known that discoveries, that seemed at first to be without any application to the wants of mankind, have at length, through the higher development of commerce by means of them, contributed to the general good. Experiments in magnetism and electricity, which led to the invention of the electric telegraph, were made from curiosity only. The modern chemist takes little note of the monetary value of his discoveries; but the practical man presently finds their application to some use that has its equivalent in dollars and cents. None could have anticipated the use of spectrum analysis to the arts, and yet it is found invaluable in the manufacture of steel.

Many other instances may be noted to illustrate the proposition that every addition that may be made to physical science is capable of an economic use, and that the practical value of all the knowledge we now have may appear with further discovery.

For such reasons, science is likely to receive increased attention from the practical, money-making world; but a real love of knowledge for its own sake is the characteristic of few, and we must not expect that a very large portion of mankind will pursue the truth merely for the purpose of knowing it.—*The Typographic.*

An Atlantic Cable Broken.

After nearly two years of uninterrupted operation of both the Atlantic cables of the Anglo-American Telegraph Company, the 1865 cable failed at twenty minutes past twelve o'clock P. M., on March 11. The tests at Heart's Content show that the fault this time is on the other side, probably not far from the Irish coast. The eminent English electrician, Mr. Willoughby Smith, left London on the evening of March 11 for Valentia, to verify the tests made on this side and definitely locate the fault.

The 1866 cable and the French Atlantic cable are both in excellent condition, and will be able to satisfactorily and promptly transmit all the business offering. Probably the only unfavorable result of the interruption will be the expense to the company of picking up and repairing the cable, and this they can well afford to do, being in a very prosperous condition. The new cable which is to be laid this season by the French Atlantic company is rapidly approaching completion, and within a few weeks New York will be in direct cable communication with Great Britain.

The project of laying a competing cable, by the Great Western Telegraph Company, has been abandoned.—*The Telegrapher.*

Small Fast Steamers.

Messrs J. I. Thorneycroft & Co., of Chiswick, Eng., near London, have built a number of vessels of this class, one of which, the Firefly, on a recent trial made the excellent speed of 18 miles per hour. Her dimensions are as follows: Length over all, 53 feet, breadth, 6 feet 6 inches, draught of water, 2 feet 6 inches. Inverted direct acting engines, two cylinders 6 inches diameter, 8 inch stroke. After the trial this boat was coaled and lifted on board a steamer and shipped to Ghent, Belgium, where on arrival she was lowered again into the water, fire lighted, and she steamed off to her destination near Ghent.

The same builders have lately tried another small craft of about same size, with similar results.

The Effect of Flat Wheels on Railroad Track.

A correspondent of the *Railroad Gazette* considers that the surface or tread of car wheels should be tested by the use of a hammer, and when blisters are found the wheels should be rejected because the blistered spot soon becomes flat and not only damages the rail but shakes the whole car so as soon to do as much damage to the car as the price of a good wheel. It is believed that these flat wheels making 200 revolutions per minute, with the flat spots making steam-hammer blows on the track at each revolution, are a frequent cause of broken rails.

A SINGULAR occurrence, illustrating the force of the wind and the mechanical effects of pneumatic power, recently took place at Kaighn's Point, N. J. While twenty-five men were at work upon a vessel in the great ship house of Wood, Dialogue, and Co., the wind suddenly lifted up the building and carried it away without injuring any of the men or the vessel. The building was 250 feet long, 80 feet wide and 80 feet high. Loss, $15,000.

APACHE TELEGRAPH.—The Apaches have a very simple and yet effective system of telegraphy, which has unquestionably been in vogue from time immemorial. Lookouts are stationed on every prominent peak, within the range of one another's vision, commanding a complete view of the entire country. No human being can enter the region under surveillance unnoticed. Anything happening necessary to communicate to his fellow watchmen, the lookout at once ignites a pitch pine brand, which he moves in a manner intelligible to his confederate on the adjacent eminence, each movement having a significance familiar to them. This is repeated with lightning rapidity from mountain top to mountain top, until it reaches the chief in his fastness. Instructions are conveyed to his scouts in a like manner.

THE INCREASING WEALTH OF THE WORLD.

We are at present in such a stage of the development of the industry of all civilized nations that the increase in producing capacity far outstrips increase of population, so that the amount produced and consumed on an average by every person far exceeds in quantity and value that which was ever before known. It should not be lost sight of that only food, drink, fuel, and clothing are entirely consumed, but that all the other products of industry are utilized for building and manufacturing, by which operations nothing in reality disappears; but, on the contrary, the value of the manufactured material is increased. Thus the stone and timber are transformed into dwellings and furniture, the iron into railroads, engines, and steamships, and the products of metallurgy into all kinds of tools and machinery, all much more valuable than the material used to produce them; so that in their case the value of property is raised by two steps, first by the production of the raw material, second, by the use of this in making the objects desired. Even the *fuel* consumed under the steam boiler of a manufactory gives more than its equivalent in the products of the manufacture; and who will deny that the value of the development of human society is not worth a great deal more than the value of the food and other necessaries consumed by the human race? Therefore, strictly speaking, even in this case nothing can be considered lost, but humanity in general is the constant gainer. So the workman who earns his wages gives the products of his labor back to his employers, a value surpassing that of his earnings if this was not so, he would not have been employed; and thus the workman has, besides earning a living for himself and his household, contributed his share to the increase of the wealth of the world. Even the Chinaman who, after several years of toil here, returns to his native home, carrying some of his earnings with him, if looked at from this point of view, leaves behind him in the results of his labors a greater value than all that he can possibly carry off; he has thus been a benefit to us, and has the full right to go where he pleases.

If we look at the statistics of the increase of productive capacity in various branches among different nations, we are especially struck at the development that has taken place during the last decade. Let us, for instance, take the single article of iron. In the United States, in 1860 it was confined to half a million tuns, while in 1870 it was increased to over two million tuns, employing 150,000 workmen; while 850,000 men are employed to work this iron into all kinds of machines, etc., making one million men employed by the iron industry alone. The value of the raw material is estimated at $200,000,000, increasing by further labor to $1,000,000,000. The production of steel manufacture in Germany is still more startling; in 1860 only 250 tuns of manufactured steel, worth three millions of dollars, was produced by 4,000 workmen, while in 1870, 2,000 tuns, worth twenty millions of dollars, was the result of the labor of 14,000 workmen.

Let us take a totally different branch, cheese; in 1853 one million pounds of cheese were exported from here to England, and in 1870 seven million pounds. The State of New York alone has now nearly 1,000 cheese manufactories, which use the milk of more than 250,000 cows, making therefrom 80,000,000 pounds of cheese, which is 1,000 pounds of cheese for every three cows. The cheese production of the whole United States is now over 100,000,000 pounds, of which 60,000,000 are exported. England exports scarcely 3,000,000 pounds, while little Holland, which used to be the principal cheese producing country of the world, exports at present 25,000,000 pounds. This latter fact suggests the extent which the cheese production of the United States may reach in the course of years, and the wealth which its exportation will bring back, as the Hollanders used to boast that their cheese production alone was more valuable and reliable than a gold mine, very few of which surpassed the Dutch cheese in the profits realized.

We could easily fill many pages with other illustrations of the immense increase of the production which, as it continually far outstrips the increase in population, cannot fail to increase the sum total of valuable property. This view of productive capacity and its results is the best argument against that conservative class of people who sometimes raise their voices against useful inventions and new patents, under pretext that such improvements often take the bread out of the mouth of the workmen, who are unable to compete with hand labor against machine labor. Experience has proved that all such fears are totally groundless, and in every case have the machines which increased production been a blessing in the end, giving more labor and higher wages to those using them than they could obtain by their unimproved methods and much smaller productive capacities. So since the art of printing has superseded manual copying, there are probably a thousand printers for every manuscript writers of the olden times; when at a recent period the sewing machine superseded a great many of the most tedious duties of the seamstress, the prophecy that its use would impoverish a large class of women who made their living by sewing was not fulfilled. On the contrary, the sewing machine has been a benefit all round; and so it must be with every invention which enlarges the total amount of the valuable products of labor, and therefore contributes its share to the increase of the world's wealth.

Commissioners to Vienna.

There are a sufficient number of Commissioners to the Vienna exhibition appointed by the President to make a respectable show here if they would remain at home. Some eighty have been appointed and confirmed by the Senate, and we are informed that the end is not yet.

SCIENTIFIC AND PRACTICAL INFORMATION.

GOLD IN LAPLAND.

Traces of gold had been discovered years ago in different parts of Lapland, but not until a certain Ewast, formerly a California miner, with some companions explored the country was much attention given to it. They found in a short time gold to the value of more than $190. A large number of adventurers rushed to the gold districts, many of whom were without means and had had no experience in mining. By a ukase of the Senate of Finland, dated April, 1870, it was decreed that the privilege of obtaining gold should be granted only to applicants who had sufficient capital for the effective prosecution of the work. Several companies were then formed, and about 19 of them were registered towards the end of June, 1870. They began near Ivalo, on the river Tanna, where large buildings for the workmen were erected. This river forms the boundary line between Lapland and Norway, and the working was soon extended along its shores near Vasko and Tanna-Juk, also along the rivers Kenna and Kytnien. The greatest yield was obtained from the river Tanna. The gold found showed traces of platinum. The gold-bearing sand of the river showed great resemblance to that of the river Sacramento, Cal. The method of obtaining the gold was similar to that used in California, namely, by washing it out in a wooden trough.

In July, 1870, a Norwegian captain named Daal explored the western shore of the river Tanna and the result was that the greatest yield was discovered at the confluence of the Ivalo and Tanna. The Norwegian government then granted to the Russian companies the privilege of extending their works to their side of the river. In the middle part of September, every vestige of vegetation disappeared, owing to the approach of winter, and compelled the abandonment of the work till the following spring. In the seven weeks from July 21 to September 9, 124,141 cubic feet of gold-containing sand were washed, yielding 615 ozs. of the precious metal.

INK PLANT.

The botanists of Europe are endeavoring to acclimatize a plant growing in New Granada, which is valuble for the manufacture of ink. The juice, called "Chanhi," is reddish, but changes after a few hours into a deep black, and is then ready for use. The "Chanhi" has less destructive influence on the steel pens than common ink. Experiments made in Spain demonstrated that the ink was not even spoiled by sea water, which is invariably deleterious to ordinary ink.

TESTING GOLD USED IN GILDING.

P. Guyot proposes for this purpose the use of a solution of chloride of gold or a solution of nitrate of silver. Neither affects at all the genuine gilding, but imitations, when touched with the former solution, show a brown spot, and with the latter, a gray spot. The gilt designs of wall papers are examined by Guyot with chloride of sulphur. One drop of this salt, placed on imitation gold paper, produces a dark brown rim, which does not appear when gold has been used. Thin gold leaves, if placed with chloride of sulphur in closed bottles and well shaken, show no change, but alloys of base metals gradually blacken. If the gold is placed in hermetically closed bottles under a slight aerostatic pressure, it will disappear in a short time and combine with the chlorine to form chloride of gold.

CONSUMPTION OF TIN.

According to the *Polytechnisches Çentral Blatt* the annual consumption of tin in America and Europe was in 1868 and 1869 about 22,000 tuns; in 1870, 24,000 tuns; in 1871, 27,000 tuns. Should the consumption increase in the same ratio, possibly the production will not be equal to the demand, as during the last year only about 27,593 tuns were produced, as follows: Of English tin, 10,500 tuns; of Banca tin, 90,000 tuns; of Straits tin, 9,500 tuns; of Billiton tin, 2,700 tuns; total, 27,593 tuns.

CINCHONA TREES IN INDIA.

In the plantations of the English government on the Neilgherry hills, there are about 2,600,000 cinchona trees, which cover over 950 acres of land. The largest trees are 30 feet high with a circumference of three feet. The quantity of 7,295 pounds of splendid bark was sold last year in London at the price of from 50 to 60 cents per pound. There were also furnished about 35,000 pounds to the Indian depots, so that the proceeds amount to about $8,000. The capital invested by the government for the introduction of this important tree will soon have been repaid with interest. Hundreds of natives have been cured of fever annually with the quinine obtained, and the object of the beneficent intention of bringing the antidote of fever within reach of the poorest has been fully realized.

TO PRESERVE CHEMICALS.

Earthen vessels are now constructed with a groove near the top. The groove is filled with castor oil, with which the cover is brought in contact in closing. The connection with the outer air is thereby totally interrupted. Chloride of lime, for instance, was preserved in this manner for two years, without deteriorating in the least by the absorption of moisture.

SOLIDIFICATION OF NITROUS OXIDE.

Mr. T. Wells exhibited, at a recent meeting of the Chemical Society in London, the formation of solid nitrous oxide in large quantities. Liquid nitrous oxide quickly solidifies if a current of air be passed through it. Unlike carbonic acid, the liquefied gas can readily be preserved for some length of time in an open vessel, provided it be kept still. Liquid carbonic acid becomes solid immediately it is allowed to escape from the vessel containing it, since the vapor tension of the carbonic snow at the time of its formation is much above the atmospheric pressure: whilst liquid nitrous oxide boils at 1·92° Cent. and solidifies at 1·99°, so that the vapor tension of the solid is less than one atmosphere. The density of the liquid at 0° is ·9004, and, like liquid carbonic acid, it is very expansible and immiscible in water.

ADULTERATION OF RHUBARB AND YELLOW MUSTARD.

When rhubarb or mustard is adulterated with turmeric root, the adulteration is easily detected by shaking it for 1 or 2 minutes with absolute alcohol, filtering and then adding, first a concentrated solution of borax and then some hydrochloric acid. If the solution turns brown on adding the borax and retains its brown color on the addition of the acid, it indicates the presence of turmeric. This is a simple case of reversing the usual turmeric test for borax, and making the borax the reagent which detects the turmeric. It seems strange enough that until recently this had not been thought of.

IODINE IN SUBSTANCES CONTAINING TANNIN.

It is a well known fact that iodine, when dissolved in liquids containing tannin, cannot be detected by the ordinary starch test. Tessier has found, however, that on adding to such a solution a few drops of a neutral solution of chloride of iron, the iodine is at once set free, and can be detected by covering the test glass with a watch glass or an inverted funnel, coated on the inside with a starch paste.

UTILIZATION OF SOAPSTONE CLIPPINGS FOR BUTTONS, ETC.

The powder or other filings of soapstone (steatite) obtained in the manufacture of gas burners is saturated with soluble glass, dried, and ground. In a suitable press, buttons and similar articles are pressed from this powder, burned in retorts, dipped again in solution of glass and once more burned. They are then placed in a rotating cask, polished by water, dried and again polished by rotation in a similar cask with soapstone powder. Dominoes and dice are pressed in similar manner in dies of brass or steel, and then polished.

Hygiene.

A new fortnightly journal of sanitary science, bearing the above title, comes before the public in an attractive form from the press of G. P. Putnam's Sons, New York city. $2 per annum. From the last issue we extract the following:

REGIMEN FOR SPRING.—The amount of work done in the human body during the winter, in the mere maintenance of our normal 100° of heat, would of itself be sufficient to overload the system with tissue waste by the return of spring. But when to this is added the special nerve waste caused by the wear and tear of the brain and nervous system, in the whirl of excitement and mental activity of a city winter, there should be no wonder that March is accredited with bringing "humors" and giving rise to "pains." Increased production and reduced excretion of waste, or refuse matter, of the ashes of the human furnace, are the real causes, and not any occult influence of the season. Knowing this we are the better able to understand why roots and salads, "green food" and little meat, are now craved by the natural appetite; and to recognize the wise hygienic principle in the observance of Lent, with its meager diet and abstinence from worldly gayity and excitement. What we need, physically, in this milder weather, is to "train down;" to favor the "moulting of the tissues," as Chambers says; and, mentally, to get rid of brain fag and worry—for only by rest can the nervous system be restored.

Abundance of exercise, free bathing, spare diet, should be the rules for the coming month or two. To use the furnace illustration again, the amount and quality of fuel should be reduced, and the flues and pipes be cleansed. Exercise and bathing, by favoring excretion and elimination, will do the latter, and rid the system of much perilous stuff accumulated during the suspension of out door exercise. As to the fuel, fish, with its food for the brain and nerves, but scanter supply for adipose and muscle, should enter largely into the spring dietary. Fruits also, of which, thanks to modern methods, there is abundant supply even now, and vegetables, too, favor the "wasting" process. The class of agents of which we wrote in our last—tea, coffee, tobacco and alcohol—which retard tissue change should be used either more sparingly or not at all; and thus the usual "bilious" and other complications of spring may be largely avoided.

A Voice from Colorado.

MESSRS. MUNN & Co.,

Gentlemen:—I hereby acknowledge the receipt of the SCIENTIFIC AMERICAN for all of the members forming the club which I sent you, also of two copies of the Science Record, and of one copy of your splendid steel engraving, which came in good shape. All of the subscribers express entire satisfaction, and many much regret not having taken your paper years ago. Everybody should have it; lawyers, doctors, ministers, farmers, mechanics, all classes should have it, as it contains the most authenticated, useful and interesting matter published. Accept my best wishes.

Yours truly, JOHN H. PRICE.

ALL new subscriptions to the SCIENTIFIC AMERICAN will be commenced with the number issued in the week the names are received at this office, unless back numbers are ordered. All the numbers back to January 1st may be had, and subscriptions entered from that date if desired.

THE winter in the vicinity of the White Mountains was very severe. Snow to the depth of twelve feet fell, while the thermometer indicated forty degrees below zero on several occasions.

Stupidities.

Under this head, Dr. Hall, in his *Journal of Health* for March, 1873, humorously discourses on the tendency of the times, as follows:

It is really a great wonder that everybody is not dead and buried, and the world itself used up entirely, if the thousandth part of what is told us about microscopical and other "discoveries," so called, is true. One man will have it that the glorious Union over which the stripes and stars float so proudly will soon become depopulated, because respectable people don't have children; another has discovered myriads of bugs in the chatelaines and waterfalls of the ladies, boring into their skulls and sucking out all the remaining brains of the dear delightfuls. A German *savan* now tells us that every sip of tea we take is full of oily globules which get into the lungs direct, weaken them, set up a cough, and the person dies of consumption. Another man has found that the purest spring water, clear as crystal to all appearance, if let alone will deposit a sediment which generates typhoid fever; hence he proposes that everybody shall quit drinking water. Another says that bread has so much lime in it that it is turning us all to bone, and makes us stiff in the joints, that being the reason we have no lithe, sprightly old men now-a-days; hence we are full of limps and rheumatics long before our time, therefore we had better quit eating bread altogether, and live on rice and sago and tapioca. The water cure folk assure us that pork and beans and ham and eggs are full of abominable *trichinæ*, and that, if one is swallowed and gets fairly nestled into the system, he, she or it will breed a million more in a short time, and that roast beef has juvenile tape worms in it. And here come Tom, Dick, and Harry, all in a row, loaded down with microscopes and spy glasses which show as plain as day that the air is swarming with living monsters and putrid poisons, which fly into the mouth and crawl up the nose and creep into the ear; hence it is death to breath such pestilential air, and that the best way is to keep the mouth shut, plug up the nose, and ram cotton into the ears.

Ever so many learned professional gentlemen have been torturing poor figures for years to make them tell the stupendous fib that everybody is either crazy or soon will be; that the annual increase is ten per cent, consequently in eleven years everybody will be crazy, and more too.

The fact is that the people who spend their time in hatching out these tomfooleries, ought to be put to work and be made to earn an honest living. This world has been pretty well taken care of for some thousands of years, increasing in comfort and wealth and life, the average length of which last has doubled within two centuries, and the population increased perhaps three fold; and the presumption is that the Great Maker of all will so arrange all the antagonistic forces of life for the future as eventually to make "the wilderness and solitary place to be glad, and the desert to rejoice and blossom as the rose," and the race be happy still.

Rolling Mill Notes.

It is estimated that one tenth of the entire population of the United States is dependent for support upon the production and manufacture of iron. The value of the metal annually manufactured is $900,000,000, and 940,000 workmen are employed in the industry, the aggregate of whose wages reaches $600,000,000. There has been a vast increase of furnace capacity and additional machinery put in by our rolling mills during the past eight or ten months, and there is every prospect of still further growth.

We are indebted to a pamphlet lately issued by Messrs. Lewis and Rossiter, of Pittsburgh, Pa., for the following interesting information in reference to iron and rolling mills: Regarding material, English and American irons differ from each other in certain general characteristics. American is softer than English. As respects resistance to tensile strain, it is more ductile and tougher; while yielding more readily to immediate force, it will stand a greater ultimate strain; it also, undergoes vibration without crystalizing better than does English iron. The latter, being harder, stands a greater immediate tensile strain but yields to a less ultimate force. The same general difference exists as regards compressive strain.

If a bar of iron is measured and found to be exactly one foot long when cold, after it is heated to a darkish yellow it will have expanded from one eighth to one quarter of an inch in its length, varying with the degree of heat used and the quality of the bar. It follows, then, that in order to turn rolls which shall produce a definite section of iron, the last groove should be made somewhat larger than the section desired. It requires considerable experience and practice to place the exact amount of contraction in bars of complicated sections. The most accurate way of measuring the contraction is by means of a double ended calliper, having one side longer than the other. A very convenient size for use is when one side measures 4¼ inches and the other 4 3/16 inches from center to tips. For finishing work in roll turning the best of steel should be used; but in turning up and roughing out hard iron, cast iron cutters chilled on the surface may be employed to advantage. It is also advisable to use water in turning up hard iron or soft iron with fast speeds.

Fire, under rolling mills that have been built on made ground, has been the occasion of much trouble. Some of the mill owners, to prevent a recurrence of damage, have caused to be laid, beneath new furnaces, brick paving some two or three feet in depth and wider than the base of the furnace usually requires. Others, when making ground, have mixed common earth with the cinders that are thrown from the mill. Lately a fire under a Pittsburgh establishment burned over one year and was then only extinguished by an unusually high flood in the river. When laying foundations for machinery on ground made from rolling mill refuse, the pits should be dug low enough to reach solid ground, and then only the floor will sink in event of a fire.

An ingenious way of getting speeds for a roll train has recently been put in practice. The train has two sets of pinions and two sets of housings which, of course, are in the usual position between the roughing rolls and the crab. The pinions nearest the crab are different in diameter, the top one being the smallest. Between these two sets of pinions, but one spindle is employed, and by using this spindle on the top pinions, the fastest speed is gained. By using it on the larger middle pinion, the train is made to run slower; and by dropping to the lower and largest pinion, the slowest required speed is obtained. Between the first set of pinions and the crab is the usual breaking spindle, always coupled to the middle pinion; and between the second set of pinions and the roughing rolls are the three spindles: these are never changed. The idea was put in use with an eight inch guide train that could not otherwise well be altered from the original mode of driving. The plan is capable of further application.

A rail mill pinion has been in use for the last twelve months with two false teeth which were put in as follows: A dovetail groove was cut about one inch below the roots of the teeth and a cast iron piece having two teeth was nicely fitted in. This piece is firmly held in position by two wrought iron bands shrunk on each end near the teeth. A straightening plate, after getting hollow on its surface through use, has been straightened by hammering on its concave sides. A good steel punch is capable of piercing through a thickness of iron equal to the diameter of the punch.

A correspondent, referring to the rolling mills of Belgium, says that they are but poorly managed. The largest establishment is the John Cockerill works at Seraing on the river Meuse. The buildings cover one hundred acres and twelve thousand hands are employed. Locomotives and marine engines of the most powerful form are constructed. The company has its own coal mines and blast furnaces.

High Pressure Steam.

The compound cylinders are supposed to be so adjusted, says Professor Osborn Reynolds, that the work done in each cylinder equals half the whole work, that is, the expansion in the first cylinder equals the expansion in the second. This rule will not be quite accurate, but nearly; I do not know that there is any rule in practice. The difference in cylinder room, it must be noticed, is very much in favor of high pressures, as it diminishes in each case as the pressure increases. Thus the area of piston required at 300 lbs. is only half that required at 20 lbs. pressure in a condensing engine. And it is to be noticed that in the compound engines the necessary increase is much smaller for high pressures than for low pressures. At 20 lbs. the high pressure cylinder has half the area of the low pressure cylinder, whilst at 300 lbs. it has only about one twelfth.

Now as regards the strength of the engine. This is the great objection to the use of high rates of expansion. The machinery of an engine to work at 300 lbs. must, only to do the same work, be seven times as strong as that which works at 20 lbs. Here, then, is a fatal objection against the use of steam at high pressures, unless it can be met in some way. This is where the advantage of compound engines comes in: while the pressure in the one increases from 76 to 438, the other increases from 63 to 112. Thus by the use of compound engines the pressure on the pistons can be kept quite within reason.

To sum up then: By the use of steam at 100 lb. we may do with little more than half the coal required for a pressure of 14 lbs. with only three quarters the cylinder room, and shall only increase the greatest pressure on the piston by about 10 per cent. With 300 lbs. we do with 20 per cent less coal than at 100 lbs. with two thirds the cylinder room, and we must increase the strength of the machinery by 40 per cent.

I think, then, that we must look for economy by increasing the ratio of expansion and the use of high pressure steam so far, and only so far, as is necessary for the expansion for engines in which the release takes place at or below the pressure of the atmosphere. There will be advantage in pressures at least up to 120 or 130 lbs. Beyond this it must be a question for experience to decide how high we shall go.

In such engines as use a blast we shall find that there is great economy in using very high pressures of steam, provided the rate of expansion is increased. Thus, in a locomotive in which the blast was fixed at 30 lbs. it would be much more economical to use steam at 200 lbs. and expand four times, than at 100 lbs. and expand twice, and the blast would be much the same.

A New Mode of Treating Dyspepsia.

The Archives of Scientific and Practical Medicine, a new monthly edited by Dr. Brown Séquard and published by the Lippincotts, contains, among other very interesting articles, one in which the editor describes a novel mode of treatment which he first tried with perfect success in a very bad case of dyspepsia in 1851, and which has since been tested, with more or less satisfactory results, in many cases of dyspepsia, chlorosis, and anæmia. The following is an extract from the account of the first case:

"After a few days, finding that he had not improved, I decided to try a radical change of his alimentation, as regards the quantity of food to be taken at a time. Instead of three meals a day, I made him take sixty or more. Every twelve or fifteen minutes he took two or three mouthfuls of solid food, chiefly meat and bread. He drank a little less than a wineglass of Bordeaux wine and water every thirty or forty minutes. On the very first day this mode of alimentation was begun his digestive troubles disappeared, and within a week he was so well that he returned to Paris. * * * He continued the same mode of alimentation for almost three weeks, and then gradually diminished the number of his homœpathic meals, and increased the amount taken at each of them, until in about eight or ten days he came to eat only three times a day, and a full meal at each time."

The following paragraphs will serve to give the reader a clearer idea of the treatment commended:

"The plan consists in giving but very little of solid or fluid food or any kind of drink at a time, and giving these things at regular intervals of from ten to twenty or thirty minutes. All sorts of food may be taken in that way, but during the short period when such a trial is made, it is obvious that the fancies of the patients are to be laid aside, and that nourishing food, such as roasted or broiled meat, and especially beef, mutton, eggs, well baked bread, and milk, with butter and cheese, and a very moderate quantity of vegetables and fruit ought to constitute the dietary of the patients we try to relieve. This plan should be pursued two or three weeks, after which the patient should gradually return to the ordinary system of eating three times a day.

The most varied diet as regards the kind of food can be followed under this plan as well as when one has only two or three meals a day. The only absolutely essential points are that the amount of food taken every 10, 15, 20, or 30 minutes be very small (from one to four mouthfuls), and that the quantity of solid food in a day be from 32 to 40 ounces, or a little less when, instead of water, the patient drinks beef tea or milk."

Japanese Boys in the Boston Schools.

Mr. Charles L. Flint, chairman of the committee of the Rice school district in Boston, in presenting his quarterly report to the School Board, made the following interesting statement respecting the education in that school of a number of boys from Japan:

"At the beginning of the present school year, September 2, 1872, four boys from Japan, Kentaro Kaneko, fifteen years, Zeikichi Tanaka, fourteen years, Takuma Dan, thirteen years, and Chokicni Kikkawa, twelve years of age, entered the Rice school. They had then been in the country only six months and under the instruction of a private teacher. They were found to be able to enter upon the studies of the fifth class according to the present course. Kaneko today ranks at the head of the second or sub-masters' class; Tanaka and Dan nearly at the head of the third or ushers' class; while Kikkawa is among the first of the fourth class. Their conduct has been entirely unexceptionable, and their example in each class has aided the teachers and stimulated their classmates to greater exertion. Their gentle and gentlemanly manner has made them friends throughout the school, no boys being more popular with their classmates than they. When they entered the school it was with great difficulty that they could be understood. Now they speak and read quite plainly, and write in better English than a majority of even first class boys! A composition of several pages recently written by Kaneko required scarcely a single correction, either in grammar or spelling. It would be a most excellent thing for the whole school if there could be a dozen such boys in every class. They are very thorough in everything, and rarely require to be told anything twice."

A Singular Fish.

The *Rochester Union* describes a curious fish caught three months ago, in Chautauqua Lake, the third of the same sort captured in the Lake within the past forty years:

The fish is about six feet in length, and when caught weighed one hundred and thirty-four pounds. There are one back and three belly fins. But the head is what is most wonderful and peculiar about the fish. The mouth opens far back and wide enough to receive a nail cask. There is a large falling lip or jaw that sets back and upward as the mouth opens. The inside of the mouth is covered with a species of coarse hair somewhat resembling the small feathers or down of an ostrich. Projecting for almost fourteen inches from the upper jaw is a sort of shovel blade made of a hard substance. This instrument would seem to be intended for throwing food into its mouth rather than for attacking other objects or defending itself against assault. As this fish has no teeth, it is supposed that it subsists upon animalculæ or other substances, floating in the water, which are drawn or forced into its mouth by the blade attached to its jaw.

Economy of Fuel.

A correspondent in *The British Workman* tells how to build a fire as follows: The person laying a fire should fill the grate up to the top bar with coals, putting large pieces at the bottom and smaller over them, then upon these, paper enough to light the sticks, which should be laid upon, and not under, the coal. Cover the sticks with the cinders remaining from the previous day's fire; these will soon become red hot; the coal below will be warmed sufficiently to make it throw off gas; this, passing through the hot cinders, will be kindled, and will burn with a bright flame, instead of going up the chimney in smoke, as it does when the coals are laid on the top.

The fire thus laid will require no poking, and will burn clear and bright for from six to eight hours without the necessity for more coals to be thrown on.

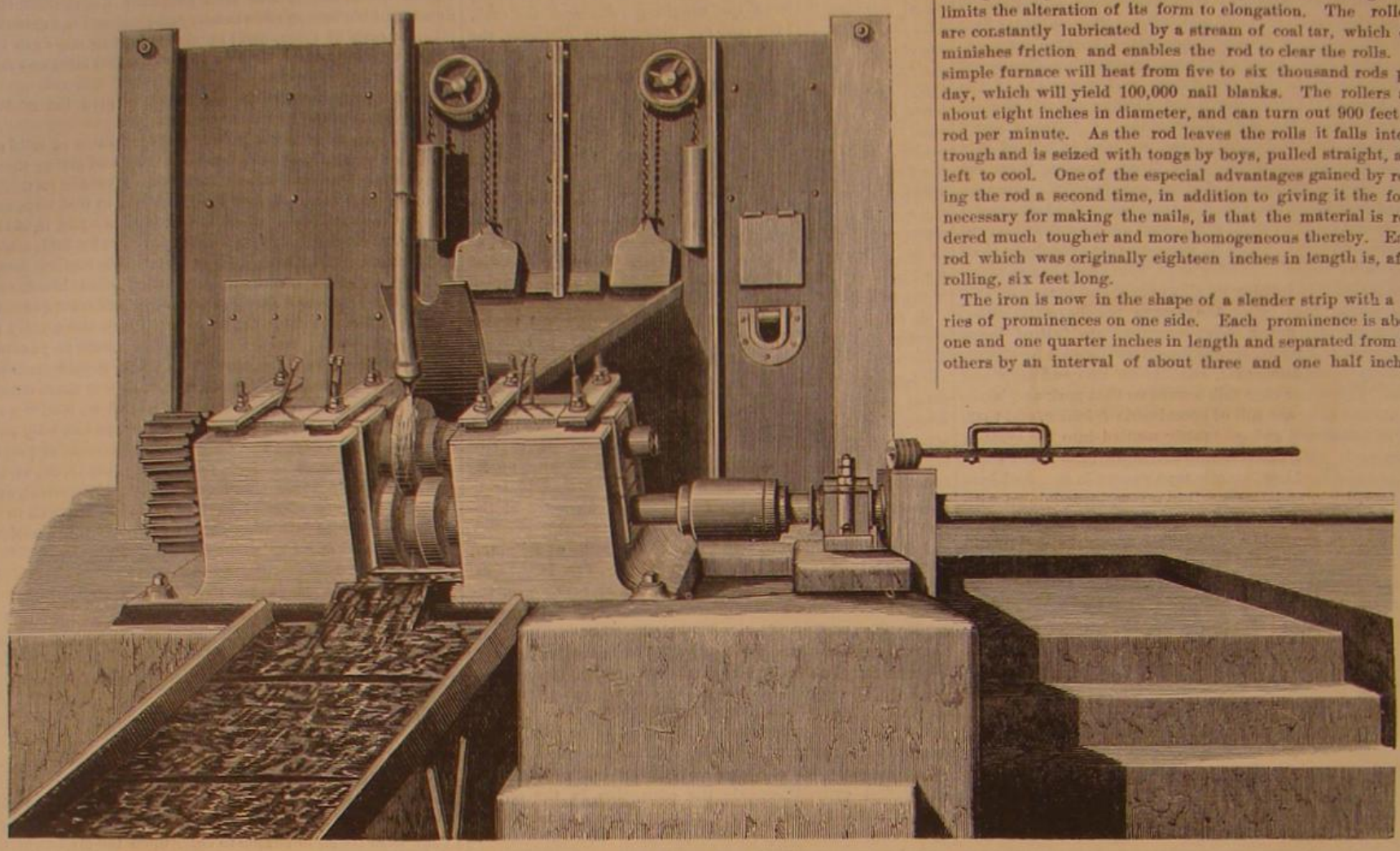
HORSESHOE NAIL MACHINERY.

A horseshoe nail must be made from a peculiar description of iron. It must be tough and flexible, and yet capable of penetrating the hardest hoof without bending. The head must be well secured to the shank, and not liable to be severed from it by the shocks incidental to the rough wear and tear it receives. In fine, it would seem that its necessary qualities are so numerous that mere machinery would be inadequate to accomplish its manufacture except in the matter of shape. Nevertheless machines have been invented and placed in operation in England which answer every requirement, and a single factory at the present time is able to produce five tuns of finished horseshoe nails per week.

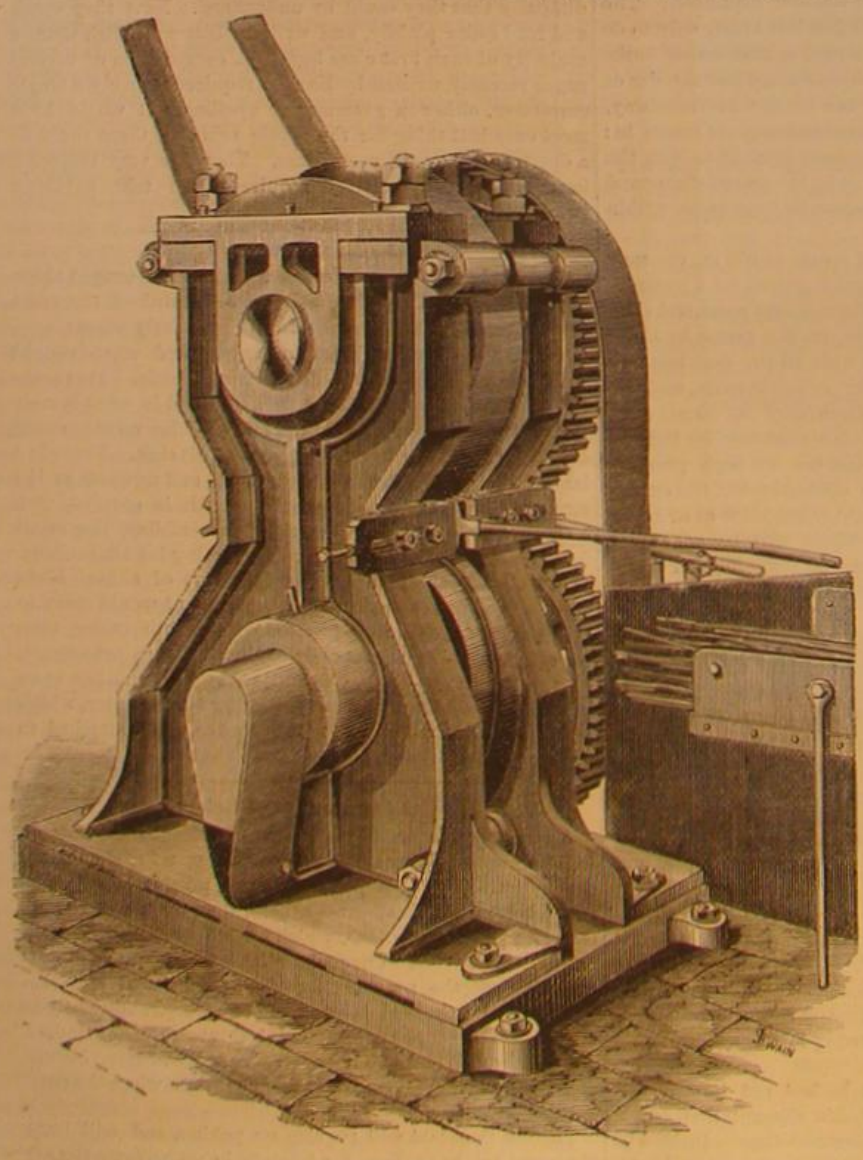
Of these very ingenious devices, we present herewith illustrations, for which we are indebted to the *Practical Magazine*. They are six in number, and represent the rolling mill, and flattening, cutting, rumbling, heading, and shaping machines, which are all inventions of the Messrs. Huggett, father and son.

The rolling mill, in which the iron is first manipulated, has for its upper roller a simple cylinder; the lower roller has a series of depressions or small nicks on its circumference, separated by intervals. Each depression corresponds to two nail heads, each interval to two shanks: and the surface of the roller is curved in the intervals so as to place the most prominent part in the center. The iron is in the form of rods, each eighteen inches long, by half an inch wide and one eighth inch in thickness. These are heated in a Siemens furnace, which is provided with two openings, at each of which a workman is stationed. The cold rods go in at one door and hot ones come out at the other, and as fast as one opening is supplied the other is exhausted. As the rods emerge they are drawn out upon a chute down which they run to the rollers, which revolve at the rate of 500 revolutions a minute. The rolling surface is very narrow, corresponding to the thickness of the rod, and a strong ring is fixed on the rolling shaft which prevents the smallest lateral spreading of the rod during the process of rolling, and limits the alteration of its form to elongation. The rollers are constantly lubricated by a stream of coal tar, which diminishes friction and enables the rod to clear the rolls. A simple furnace will heat from five to six thousand rods per day, which will yield 100,000 nail blanks. The rollers are about eight inches in diameter, and can turn out 900 feet of rod per minute. As the rod leaves the rolls it falls into a trough and is seized with tongs by boys, pulled straight, and left to cool. One of the especial advantages gained by rolling the rod a second time, in addition to giving it the form necessary for making the nails, is that the material is rendered much tougher and more homogeneous thereby. Each rod which was originally eighteen inches in length is, after rolling, six feet long.

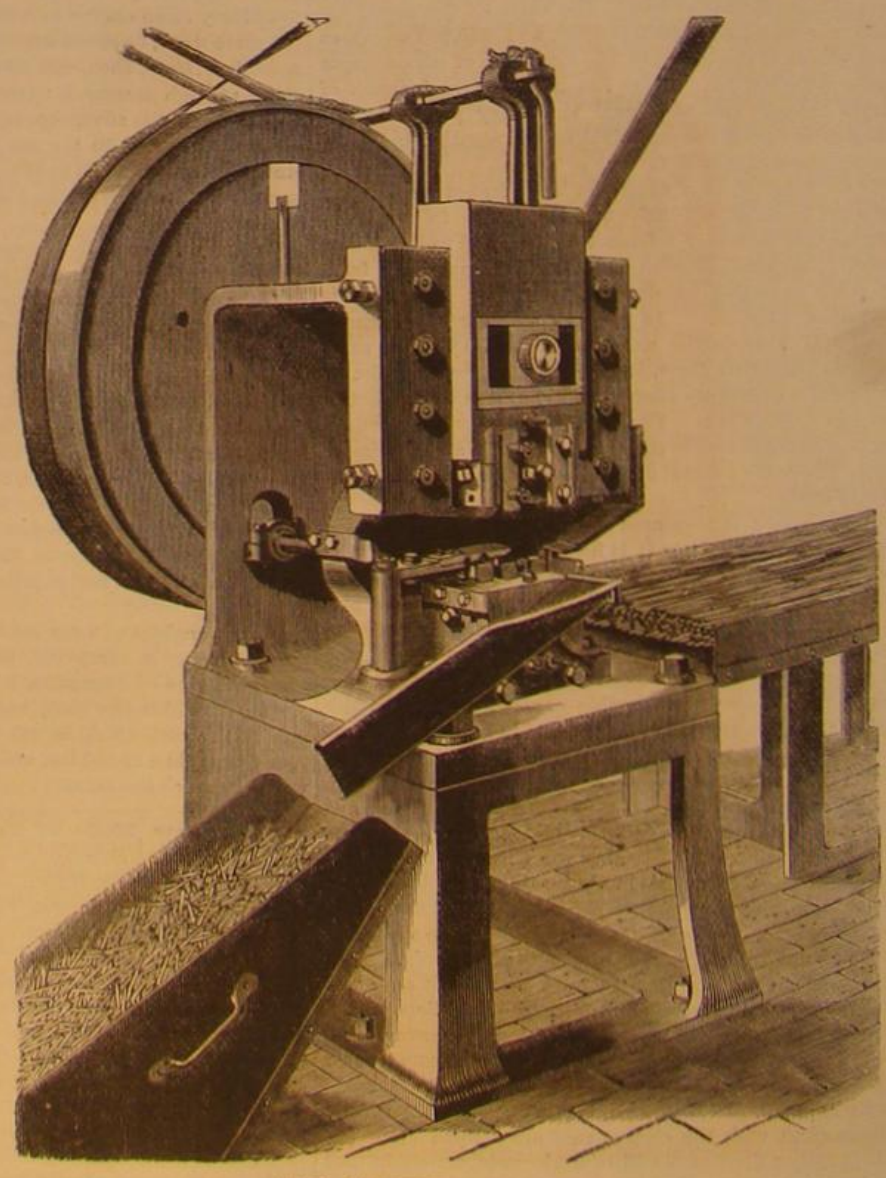
The iron is now in the shape of a slender strip with a series of prominences on one side. Each prominence is about one and one quarter inches in length and separated from the others by an interval of about three and one half inches these dimensions varying with the size of nail to be made. The rod is then passed while cold into the flattening machine, which affects only the prominences, making them nearly square in section, and afterwards into the cutting machine, which cuts it into lengths. In the latter apparatus there are three blades, two of which are at right angles to the rod and cut straight through the center of a prominence, dividing it into two nail heads, and a central knife which is set skew



THE ROLLING MILL



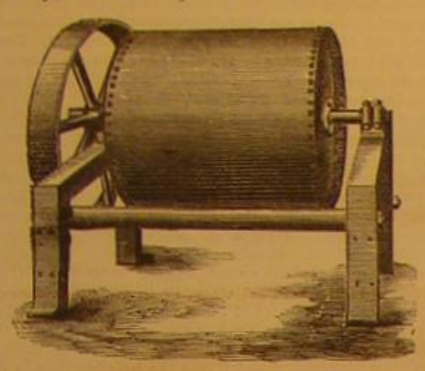
THE FLATTENING MACHINE.



THE CUTTING MACHINE.

to the rod and divides each shank into two beveled points. The pieces thus formed, called nail blanks, are placed in the rumbling machine, a revolving sheet iron barrel, the motion of which causes the blanks to clean and polish each other by friction.

The finishing process follows, calling into use the heading and shaping machines. The first of these consists of a massive die, which rises and falls in a vertical direction. Beneath it a wheel turns intermittently on a horizontal axis, and from the circumference of this wheel project several pairs of dies, which receive the nail blanks with the heads upwards. When the vertical die descends it meets one of the pairs of wheel dies beneath it, ready to receive its stroke. When it rises, a partial revolution of the wheel takes place, and the next pair of wheel dies is ready in its turn to receive the next blow. The wheel dies consist of blocks of iron hollowed out on their opposing faces to receive the blanks, and hollowed at the top so as to give proper space to the heads. The blocks are kept at a little distance apart by springs inserted between them, so that they hold the nail blank loosely, but as each pair in succession reaches a verti-



THE RUMBLER.

cal position, and just before the plunger descends, a pair of jaws closes upon the blocks and presses them tightly together, so that the blank is firmly fixed while being struck. As the plunger rises the hold of the jaws is released, and the blocks are separated by the springs. During the revolution of the wheel each pair of blocks receives, in its turn, a blow from a hammer, which loosens the nail blank so that it falls out as soon as its head turns downwards.

After being thus roughly headed, the unfinished nails are transferred to a Siemens annealing furnace, and thence passed to the shaping machine. In this apparatus they are placed singly but successively on the perimeter of a wheel. They are prevented from falling off by stops, and are compressed between a descending plunger and two lateral dies, which remove all irregularities and produce a nail of perfect finish and form. One more process yet remains to be accomplished. It consists in placing the nails, five hundred weight at a ime, in cast iron pots, which are ranged in a furnace. As soon as the nails become red hot they are emptied out upon concrete floor and left to cool. A thin film of oxide is thus formed upon their surface, which effectually prevents them from rusting.

These machines, with the exception of the rolling mill, are all attended by girls. The cutting machine can cut over 30,000 nails per day; the maximum number ever reached was 37,000. One girl, sitting at the heading machine and feeding it, can turn out 24,000 nails in an ordinary day's work.

Horse nail making by machinery in this country, as well as in England, has become quite a large industry, being carried on by the Au Sable Horse Nail Company, of Keeseville, N.Y., the National Horse Nail Company, of Vergennes, Vt., the Globe Horse Nail Company, of Boston, Mass., a company in New London Conn., and other localities. We hope before long to illustrate and describe the Kingsland patent machinery and processes, owned and operated by the Northwestern Horse Nail Company, of Chicago.

Aniline for Printing Black.

The degree of purity of commercial aniline, says the *American Chemist*, is of the greatest importance in the manufacture of different colors, and especially of blue and black. As aniline black is developed by printers themselves and not bought ready for use, the following test will enable them to determine the quality of the article they have to use:

Any aniline oil which does not boil under 192° C. must at once be rejected; and the nearer its boiling point is to that of pure aniline, 180°, the finer will be the black color produced. For practical tests several methods may be followed. Baumé's areometer gives some indication of quality. Any aniline of from 20° to 30° B. always gives a black color if not fraudulently adulterated. If heavier, it generally contains undecomposed nitro-benzol, if lighter, too much toluidine. Fractional distillation gives a more reliable result. The percentage of aniline distilling between 180° and 185° C. represents the true value of the article. Concentrated sulphuric acid diluted with three times its weight of water is also a good test. About one part of aniline is mixed with at least three parts of the dilute acid; a thick paste of sulphate of aniline is formed, and more water is added to dissolve the salt, when any tarry impurities and also nitro-benzol collect at the top.

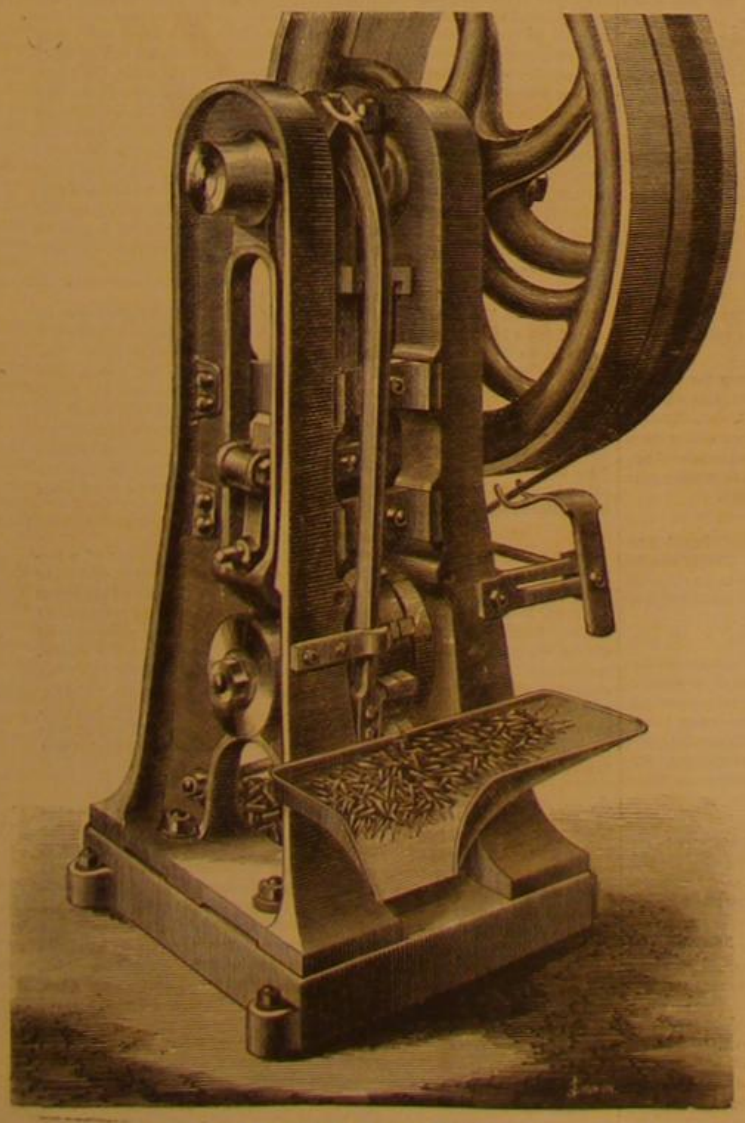
The quantity of aniline oil used is enormous, being, in 1869, 3,500,000 pounds, or about 10,000 pounds per day. Of this, Germany took two million pounds and the rest was divided between Switzerland, England and France. The quantity of coal which must be converted into gas to furnish sufficient benzol for 3,500,000 pounds of aniline is astonishing. It is estimated that 1,600 tuns of coal will produce one tun of aniline. Three and a half million pounds or 1,600 tuns of aniline require therefore 2,500,000 tuns of coal, which, in the first instance, would give 25,000,000,000 cubic feet of gas.

Dynamical Theories of Heat.

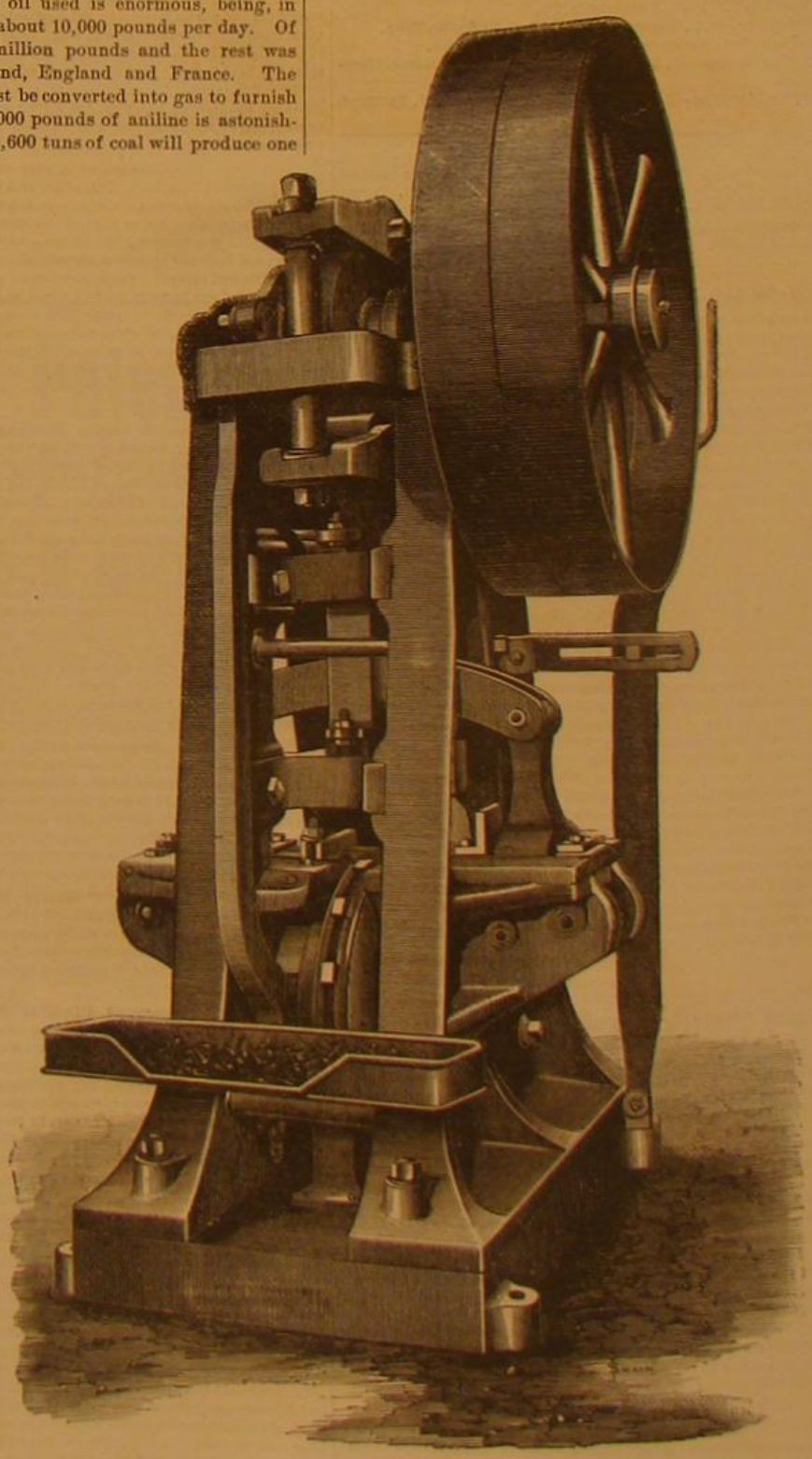
Professor W. A. Norton publishes in the *American Journal of Science and Art* a lengthy treatise on the above topic, more especially in answer to the query: Is heat any mode of motion of the atoms of ordinary matter: such atoms being regarded, in accordance with the common notion of an atom, as incapable of experiencing any change either of form and dimensions or in the intensity of their acting forces? The conclusions arrived at are that the atoms of bodies must be made up of distinct parts, bound together by certain forces; and that heat must consist in some movement or relative displacement among these constituent parts of the atoms. Two possible conceptions of an atom with its essential accompaniments are given: That it consists of a true atom, surrounded solely by an atmosphere of luminiferous ether, or that it has, in addition, an envelope of distinct electric ether immersed in the ethereal atmosphere. In view of these results, it is considered probable that heat and light originate in some mode of motion occurring in the ethereal atmosphere or in the electric envelopes of the atoms, or more probably, in the force or forces by which such a movement is produced.

Simplified, Professor Norton's theory, though at first conveying the negative idea of a complex atom, transfers the source of heat from the atom proper to a supposed ethereal atmosphere or electric envelope, one or both, and therefore, following the hypothesis, to a form of matter considered to be nearly, if not quite, as subtle as the medium of light, and whose elastic forces are nearly or quite as intense.

WILLIS WILLIAMS, of Islesboro', Me., was out on the ice hunting seagulls, when an accidental discharge of his fowling piece wounded him so badly in the thigh that he could not walk. He smeared the dog's face with blood and told him to go home ,which the sagacious animal did, and by signs and the blood alarmed the family, who followed him to the place where the young man was lying.



THE HEADING MACHINE.



THE SHAPING MACHINE.

DECISIONS OF THE COURTS.

United States Circuit Court---Southern District of New York.

WHEEL STAMP PATENT.—THOMAS J. W. ROBERTSON VS. THE SECOMBE MANUFACTURING COMPANY.

BLATCHFORD, Judge.

This suit is brought on reissued letters patent granted to the plaintiff, December 12, 1871, for an "improvement in hand stamps," the original letters patent having been granted to the plaintiff September 23d, 1857, and extended for seven years from September 23d, 1871. The reissued letters patent are grante i for twenty-one years from the 23d of September, 1857. The specification says: "My invention relates to the construction of stamps for producing an impression such as a postmark or other analogous device, a part of which requires to be frequently changed, such as the date, and part requires to remain the same, as the name of the post office. In order to give such stamps any considerable utility, the impression must be readily made and that part of the type which requires frequent change must be always on hand. This result I secure by combining in a hand stamp fixed type for producing that part of the inscription designed to be always the same, and a series of combined changeable types bearing the necessary characters to allow of any desired change, which shall be connected with and form part of the stamp. These types are connected and arranged to revolve in substantially the same manner as the combined types used in book-paging machines, but differing therefrom in having an arrangement by which the devised inscription may be printed repeatedly, without changing at each impression." (The invention covers nearly all the wheel stamps now so commonly used in banks, counting rooms, and offices, and has come into very extensive use.)

The principal defence set up in this case is that the improvements claimed by the plaintiff in his reissued patent were previously invented by one Marcus P. Norton, of Troy, N. Y. So far as regards the contents of a caveat filed in the Patent Office by said Norton on the 21st of June, 1855, it is sufficient to say that the improvements claimed by the plaintiff are not found on the caveat. So far as regards the contents of the paper called "an additional caveat" and purporting to be dated August 21, 1856, and set up in the answer as having been filed in the Patent Office on the 25th of August, 1855, to, and with, and as a part of the said caveat filed June 21, 1855, it is sufficient to say that, after due notice to said Norton and a trial had before a commissioner appointed by the Commissioner of Patents, the said paper was, in September, 1871, adjudged by the said commissioner to be fraudulent and to have been surreptitiously introduced into the caveat file of said Norton filed June 21, 1855, and that thereupon the Commissioner of Patents indorsed on said paper a memorandum signed by him, that said paper does not form a valid portion of said caveat.

There remains the evidence as to the prior existence, in fact, as completed inventions, made by Norton, of the plaintiff's improvements. As to this the burden of proof is on the defendants, and they do not establish the fact satisfactorily. Norton's own evidence is manifestly not to be relied upon. The circumstances attending the taking of his deposition in this suit, the contradictions in sworn statements he has made at different times regarding the alleged caveat, and the manner in which, as shown by the record, he caused witnesses to testify in *ex parte* depositions, to matters of which they had no recollection, make it impossible to rely on his testimony.

But the evidence of Norton and that of the other witnesses for the defendants shows nothing done by Norton, prior to the plaintiff's invention, which amounted to more than an unsuccessful experiment. The plaintiff made the first successful practical working machine.

The infringement of the patent is admitted. There must be a decree for the plaintiff, for a perpetual injunction, and an account of profits, and an ascertainment of damages and costs.

Frederick H. Betts for plaintiff.

Nelson Cross for the defendants.

[We understand that the Chamberlain Manufacturing Company, No. 10 Courtlandt street, New York, and N. L. Chamberlain, Boston, Mass., have purchased the exclusive privilege of working this patent, to whom application should be made for further information.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 21 to February 27, 1873, inclusive.

CHEMICAL TELEGRAPH.—T. A. Edison, Newark, N. J.

JOURNAL BOX.—S. W. Wilson, Philadelphia, Pa.

LOCOMOTIVE BLAST.—C. B. Knowles, J. E. Saunders, Nashville, Tenn.

PERCUSSION CAP, ETC., MACHINE.—A. Payne, Bridgeport, Conn.

PRODUCING COMBUSTION.—B. F. McCarty, F. F. Olds, F. H. Mason, Cleveland, Ohio.

TYPE WRITING MACHINE.—E. Densmore, Meadville, Pa., C. H. Farnham, Milton, N. Y.

NEW BOOKS AND PUBLICATIONS.

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC FOR 1873 is an invaluable condensation of the newest and best things in the beautiful art. It contains 160 pages, full of useful suggestions and fresh information which every photographer ought to possess. London: H. Greenwood. New York: Milner & Rogers.

HOW SHALL I INTRODUCE MY INVENTION?

This inquiry comes to us from all over the land. Our answer is: Adopt such means as every good business man uses in selling his merchandise, or in establishing any business. Make your invention known, and if it possesses any merit, somebody will want it. Advertise what you have for sale in such papers as circulate among the largest class of persons likely to be interested in the article. Send illustrated circulars describing the merits of the machine or implement to manufacturers and dealers in the special article, all over the country. The names and addresses of persons in different trades may be obtained from State directories or commercial registers. If the invention is meritorious, and if with its utility it possesses novelty and is attractive to the eye, so much the more likely it is to find a purchaser. Inventors, patentees, and constructors of new and useful machines, implements, and contrivances of novelty, can have their inventions illustrated and described in the columns of the SCIENTIFIC AMERICAN. Civil and mechanical engineering enterprises, such as bridges, docks, founderies, rolling mills, architecture, and new industrial enterprises of all kinds possessing interest can find a place in these columns. The publishers are prepared to execute illustrations, in the best style of the engraving art, for this paper only. They may be copied from good photographs or well executed drawings, and artists will be sent to any part of the country to make the necessary sketches. The furnishing of photographs, drawings, or models is the least expensive, and we recommend that course as preferable. The examination of either enables us to determine if it is a subject we would like to publish, and to state the cost of its engraving in advance of its execution so that parties may decline the conditions without incurring much expense. The advantage to manufacturers, patentees and contractors of having their machines, inventions, or engineering works illustrated in a paper of such large circulation as the SCIENTIFIC AMERICAN is obvious. Every issue now exceeds 35,000 and will soon reach 50,000, and the extent of its circulation is limited by no boundary. There is not a country or a large city on the face of the globe where the paper does not circulate. We have the best authority for stating that some of the largest orders for machinery and patented articles from abroad have come to our manufacturers through the medium of the SCIENTIFIC AMERICAN, the parties ordering having seen the article illustrated or advertised in these columns. Address

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37 Park Row, N. Y.

Recent American and Foreign Patents.

Improved Spindle Bolster.

James Barnes, Holyoke, Mass., assignor to himself and James Woodhouse, of same place.—This invention consists of a long tubular cup with a hole in the bottom, in which the spindle is fitted oil tight. A metal cap is arranged in the bolster rail, within which the upper end of the cup, which turns with the spindle, has a bearing. The cap has a tubular extension from the hole through which the spindle passes, fitting into the cup at the top.

Improved Machine for Planing Clapboards.

James Atkins, Augusta, Me.—This improvement relates to that class of machines which plane the side of the clapboard and joint the thick edge at the same time, and has for its object the feeding of the boards so that the jointing of the edge straight will be secured, and the feeding of the board and planing of the surface in the most perfect manner will be insured. It consists in an arrangement of heavy feed rolls geared together in pairs, as in ordinary surface planers, but with a series of spurs on each lower roll of the pair, and an adjustable arrangement of the lower rolls for causing them to correspond exactly to the inclined surface of the bed of the machine, whereby the said objects are secured.

Improvement in Stereotype Blocks.

Wm. Schnauffer, Baltimore, Md.—This invention consists in divided stereotype plate blocks, each division having a pair of supports so as to enable all to be capable of being used separately or in connection with each other.

Improved Burglar Alarm.

Henry L. Brower, New York city.—This invention consists of a small, light, portable, and ornamental alarm or call bell, so contrived that the devices for restraining or holding the clock mechanism (used for actuating the bell hammer) in check will be caused to release the said mechanism and allow it to act, if the alarm be lifted from the table or other support, or if a knob be lifted or pulled, or turned to the right or left. It may be used for a burglar alarm by attaching small threads or cords to the knob, and arranging said threads so that the opening of a window or door, or the passing through an open door or window by a person will, by his coming against the cords or threads, pull the knob or turn it, and thereby set the alarm in motion; also, for a fire alarm by having weights or springs, let go by the burning of the threads to pull or turn the knob and liberate the sounding mechanism.

Improved Tool for Laying Tile.

George W. Nevill, Richmond, Va.—This invention consists in a tool formed of two adjustably connected tubes on which the tiles are held firmly while being carried into the ditch, and from which they may be then readily detached. The advantages of this tool are that the operator is enabled to lay the sectional tiles by means of a level, or otherwise, at a regular and more uniform pitch; to lay a line of tiles with much greater accuracy, with far greater rapidity and with an economy of at least 50 per cent in the cost.

Improved Sewing Machine Table.

James W. Cheney, Detroit, Mich.—This invention has for its object to furnish a simple and effective method of connecting the cover of a sewing machine table to the edge of the same for forming an extension thereof when not used as a cover for the operative mechanism. The invention consists primarily in the employment of a hooked or curved plate applied to the under side of the cover and interlocking with a slotted plate secured to the edge of the table for forming a detachable fastening device which will cause the cover and table to be flush or even with each other when arranged in position. The invention also consists in the provision of a hinged supporting arm applied to a pendent bracket secured to the table, for maintaining the cover in its proper position when used as an extension leaf. The invention also consists in combining with the hinged supporting arm and bracket a pair of spring jaws for securing the hinged arm when it is turned into a vertical or inoperative position.

Improved Railroad Train Indicator.

Samuel W. Hemenway, Lansing, Iowa.—This invention consists of one or more miniature ways constructed on a scale proportioned to the real railway as to the stations and distances between them, with the time of starting from the end and the time the trains are due at the stations marked opposite them; also blocks representing cars and a screw, with each way, for actuating them. The screw is worked by a clock, so that a block being put on the track at the time for the starting of a real train will show to the eye the position of the train on the railway at any time during the trip.

Improved Plow.

James R. Nichols, Bastrop, Texas.—The invention consists in a plow cutter having a bend at one end, sharpened at the other and perforated at different points, to adapt it to be used with a sweep or plow.

Improved Candlestick.

Charles H. Doughty, Newburgh, N. Y.—This invention consists of an open socket for the candle formed by the vertical edges of four thin plates radiating from a common center, but sufficiently distant from the center that in pressing the candle down between them, they will cut or press into the sides and hold it fast. Three or more of the plates may be used. At the bottom of the socket the said plates extend to the center. The object is to provide a candlestick which cannot fill up in the socket by melted tallow or wax, and by which the lifting of a pusher to expose the light is avoided when the candle is nearly burned to the bottom.

Improved Paint Brush.

Philip Wagner, New York city.—This invention relates to a new extension brush case. The top or bridge of the brush holder, which is usually soldered flat upon the upper edge of the face plates, is, in this invention, provided with side flanges. The bridge thus made is sprung over the top of the case and fastened by solder, and will then and by the aid of its flanges be held firm and secure. The lower part of the case is made movable up and down, and can be fastened by a screw at suitable hight. This slide or sleeve is made of metal or other hard material, and will, when set down, shorten the working part of the hairs, or lengthen them when moved up. The paint or varnish will be arrested by the lower edge of the extension, and cannot enter within such extension. For thicker varnish or paint the sleeve is moved down; for thinner material it is set up, and also when the hairs are worn short.

Improved Grain Binding Harvester.

Charles F. Goddard, St. Ansgar, Iowa.—This invention has for its object to furnish an improved harvester, which shall be so constructed as to cut the grain, rake it into gavels, and bind it. In using the machine one end of the straw band is attached to an arm. The other end of the band is passed around a hook and secured in the spring jaw in the end of the short arm of a crosshead, placing the band being all the attendant has to do. As the rake moves forward it pushes the gavel over the arm and raises said arm into a vertical position. As the rake head rises and moves back a lever is operated, which turns the crosshead around one and a half times, twisting the band. As the crosshead completes its movement its long arm strikes and pushes back the hook, which catches the end of the band and draws it through said band. At the same time the spring jaws of the crossheads strike against stops, which open said jaws and release the bands, and the bound bundle drops to the ground. As this operation is completed the lever slips from a pin and the spring draws it back, which turns the binding device back into its former position ready to receive another band.

Improved Sulky Plow.

William Ough, Orion, Ill.—This invention consists in means for raising, lowering, and holding the frame which sustains the plows, and thereby graduating the depth of furrow which is to be cut by the latter. The device can thus be used in almost every kind of soil. By connecting both ends of the plow beam with the lever, it is raised and lowered in a level position, or nearly so, moving the plow up and down, which is much easier than drawing it diagonally through the soil, as is usually done.

Improved Butter Bucket.

John F. Dumont, Kansas City, Mo.—This invention consists in forming an air tight butter bucket in three easily detachable parts so that it can be speedily subdivided and all portions thereof nicely and thoroughly cleaned, also in the particular mode of clamping these three parts together and of locking and unlocking them.

Improved Ditching Machine.

George W. Nevill, Richmond, Va.—This invention consists in means for enabling the vehicle to turn in a small circle at the end of ditch, or when it becomes necessary, and after cutting one layer of earth to return and cut another; also in means for enabling the flanged soil-carrying wheel to adjust itself both laterally and vertically in an easy and non-frictional manner to the inside of ditch; and finally, in means for supporting the ditching wheel frame in its true position while the front axle may move independently of it, and *vice versa*.

Improved Substitute for India Rubber.

Dr. Elbert H. Rogers, Tuscaloosa, Ala.—This invention consists in the process of obtaining rubber pulp from bamboo and other berries by first expressing the juice, secondly, drying the hull, pulp, and seed in a mass, thirdly, disintegrating said pulp, hull, and seed by trituration, and finally separating the pulp therefrom by a fan.

Improved Furnace for Melting Brass and other Metals.

Ira D. Bush, Detroit, Mich.—This invention consists of a rotating grate frame, constructed and arranged in a furnace. The furnace is supported in the frame on trunnions. The improved grate frame or plate is confined to the under side of the furnace bottom on a central pivot and pin. There are three, more or less, air ports in the bottom of the furnace one for each space or compartment in the furnace between the partitions. Each of these apertures is provided with a removable grate, either attached to or cast with the rotating grate plate or frame. By turning the plate the grates are readily removed from the air ports, which allows cinders and refuse to be discharged during the process of melting.

Improved Railway Dust Preventer.

John Wellby, Fredericton, Canada.—This invention consists in a dust shield for cars, carriages, and other vehicles. It is a frame made with close triangular ends, which is designed to be secured to the lower part of the car body, and which should project downward so as to be as close to the ground as practicable. To the upper parts of the ends of the frame are pivoted the journals of a roller, to which is attached one edge of a canvas screen, the lower edge of which, when unrolled, is designed to be secured to the lower bar of the frame, so that by detaching the lower edge of the screen or blind it may be rolled upon the roller to give convenient access to the wheels when desired. The end screens consist of a frame covered permanently with a cover of wood or thin sheet iron, and should project so that the end screens of adjacent cars may come as near each other as practicable without danger of being broken.

Improved Bread Worker.

Joseph H. Balderston, Colora, Md.—This invention has for its object to furnish a machine for working or kneading bread. In using the machine the bread, mixed to the proper consistency for working or kneading, is placed in the closed end of a box. The lever is then moved up and down and actuates arms to the ends of which balls are fastened. The effect of this is to cause the dough to revolve toward said balls, so that by continuing the operation a short time the dough will be thoroughly worked.

Improved Apparatus for Loading and Unloading Hay.

George W. Long, Delaware Center, Iowa.—This invention has for its object to furnish an improved device for unloading hay, corn in the ear, etc.; it is simple in construction and is said to be effective in use. The invention consists in the combination of the sling, the ropes attached to it, the block, crank shaft, lock and trip latch and trip rope with each other. Two timbers of a length about equal to the length of the hay rack are connected by a number of small ropes of such a length that when extended across the hay rack the timbers may hang down at its sides. To one of the timbers is suitably attached the end of a rope, the other end of which is left free. To the other timber, at equal distances from its center, are attached the ends of another rope, upon the center of which is formed a loop or eye to receive a hook attached to the pulley upon the hoisting rope. The same rope passes through holes in the sides of a block in the middle part of which is formed a large hole or opening, across which extends a shaft to one end of which is attached a crank. A catch and lever is arranged to hold the crank in any desired position. In using the device, a sling is extended upon the wagon rack, the load is built upon it, and the loaded wagon is drawn upon the barn floor, to the side of the stack, or to any other place where the load is to be unloaded. The end of the rope first mentioned is then attached to the shaft on the block to wind the rope upon the shaft. When the sling has been drawn sufficiently tight about the load the latch is adjusted to catch upon the crank to lock it, and the hoisting rope is drawn upon to raise the load and carry it to the desired place. When the load is brought over the place where it is to be deposited, the trip rope is drawn upon to withdraw the latch and release the crank and shaft, allowing the rope to unwind and the load to drop.

Improved Awning.

John Boyle, New York city.—The invention consists in the mode applying tension rods to awnings. To the ends of the main rod are attached the sockets or couplings to which the brackets are fastened. To the sockets are attached, or upon them are formed, two eyes. Two strengthening or straining rods, which are passed through the eyes, are drawn taut by nuts screwed upon one or both their ends. Bridges are used, according to the length of the rod, and are made with two arms, through the outer ends of which are formed holes for the passage of the straining rods. The eyes and bridges are so arranged that one of the rods may be below the main rod to resist the downward pressure, and the other upon the inner side of said rod to resist the inward pressure.

Improved Bed Bottom.

Benjamin Holmes, 95 Grand Street, New York city.—This invention relates to the construction of spring bed bottoms. Double conical springs are attached by straps to the slats of the frame. Each spring has two fastenings, one on each side of the slat. By making the slats of the proper width and arranging the springs upon either side, the requisite number of springs is distributed uniformly and so that each may bear its proper proportion of the weight. The springs are held at top and bottom by twine or cord, arranged in the usual manner, with a border band of rattan or wire surrounding them and forming the boundary of the bottom. The bottom is incased in strong cloth with cotton batting in the sides.

Improved Oscillating Chair.

William T. Doremus, 266 Canal Street, New York city.—This invention has for its object to furnish an improved chair, which shall be so constructed as to yield to the weight of the sitter as he sits down and leans back, thus relieving him from encountering the rigid resistance found in sitting upon an ordinary chair. Bars are placed at either side of the chair, the upper ends of which are pivoted to the chair seat by a pin passing through the said bar and into the said seat. The lower part of each bar passes down through the pedestal and has a nut screwed upon its lower end. Rubber springs are placed between the back parts of the pedestal and seat. By this construction, when a person sits down upon the chair his weight compresses the springs, and at the same time slightly inclines the chair seat to the rearward which inclination may be increased by leaning back heavily against the chair back. The front part of the pedestal is provided with a stop to receive the forward part of the seat when said seat is allowed to come into its ordinary position.

Improved Oil Still.

Emil Schalk, New York city.—The retort or still, in which the oil is to be heated, has a large passage through it from side to side between the bottom and top, so that a chamber is preserved below and another above, also spaces at the sides for the oil to be distilled; through this passage are arranged vertical tubes as close together as will best promote the direct application of the heat which passes through the still to the oil, which circulates through the tubes, and not obstruct the draft. The oil enters the lower chamber at the pipe where the heat is lowest and the residue escapes from the upper chamber where the heat is greatest. The tubes, being vertical and having a large chamber below, will not be obstructed by the accumulation of impurities.

Improved Torpedo.

Charles Nelson, East New York, N. Y.—This invention consists of a torpedo in which the fulminate is separated from the powder, gravel, and other filling, and inclosed in a paper sack and fixed on the center of the paper wrapper. It is thus placed at the bottom part of the completed torpedo. It is either inclosed in one wrapper, or in a package of two or more piles of strong paper. The fulminate is placed at the bottom, and the whole, including an exterior thin fancy colored paper, is folded over the powder and secured by twisting together and gumming the twisted parts. The object is to guard against explosion by concussion of the sides of the torpedo, and to provide a wrapper or case that will not break open easily when subject to concussion, as the torpedoes now made do to such extent that if one in a mass or package explodes the whole will be fired.

Improved Sofa Bedstead.

James K. Stockton, New York city.—This invention relates to a new sofa bed, and has for its object to permit the use of short frames and cushions for such purpose. The seat of the sofa, having projecting pins or trunnions, is pivoted thereby to the frame so that it can be entirely revolved. To the front of the seat is hinged a cushioned frame of similar extent, which in the sofa is folded under the seat. To the back of the cushioned frame is hinged the sofa back, which is cushioned on both sides. A plate of wood is placed into the back of the sofa, projecting outwardly and forming a recess for the admission of the cushion. When the sofa is to be transformed into a bed, the back is carried forward, the seat completely revolved on its pivots and the cushion thereby brought forward of the seat. Legs, sliding in recesses of and pivoted to projecting arms fastened to T-shaped pieces, are drawn out and turned down for the support of the cushion. A foot board is folded up till it rests on the projecting extension of legs. Clutches, applied to the sides of the cushion, are turned up and hold the foot board firmly pressed against the legs, stiffening them and producing a stable support to the cushions. In this manner a bed is completed whose length is obtained by the successions of the several cushions.

Improved Steam Generator.

Patrick J. McMahon, New Orleans, La.—An ordinary vertical tubular steam boiler is employed with a superheater above the upper tube sheet, through and around which the products of combustion pass on their way to the chimney. Into the bottom of a tank or reservoir, which is nearly filled with water, a steam pipe leads from the steam space of the boiler. The horizontal portion of said pipe is perforated, and extends nearly or quite the length of the reservoir near the bottom. Another pipe leads from the dome to the superheater with which it is connected. An overflow pipe connects with the boiler at the surface of the water therein, and discharges into the first mentioned pipe. The reservoir is provided with an independent force pump for its own supply. The water to supply the boiler is taken therefrom. When steam is generated it will be discharged into the reservoir through the pipe, and will escape into the water through the perforations and be condensed. The heat thus generated will be absorbed by the water, which will soon become heated. As the pressure increases in the boiler it will increase in the reservoir, and the steam generated in the reservoir escapes into the dome and to the superheater, whence it is conducted into the engine. The steam pipe is always open, and consequently any great or sudden accumulation of steam in the boiler will be absorbed by the water in the reservoir. This large body of water will therefore store up such heat and power and act as a balance wheel to equalize the action of the boiler. From this arrangement it will be seen that a sudden evaporation in the boiler cannot cause a sudden increase of pressure, and also that a sudden demand for power will not suddenly reduce the pressure.

Improved Bed Bottom.

Peter Boesen and Michael Bedessem, Kenosha, Wis.—The upper bed bottom frame is supported on spiral springs and covered with canvas or other fabric, which also rests on springs. The springs at the ends of the bed rest upon a frame, but at the middle of the bed they rest upon a suspended frame which is hung by and moves loosely upon rods extending down from a frame above. Braces are arranged which form yielding crossed supports for the bed bottom, and serve to steady and equalize the downward and upward motion of the same, so that if, for example, one side of the bed is being depressed only, such depression will still leave the bed level, and not cause it to become inclined to the weighted side. When the bed is weighted in the middle the springs at rest in the frame will be less compressed, because they have no immovable support, as those springs which rest on main frame and will therefore make the middle of the bed softer and more perfectly elastic than the sides.

Improved Barber's Chair.

Adam Schwaab, New York city.—This invention has for its object to improve barbers' chairs. The chair operates easily, as the occupant adjusts the inclination of the back to suit his own comfort by pressing with the body on the upper part, the segment shape above the pivots giving a more extended rest for the body. As soon as the shaving process is completed and the person sits up, the barber lifts the levers from the ratchets and places the back in an upright position between the hind legs. The arms remain stationary, the back performing the same motion which in the old chairs is accomplished by the combined back and arms pivoted to the front legs.

Improved Car Ventilato

John J. Crowley, Whistler, Ala.—This invention consists of two ventilating pipes, a fan blower, a conducting pipe, a distributing pipe, and a system of valves, all combined in a car in such manner that the fan blower, which is driven by a belt from a pulley on one of the car axles, will force a blast of air into the car, no matter which way it runs, it being only necessary to shift the valves when the direction of the movement of the car is reversed.

Improved Iron Bridge.

William B. Cooper, Albany, N. Y.—The object of the invention is to enable bridge builders to construct the tubular arches of iron bridges in sections so that the arches can be transported and put in place without difficulty, and so that the parts can be put together and adjusted without previous boring or fitting. The block or connecting section is a shell, made in two parts, divided longitudinally and vertically in its center. This shell is open on the under side to admit the eyes on the ends of the braces, which eyes are secured to the shell by means of a bolt through the latter. On each end of the shell is a circular flange, a semicircular half being cast upon each half of the shell, which flanges enter the ends of the sections of the arch. The ends of those sections or tubes consequently bear against the ends of the shell or block, and the ends of both are beveled with reference to the curve of the arch. When the connection is made and the parts put in place the latter are expanded by means of one or more keys, a groove being cast in each of the parts to receive the keys. The flanges are thus made to bear against the insides of the tubes and make the connection firm and rigid.

Machine for Stiffening Netting for Bonnet Frames, etc.

Peter C. Ritchie, New York city.—The top bars of the frame are provided with small hooks, upon which the edges of the mosquito net or foundation are hooked. A box, in which the stiffening mixture is placed, slides back and forth in ways in a frame. A roller revolves in bearings attached to the middle part of the ends of the box and is covered with several thicknesses of a coarse cloth which takes up the stiffening mixture from the box or trough and transfers it to the mosquito net or foundation as the said box is drawn back and forth beneath it. The roller is revolved to apply the stiffening mixture to the mosquito net or foundation by the movement of the box or trough. A bar or scraper is arranged in such a position as to remove the surplus stiffening mixture that may be raised by the roller, and thus prevent more than the proper amount of said mixture from being applied to the mosquito net or foundation.

Improved Paddle Mechanism for Boats.

Charles Howard, New York city.—This invention relates to an improvement on the "improvement in paddle mechanism for boats," which was patented March 19, 1872, No. 124,746. The present improvement consists in attaching the upper end of the paddle directly to the pin or wrist of the upper or short crank instead of having an intervening arm or connecting rod extending from said short crank to the upper end of the paddle, as in the aforementioned letters patent. The lower or long crank is, as before, connected to the paddle near its middle. The paddle shank, provided with a slot or guide, by which the paddle is allowed to slide up and down on the pin or wrist of a crank in such a manner as to allow two cranks, of different lengths, to be attached to the paddle.

Improved Cultivator.

William Taylor, Mansfield, Mass.—This invention is an improvement in the class of cultivators for corn, potatoes, and analogous crops, which have hinged adjustable wings or sections. To the rear edge of the inclined sides of the hoe plow are hinged the forward ends of the wings or plates, the lower edges of which are concaved to give the desired form to the hills. To the inner sides of the rear parts of the wings are pivoted the outer ends of the two bars, the inner ends of which are pivoted to a block that slides back and forth in a longitudinal slot in the rear part of the plow beam, so that the wings may be spread apart or drawn toward each other by adjusting the position of the said block. To one of the rounds of the handles is pivoted a lever, the lower end of which is connected with the sliding block, and its upper end projects into such a position that it can be conveniently reached and operated by the plowman to expand and contract the wings, and by suitable mechanism it is held securely in any position into which it may be adjusted.

Improved Harvester.

Alexander Rickart, Schoharie, N. Y.—The invention consists in an improvement upon the usual means for throwing in and out of gear the mechanism which drives the cutter bar. The drive wheels are connected with the journals of the axle by pawls and ratchet wheels. To the axle, at the inner side of one of the drive wheels, is secured a large gear wheel, which meshes into the teeth of a small gear wheel attached to a shaft which revolves in bearings attached to the frame. To the forward end of the shaft is attached a small crank, to the crank pin of which is pivoted the end of the pitman, the other end of which is pivoted to a sickle bar that slides upon the finger bar in the ordinary manner. To the rear part of the platform or frame are attached bearings which receive the axle, and which are so formed as to slide longitudinally upon the said axle so that the gear wheel may be thrown into and out of gear with the other gear wheel by sliding the said frame or platform upon the said axle. A pin, having a hole through its base for the passage of the axle, is kept from sliding upon said axle by a collar secured to it, and to the pin is pivoted a lever, having a double cam formed upon it. The double cam works between studs formed upon or attached to the frame so that the said platform may be moved in one or the other direction to throw the gear wheel into and out of gear with the other gear wheel. The space between the shoulders or studs is made a little wider than the double cam, and in it, along one of said shoulders or studs is placed a bar or arm, the lower end of which is secured to the platform or frame, and its upper end is left free. The bar or arm is held forward against the double cam by a set screw, which screws through the shoulder or stud along which the bar or arm is placed, so that by turning the said screw forward the wear may be taken up.

Improved Railway Snow Plow.

Peter A. Smith, New York city.—This invention consists in a plow made V shaped, the rear parts of which are bent inward so as to be parallel with each other and directly over the rails of the track. The walls of the plow are made double to form chambers. With the chambers are pipes communicating with the steam drum, or with the exhaust of the engine, to enable steam to be introduced into the said chamber. In the outer plate of the plow are formed a number of small holes, through which the steam blows upon the snow. The rear or parallel parts of the plow have a number of small holes in their bottoms, through which the steam may blow upon the rails to remove any snow or ice that may adhere to said rails.

Improved Shoe Brush.

George Wale, Hoboken, N. J.—This invention has for its object to furnish an improved shoe brush which shall be so constructed that the blacking may be applied to the shoe, and the shoe polished, without its being necessary to touch the box of blacking, or anything but the handle of the brush. In the brush for applying the blacking is formed a channel, leading in through the rear edge and out through the center of the brush, side of its stock. This latter opening is closed by a valve attached to the end of a lever, which is pivoted to a plate attached to the edge of the stock of the brush over the hole in said edge. The plate has a hole formed through it directly opposite the hole in the brush stock, and of a less diameter than said hole. The box to contain liquid blacking is made close, and with a small tube in one end. The tube has several small holes formed in its sides, and its outer end is closed with a cork. Upon the tube is placed a piece of rubber pipe, which, when the tube is pushed into the hole through the plate, is pushed back by said plate so as to uncover the holes in the said tube and at the same time serve as a packing to prevent the blacking from leaking out between the tube and plate. The box is kept from slipping outward by a flange. A plate is placed at such a distance above the back of the brush that the box may be readily slipped into place beneath it. The ends of this plate are bent downward at right angles, and are attached to the side edges of the brush, and to it is fastened the handle. The plate and the forward part of the handle receive the rear part of a lever which is so formed as to press down upon the box or upon the spring when the said lever is operated, so that the valve will be opened and the box compressed by the same operation of the lever to eject the blacking into the brush.

Improved Sawing Machine.

Hugh A. Current, Clarksville, Tenn.—The saws are so placed in respect of the transverse direction of the machine as to divide the pieces of wood in about three pieces, and one is placed behind the other for dividing the labor. A wide endless carrier belt of leather is placed outside of each saw, and a couple of narrower carrier belts are arranged between the saws. These belts all work over rollers at the ends of the frame and carry a number of long, curved clamp fingers, which are mounted on curved plates so shaped that they will pass over the rollers readily. The fingers project forward and are drawn down toward the belts when they are passing between the rollers, so as to clamp the sticks of wood and hold them firmly; but as they come up over the rollers from below they project upward so as to allow the wood to be placed immediately in front of them so that they will come down on, and clamp it fast. Rails or ways are made alongside of the belts, whereon the wood pieces are moved to and from the saws. Intermediate supporting rollers may be employed, as required to support the belts. The saws are arranged to be adjusted on the mandrels so they can be shifted to saw the pieces in different lengths.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business: and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents.*

This 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?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, New York, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office such a measure often saves the cost of an application for a patent.

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.

Rejected Cases.

Rejected cases, or defective papers, remodeled for parties who have made applications for themselves, or through other agents. Terms moderate Address MUNN & Co., stating particulars.

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.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

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A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, for full particulars.

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Foreign designers and manufacturers, who send goods to this country may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief; any new and original design for the printing of woolen, silk, cotton, or other fabrics; any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

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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. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. 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 MUNN & Co., 37 Park Row, New York. Circulars with full information on foreign patents, furnished free.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row.

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Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

On the first of September, 1872, the new patent law of Canada went into force, and patents are now granted to citizens of the United States on the same favorable terms as to citizens of the Dominion.

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.

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.

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 full instruction.

Copies of Patents.

Persons desiring any patent issued from 1836 to November 26, 1867, can be supplied with official copies at a reasonable cost, the price depending upon the extent of drawings and length of specification.

Any patent issued since November 21, 1867, at which time the Patent Office commenced printing the drawings and specifications, may be had by remitting to this office $1.

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MUNN & Co. will be happy to see inventors in person, at their office, or to advise them by letter. In all cases, they may expect an honest opinion. For such consultations, opinions and advice, no charge is made. Write plain: do not use pencil, nor pale ink: be brief.

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Notes & Queries

J. B. asks: Is there anything poisonous from a cast iron furnace when wood is used for fuel?

J. W. J. says: How can I make a cheap calcium light to experiment with? What kind of gas shall I use?

E. T. C. asks: What kind of oil is best for a blacksmith's bellows? Is there anything not injurious to the leather or poisonous that can be used in the oil, that will prevent rats and mice from gnawing the leather?

R. H. D. asks: What advantage have turnbuckles over nuts and check nuts, for the shrouds, stays, etc., of small boats? The latter are so much cheaper, that I would prefer them if as good.

J. Q. asks: What is the difference in the crushing weights of a stamp that weighs 500 lbs., with a face six inches in diameter, and a wheel that is six feet in diameter and 18 inches face, and weighing eight tuns, rolling or twisting around on a circle of six feet in diameter.

A. Z. says: I have a portable steam engine, 120 lbs. power, 4 feet stroke, and 8¼ inches bore; the length of the boiler is 6 feet, the diameter 38 inches, with 22 flues. In trying to run a 50 saw cotton gin, I hitched the piston to an ordinary wooden fly wheel with a drum of 5½ feet diameter. The gin runs perfectly well with 70 lbs. of steam, but soon the speed diminishes till it runs very slowly. What must be done to make it run? What is the reason it does not keep its speed? If I attach two small fly wheels to the main shaft of the gin, on one or both sides, do you think that it will help the steam to keep up a sufficient speed?

A. M. says: I am running a circular saw mill, making 500 revolutions per minute. The saw is 60 inch, friction feed; saw mandel is 8½ inches cast steel running in self oiling Babbitt lined boxes. The box next to the saw is hot all the time, but the box next to belt runs cool. I have refilled the box several times and in different ways without success. I use lard oil and have changed mandels twice in six months. It will get hot, whether the saw is on or not, if it runs one hour. Can any one explain?

H. C. D. says: I have an 18 × 75 foot open flat boat, which draws 4 inches: also have (and wish to apply to it as a power, by suitable cog gearing and pitman connections to a steam wheel) a 10 or 12 horse power portable engine of 150 revolutions per minute. I wish to know what are the best length and width of bucket, diameter of wheel, and speed of same. What size should the shaft be to drive said boat 3 miles an hour against a current of 3 miles an hour when the boat is loaded to draw 10 inches?

Answers to Correspondents

C. C. S. asks: How can I construct an ice boat? Answer: Read page 88 of our volume XXVI.

H. E. B. repeats B. W. C.'s query. Answer: See our reply on page 171 of this volume.

D. A. K. will find full directions for a bath for nickel plating on page 65 of our volume XXVI.

W. E. G. says: I received the SCIENTIFIC AMERICAN dated March 1st on February 22 containing "Index of inventions for which letters patent of the United States were granted for the week ending January 28, 1873, and each bearing that date;" how can this be when you publish your paper and subscribers receive it on February 22? Answer: The SCIENTIFIC AMERICAN for each date is issued in the preceding week, and contains the latest Index of Patents published by the Patent Office. Our correspondent's statement is perfectly correct.

J. A. & Co. say: We put a set of new tubes in a small upright boiler; and in eleven months they were corroded so that we had to put in another set. Will you please inform us what ingredients and what proportion we ought to put in our tank (which we pump from) to prevent the corrosion in the boiler? Would it be best to use copper tubes? Answer: We should require a knowledge of the character of the impurities of the feed water before we could give an intelligent reply.

A. H. M. says: In your paper of March 1, you inform A. B. S. that the back pressure on engine is about ½ lb. per foot of submerged end of exhaust pipe. If this is correct, please explain this phenomenon. I have a steam pump, and within about ten feet of it stands a cistern, the bottom of which is 6 feet above the exhaust pipe of the steam pump. I placed an upright wooden pipe, 3 inches bore, between the pump and cistern, of sufficient length to reach from the ground to above the top of the cistern. I took the exhaust pipe (1¼ inch gas pipe) into the side of the wood pipe, level with the engine, ten feet above, at the top of the wooden pipe. I run a 2 inch pipe horizontally over the top of the cistern and turned it down into the cistern, which is 4 feet deep, within a foot of the bottom. The cistern is usually full, or nearly so, of cold water. The pipes were all airtight from end to end, except a hole, ¼ inch in diameter, bored into the perpendicular wood pipe 2 feet below the exhaust pipe, intended to let off the condensed steam. Result: Upon starting the engine (pump), a stream of cold water started from the small opening with the force of say about 10 feet head. I enlarged the hole until, finally, I made it 1¼ inches in diameter, which had only the effect of increasing the discharge of water. In fact, it made and maintained a continual siphon whether the pump was running or not. The speed of the pump did not appear to be affected, but it occasionally pounded as from water in the steam cylinder. I finally overcame the difficulty by a valve in the top of the perpendicular pipe opening inwardly, but held closed by a slight spring. Now when it inclines to draw the water over by the vacuum found in the siphon, the valve admits air which the next exhaust forces down into the cistern, keeping up a commotion at intervals of say three to five strokes of the pump. If there had been the back pressure stated, could a vacuum have been formed sufficient to have made a siphon? Answer: The arrangement described forms a pretty effective condenser, as first made. As modified, our correspondent will find, we presume, should he measure it, a back pressure such as we stated, so long as the mingled steam and air are being forced down into the tank. With a steam engine exhausting into its own feed water tank, the first effect, on starting the engine, might be to produce a vacuum in a similar manner, but, as the exhaust is capable of heating several times the weight of the feed to the boiling point, condensation would soon cease, the vacuum would be destroyed, and the back pressure would become a load on the engine.

W. S. B. says: I was with Mr. LeVan when he examined the boiler at Conshohocken, Pa. Mr. LeVan found the iron reduced to three sixteenths in one place, which was not where the boiler burst from the strain upon it, but where the mud drum was torn off. His statement that the steam gage ten minutes before showed a pressure of 53 pounds is incorrect, because there was but one gage in the mill, and the boiler was shut off from that one. There are today worse boilers in this mill working at from 60 to 125 pounds pressure. I saw one, this week, taken from the next furnace to the exploded one, with 18 patches on the fire sheets. I heard the proprietor say last summer, in reply to the engineer's opinion that they were carrying too much pressure, namely 100 to 110 pounds, that it was all nonsense, that those boilers were able to stand 150 pounds pressure. The trouble was that they wanted one man to do three men's work, and one man was doing it for less than one good man's wages, and he forgot to open the connection with the other boilers. The loss of 17 human lives was the result, with many more persons crippled for life. Please state at what pressure the safety valve, as described last week, would blow off. Answer: Such an arrangement of steam gage has been a cause of quite a number of explosions of old and worn out boilers. The effort to obtain the labor of three good men by paying a low price for the time of one man is another cause, which, perhaps, operates quite as often in producing explosions as almost any cause appertaining to the boiler itself. We fear it may be a long time yet before it shall have become a well recognized fact that nothing is ever saved in the long run by attempting to obtain service of any kind without giving the proper equivalent. Should other explosions occur, as apprehended by W. S. B., he will have the satisfaction of knowing that he has done a duty in the premises by giving fair warning through the SCIENTIFIC AMERICAN to those interested. We do not know to what safety valve the last paragraph refers.

J. W. S. says: I am firing a twenty-five horse portable tubular boiler with soft coal. How much more fuel will it take to fire with the furnace door open than with it closed? I run steam down hill to one 12 horse engine through 850 feet of 1¼ inches pipe, boxed in and packed with sawdust. Thinking that some of the power was lost in carrying steam so far, we fitted on a steam gage on steam pipe at engine and found 2¼ pounds more pressure than the gage showed on the boiler. We then placed our gages together on the boiler and found them both alike, both standing at 80 lbs. How does this occur? I have seen it stated in your paper that steam loses one pound in passing through each ten feet of pipe. We also run steam up hill 300 feet, in 1¼ inches pipe to a 12 horse engine. Placing the gage there, it indicated 5 lbs. less than gage on boiler. But the pipe runs under a road, and the dampness may condense the steam there. Does it take more steam to run up hill than it does down? What is the difference (if any) in the pressure on top of a boiler and on the bottom? Take a very light carriage, something like a velocipede only three wheeled with one person on it. How many pounds of force is required to propel it one thousand yards, on level ground, in one minute, and how much on an iron track? The power is to be applied in the form of a weight.

C. E. G. says: I want to know how the black glove finish is put on to such articles as harness buckles. Answer: Dissolve three sticks of black sealing wax in half a pint of alcohol. Appiy with a sponge.

J. L. J. asks: What do you mean by excessive priming? Answer: Priming is water carried into the cylinder of an engine by the steam, and it causes pounding of the piston and wears away both piston and cylinder. Dry steam alone should be admitted to an engine. In answer to your other question: Yes, very creditable. Persevere.

J. B. F. asks: Why is there a star marked in the constellation *Leo* (second star from point of the Sickle) called *Ras-al-Asad*, of the third magnitude, while it is not to be seen there? Answer: This star (called *Rasalas* in Procter's atlas) is to be seen at any time in the designated place.

Several correspondents have called our attention to an omission in the paragraph relating to the cone pulley on page 123 of the current volume of the SCIENTIFIC AMERICAN. The length of line B C is not given. It should be made equal to the difference between the least and the greatest radii of the cone.

N. C. M. says: On October 15, 1872, a short time before sunset, I saw a spot upon the sun with my naked eye. Viewed through a field glass of good power, it was resolved into two spots, very close together, and several *other smaller spots* were visible. The atmosphere at that time was quite hazy. Were the sun spots at that time remarkable for their size? Answer: November 10, 1872, and thereabouts was a period remarkable for the size and number of the spots on the sun; one double spot was to be seen as single with the naked eye. Taking into consideration the time of the sun's revolution on its axis (about 25 days) the same group would have been visible on October 15.

C. W. W. asks: When did the vernal equinox fall back from March 21 to March 20? Answer: The answer to the question in regard to the vernal equinox involves the whole theory of the construction of the calendar; it may be found in any encyclopedia and almost every work on popular astronomy. Lockyer's "Elementary Lessons in Astronomy" well discusses the subject, in the chapter on the measurement of time. Our correspondent falls into error in supposing that there is or ever has been any positive fixed date for the occurrence of the equinoxes. It is impossible to avoid some variations, as the time of the sun's revolution from one equinox to the same equinox again is not an exact number of days. It has been the object of all calendars to so correct the resulting errors that the varistions are kept within as small a limit as possible. *By the system* now in use, instituted by Pope Gregory XIII in 1582, the vernal equinox is always reckoned on or near March 21. This year it happens on March 20.

J. W. P. requests us to publish information about how to make good hard soap, and the chemistry thereof. Answer: To make soap, boil fatty or oleaginous matter with a weak alkaline lye rendered caustic by quicklime, and add portions of stronger lye from time and time, the ebullition being still continued until these substances, acting on each other, combine to form a tenacious compound, which begins to separate from the water; to promote this separation and the granulation of the newly formed soap, some common salt is added and, the fire being withdrawn, the contents of the boiler are allowed to repose for some hours in order that the soap may collect into one stratum, and solidify. When this happens, it is pressed into molds or cakes and, when quite solid, cut into bars. If the soap be made from the cheaper kinds of fat, it will hardly acquire firmness to satisfy the thrifty washerwoman; but it can be prevented from melting too rapidly in hot water by the introduction of 5 per cent of fused sulphate of soda. Ure says that this addition not only hardens the soap, but improves its color.

W. R. J., Jr., asks at what rate and to what extent mercury expands on the application of heat. Answer: Dulong and Petit found that mercury expands $\frac{1}{5550}$ of its volume for each additional degree (centigrade) of heat up to 100° C. From 100° to 200°, the average expansion for each degree is $\frac{1}{5425}$, and from 200° to 300° $\frac{1}{5263}$.

E. C. H. takes exception to our reply to a correspondent that the rotundity of the earth is 8 inches per mile. By the rotundity of the earth, expressed in inches, we mean the distance of the surface of the planet from the extremity of a line whose other end is tangential to the curve. The common formula is: ⅔ of the square of the distance in miles will give the rotundity in feet. Square of 1 mile is 1; ⅔ of 1 foot is 8 inches.

P. L. D. asks: Can any of your readers give any information as to the best method of making paper transparent, but the substance used must not prevent the use of mucilage on the paper? Answer: Canada balsam and turpentine make a good preparation for tracing paper.

L. E. H. asks: What regions of the world produce gutta percha, and India rubber or caoutchouc? Answer: Gutta percha comes chiefly from Borneo and other islands of the East Indian archipelago, and caoutchouc from South America and the East Indies.

W. F. C. S. asks: 1. What proportion ought the tooth of a gear wheel to bear to the space between it and the next tooth? 2. We have a six wheeled switch engine with four equalizers, two on each side. The engine when started with a train of cars would cock up her front and duck her rear, as far as the vertical play of the laws would allow. The fault was discovered to be caused by the front equalizer. How is this? 3. What is meant by the point of suspension being above the center of gravity? Is it as seen in a scale beam? Answer: 1. The side clearance in gear wheels will properly vary with circumstances. We have seen cut a sixteenth allowed in a well cut mortise gear of 4½ inches pitch, and, on the other hand, that amount of clearance is none too great, in a rough cast gear of an inch pitch. 2. With the second arrangement, the engine was tied down forward, while, with the first, as we understand the two arrangements, the equalizers allowed the main frames to take a position in line of draft? Precisely.

H. P. & C. asks: In the construction of a hydraulic ram should the pipe that conducts the water from the ram to the place required be larger at the axle and or *vice versa*? Is tin lined lead pipe preferable to ordinary gas pipe for that purpose? Answer: A pipe of the same size all through will do. Tin lined pipe unnecessary.

J. B. J. says: You replied to P. R. S. who wanted to know how much water it takes to run a ten horse power steam engine per hour; your answer is from 50 to 200 gallons per hour, according to quality of boiler and machine. Is the answer correct? Should it not be per day? Answer: Our reply reads as we intended it should. A good 10 horse power engine with equally good boiler should require about 50 gallons of water per hour. This is something over 300 pounds, and it would be evaporated by 30 pounds of coal. Three pounds of coal per horse power per hour is extraordinarily good work for such small power. About 1,700 pounds, or 200 gallons of water requires frequently 200 pounds of coal for its evaporation, and a ten horse engine has been known to reach this figure on many occasions.

W. H. W. asks: How is petroleum applied to boilers to remove scales, I mean such as locomotive boilers, that cannot be got into? Is it not apt to make the boilers prime? Answer: When the boiler is empty, and just before filling it, put in the petroleum. Then turn on the feed, and as the boiler fills, the oil, floating on the water, reaches every part and saturates every square inch of incrustation.

M. J. D. asks: Will you give me the rule for finding pressure per square inch on slide valve? Answer: We know of no recorded experiments on this point. If our readers can give the information, we shall be pleased to receive it. We think that some of our friends of the Engineer Corps of the navy can enlighten us.

T. P. says: My friend argues that a chain wound around a log and fastened to a pin in the log will roll up the skid poles on to a wagon more easily than it will by simply running the chain once around the log and fastening to the wagon. I contend that it makes no difference where the end of the chain is secured; the draft to the horses is the same, as the pulling point is always on the top of the log. He contends that winding the chain around the log helps to roll it, as part of the chain is pulling down on the side of log next to wagon. Answer: T. P. is right.

M. D. asks: 1. How long is a knot, used in estimating the run of a steamboat? 2. What is the area of a sphere or globe four feet in diameter? Please give a rule for the same. 3. How much more water will a forty horse power boiler evaporate with one pound on the safety valve than if there were ninety pounds, other things remaining equal? Answers: 1. The knot or nautical mile is about one sixth longer than the common statute mile. It is given by various authorities as 6,050 6,086, 6,120 and 6,133·75 feet. Bowditch gives 6120. The United States standard and most generally accepted value is 6080·27 feet. 2. The surface of a sphere is calculated by multiplying the square of its diameter by 3¼ or more exactly, by 3·1416. The solid contents is measured by the product of the cube of its diameter by ⅙, or, to be precise, 0·5236. For a sphere 4 feet in diameter, these values are 50·265 square feet and 33·510 cubic feet. 3. In the inverse proportion of their total heats. If in both cases the boiler was fed with water at a temperature of 32° Fahr., the proportion would be as 1,148 to 1,133, about 2 per cent.

"Anxiety" says: I have a brother fourteen years of age who appears to be deficient in capacity and inclination for books. I am without sufficient patience to teach him, and I have found after schooling him two years that he cannot spell the simplest words, neither can he parse, or work out the easiest sum in arithmetic. Evidently the schools should share equally the blame: but I write for your advice regarding a trade for him. He can make a good pigeon house, ladder, and chicken house, appears to be fond or lending a hand to everybody about the house, and centers every interest in pigeons and chickens. What must I do with him, I mean, to have him out of my sight? Can I apprentice him? Answer: In the first place make up your mind to be really a brother to the poor boy; that is, be to him a loving and devoted friend. Bear with his infirmities, encourage the development in him of a good character by the exercise of the most patient kindness on your part. Take an interest in what interests him, and kindly endeavor to help him therein. Poultry breeding, especially of improved varieties, is not a bad occupation and requires the exercise of considerable intelligence. Supply him with pictures upon the subject, tools, materials and specimens of poultry, that is if you have the means. He will thus insensibly acquire a taste for that kind of information and ability to make use of what he knows; and thus a stepping stone to improvement in other directions, mental and practical, will be insensibly gained. Do not undertake to drive him out of your sight because he is a nuisance; on the contrary, strive to see how much you can improve and lift him up. But if there is any body in the world who can be a better friend to him than yourself, it might be your duty to encourage him to enjoy such influences.

M. A. H. says: I have in view the improvement of a small water power; the fall is about 28 feet. The hight of dam will be 10 feet. I propose to use a small turbine, and convey the water from dam to wheel in a penstock. The whole length of penstock will be about 300 feet; about 120 feet of it will be on a level with base of dam and the last 80 feet will be built down a steep incline, the lower end being 26 feet lower than the upper. The wheel is said to use under this head 156 cubic feet of water per minute. The diameter of penstock when attached to wheel is 12 inches. What I want to know is Shall I get the benefit of the whole fall if I make the penstock the same size all the way? If not, would it do to construct the portion on a level with base of dam of 16 inches diameter and the remaining part 12 inches? Also which would be cheaper, water or steam power? Can the tables giving power and quantity of water for turbines be relied on? Answers: 1. Make the penstock of a section at least as great as the wheel and of uniform size. The effect will be that due the whole fall less the moderate friction of the pipe. 2. Where it is uniform and reliable throughout the year or that portion of the year during which it may be required, water power is cheapest. The advantage of steam power lies in its reliability and uniformity and the privilege which it permits of locating the manufactory where convenience of transportation and proximity to market may make it desirable. 3. The tables of power of turbines are often unreliable; consult only those which are known to be based upon actual tests of the wheels themselves. If a manufacturer will consent to allow a test of his wheel before purchase, he can evidently be trusted.

F. H. D. says: 1. How far is it practicable to carry steam from boiler to engine under about 60 lbs. pressure with pipe well protected? 2. How high vertically can water be raised with steam siphon through an inch pipe under same pressure? 3. Will coal tar do to paint tin roofs? 4. With 10 feet fall of water, what per cent of same could be raised 50 feet with hydraulic ram? Answers: 1. By very carefully protecting the pipe with non-conducting and non-radiating covering, and providing for the trapping off of water of condensation, steam can be conveyed almost any distance without great loss. Always make a steam pipe as short as possible, nevertheless. We have seen steam conveyed several hundred feet in well covered pipe, but the most economical steam engines which have come under our observation have had short steam pipes. 2. We know of no experiments on this point directly. The Giffard injector has been made to force water into a steam boiler while supplied with its own steam from a separate boiler carrying but half the pressure of the first. We should, from this fact, judge it possible for a well proportioned steam siphon to lift water to a hight of nearly 120 feet, with 60 lbs. steam. We should make the pipe large in proportion to the size of the instrument. The friction of water in pipes is often a serious retarding force. 3. Yes. 4. The hydraulic ram, if well designed, should force, with a fall of 10 feet, about five per cent of the water supplied to it to a hight of 90 feet.

A. W. asks: Did you ever know of an instance of the water leaving a steam boiler and going into the main steam pipe, so as to fill the pipe and stop the steam pump? If so, what was the cause and what the remedy? There has been a case of the sort brought to my notice, and I know of no cause unless it was because it was a new boiler, and that there was animal grease enough about it to make it foam badly. The boiler is connected with seven others, six of which are old boilers and never known to foam. It has always happened in the night time, when the rest were making little or no steam. The water used is river water. If this boiler be cleaned first, so that there is not much fire under it before cleaning the others, it has ceased to trouble. Answer: Cases have occurred in which steam has gradually filled a pipe as described, by condensation, where little or no current was passing through. Other cases are often met with in which so great a velocity has occurred as to take over sufficient water "mechanically—by foaming—to choke a pipe. Our correspondent can judge for himself to which class of phenomena the case which he gives belongs.

E. R. D. says: I have charge of a 20x48 Corliss engine, making 56 revolutions per minute. On the side of the cylinder, there are two ¾ inch globe valves for attaching an indicator. Can you tell me why I get strong electric shocks when I open either of these valves? Is it owing to the friction of the escaping steam, or to superheated steam let in from the superheater? Let me ask, as to my letter, published on page 164 of this volume: Were the fires caused by electricity or superheated steam? I will add a little more information: About 20 minutes before stopping, the last fire is put on, consisting of shavings and coke screenings mixed. Five minutes before stopping, full feed is put on and kept on till the water is six inches above the top gage cock. Twenty minutes after stopping and shutting off all valves, steam rises from 40 to 100 lbs., and will continue to rise if more cold water is not let into the boiler. Answer: The discharges are produced by electricity generated by the friction of particles of water, mingled with the escaping steam, against the sides of the orifice. Faraday proved that perfectly dry steam would not produce this effect. Superheated steam therefore, is not the cause, in this case. It is very probable that the fire referred to may have been due to electrical sparks, which are quite capable of igniting very inflammable substances.

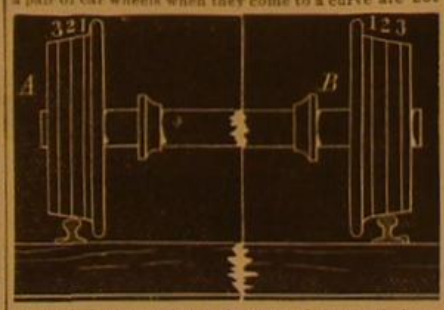
C. asks: If it is 14 feet from the rim of one driving wheel of a locomotive to the rim of the other, how wide should the tire of the driver be to remain on the track going around a 14 degree curve? 2. Is it, or is it not, atmospheric pressure which causes water to rise in a pump to fill the vacuum caused by the valve? Answers: 1. Lay it down on paper and determine it for yourself. You will be better satisfied than with a mere estimate. 2. It is.

W. S. H. asks: Which is the best form of punch for thin hammered iron? Should it be straight, with parallel sides, as at A, or conical, as at B, or hol-

lowed, as at C? Answer: The straight punch will be preferable, as the others will be more easily broken.

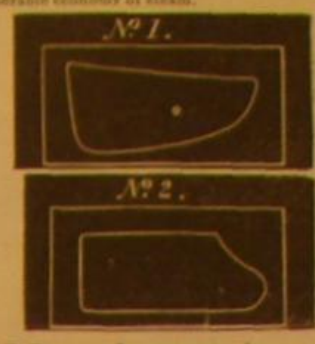
F. says: There are two lines of heavy shafting upon the same plane, but they are at an angle with each other of 35°. I wish to communicate 100 horse power from one to the other. The common mode, I am aware, is with gears, but in this case the noise is a serious objection. The driving shaft runs at a speed of 100 revolutions. Hooke's universal joint can be used successfully up to 15°. Can you inform me whether it is practicable to use three of Hooke's universal joints of 11° each, and in this way make the angle of 35°, communicating 100 horse power, and driving the second line of shafting? Will it work? Will the percentage of loss of power be greater than it would be if gears are used? Will the motion of the shaft driven be irregular? The size of shaft used is 3⅛ inches diameter. Answer: Three Hooke's joints would be likely to give trouble by the [illegible] them. The motion would be slightly irregular. There are patented modifications of Hooke's joints which are claimed to work well at any angle. If practicable, a belt led around guide pulleys would probably give most satisfaction, if it is impossible to use gearing. A double Hooke joint will give regular motion. In this form, an intermediate shaft is connected with each main line by a Hooke joint at each of its ends.

J. C. C. says that our answer to J. H., as to sliding of wheels on curves, was correct. Without coning, the flanges would last but a short time. The proposition of J. J. C. will not convince any railroad man that coning is an injury, from the simple fact that a pair of car wheels when they come to a curve are not



of equal diameters, that is, the parts of the treads bearing on the rail (see engraving) as at A, curve to the left and at B to the right. The wheel, being largest at or near the flange, travels a greater distance in the same number of revolutions than it does at figure 3, allowing it to curve without grinding the flanges, that is, if the curve is not too sharp; but the instant the wheel comes to a straight track, the bearings on the rail become of equal diameters, and the least tendency to vary from the center of the track is regulated by the cone. If J. J. C. will examine a pair of driving wheels with the coning worn off, he will find the flanges half ground off also, that is if the drivers are run very long after they become cylindrical or nearly so.

W. T. asks: Will you please give me the calculation for horse power practically in use under the following conditions: 10 inch cylinder, 2 feet stroke, cut off at end of stroke. Steam enters through about 10 feet of 2½ inch pipe. Pressure on boiler, 100 lbs., number of revolutions, 90. I do not know what to allow for friction and loss of pressure of steam in transmission; and the calculation without allowances gives so much that it would seem to require a considerable deduction to accord with our ideas of what we are using. Answer: A ten inch cylinder has 78½ inches area of piston; steam entering through 10 feet of 2½ inch pipe from a boiler carrying 100 pounds steam should reach the cylinder with a pressure of, probably, not less than 90 pounds, the engine making 90 revolutions per minute. The mean pressure will be reduced somewhat in the steam ports and, it may be, very greatly. We can tell nothing about it without seeing an indicator card. We can only guess that the average pressure on the piston in such an engine, under such circumstances, will not exceed 60 pounds per square inch. The horse power would, in such a case, be $78\frac{1}{2} \times 60 \times 90 \times 4 \div 33000 = 51\frac{1}{2}$. This, our correspondent must remember, is merely an estimate. An engineer accustomed to the use of the indicator can settle the matter at once. The steam pipe is large enough. The valve should not be allowed to follow full stroke. It would save fuel and give more power if cutting off at ¾. An engine following full stroke usually gives an indicator card like No. 1, while, if cutting off at ¾, it would make a diagram like No 2, giving equal or greater power with considerable economy of steam.

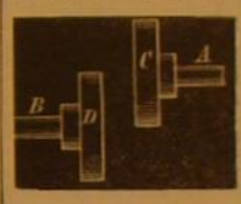


N. T. P. says: I propose to bore a hole 8 inches in diameter about 8 or 9 feet into permanent moisture, insert a lightning rod into this hole to the bottom, and then fill the hole nearly to the top with small scrap iron. Will this give sufficient dissipating surface? Answer: The ground connection which you propose is much better than the common practice of merely sticking the extremity of the rod into the ground for a short distance. The value of a ground connection depends on the quantity of conducting material which is introduced between the extremity of the rod and the earth. The greater the quantity of the conducting material, the better. Scrap iron is good for the purpose. Coke and charcoal are also excellent.

J. M. M. asks: Is there any liquid that can be prepared to black stoves with and not burn off, different from common blacking? Answer: There is nothing better than first quality plumbago for blacking stoves.

W. McC. asks: Can you tell me whether pine stumps can be blasted by any known process that will be cheaper than extracting them with a machine? What would be the cheapest and safest mode of blasting? Answer: Removal by the machine would be more effective than blasting, probably also cheaper. We have seen it stated that a good method is to bore the stumps and pour in petroleum. In a few days the oil will have penetrated the stump, which is then set on fire and will burn until consumed.

J. E. W. says: I have two shafts parallel to each other, distance from center to center three inches. I desire to transmit positive motion from one to the other, both to run at the rate of from 3,000 to 3,500 revolutions per minute and with as little noise as possible. Please tell me the most practical, durable and economical way to accomplish it. Answer: Will not this do?



A and B are the two shafts, two inches from center to center. Fit on end of each a face plate, C D, and connect with links, E F, each three inches from center to center, making both links of same length by drilling the holes for pins simultaneously, clamping them together during the operation, and drilling in face plates, with equal precision, holes to take the pins. Then assemble as in the next figure. The face plates must be of such size that the distances E E and F F shall exceed the length of links over all, as otherwise they could not pass each other while revolving. Grind the pins to fit. If this will not do, try friction gearing, if the work is light and it can be worked in.

T. A. claims that January 1st, 1901, is the first day of the twentieth century. H. claims that January 1, 1900 is the first day of the twentieth century. Which is right? Answer: T. A.

Wm. H. Seaman, Lecturer on Botany, Howard University, Washington, D. C., says in reply to E. S. who asked how to preserve the morning glory pollen as a microscopic object: By mounting it in a cell filled with a mixture of glycerin, distilled water and alcohol, you can keep it in a natural condition. The proportions of the ingredients must be varied according to the nature of the object. The density should be that of the sap of the plant and this is arranged by altering the proportion of glycerin. If it is required to preserve color, but very little alcohol must be used, and a drop of carbolic acid to a dram of fluid is a useful addition. Verrill's solution is also very suitable.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Million Dollar Telescope. By S.V.C., and by S. L. D.

On the Creeping Rail Problem. By M. S. M.

On Small Pox and its Remedies. By A. B.

On Steam Launches. By J. T. B. S.

On the Atmosphere and the Milky Way. By H. A. C.

On the Motions of the Sun. By C. H. B.

Also enquiries from the following:

J. D. N.—C. W. H.—W. I. L.—J. F. E.—F.C. J.—W. C.—R. C. L.—H. B. M.—F. B. M.—D. D. E.—J. E. R.—J. A.—S. D. N.—G. R.—J. N. B.—C. W. J.—W. D. P.—S. & Co.—W. B.—H. W. A.—H. G.—F. H. L.—R. H. B.—R. A. D.—R. C.—A. C. B.—J. C.—J. C. H.—H. A. V.—W. H. T.—J. S. T.—N. M. L.—J. S.—A. B. & Co.—W. H. O.—W. F. D.—A. D. H.—R. H.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

March 4, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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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:

21,891.—IRON MOVING MACHINE.—C. Hewitt. May 21.
21,892.—STEAM REGULATOR.—A. P. Pitkin. May 28.
21,932.—ROLLING METAL.—J. S. Palmer. May 28.
21,456.—RAILROAD BAR.—H. Webb. May 28.
21,478.—STONE SAW MACHINE.—A. M. Merriman. June 4.
21,491.—LOOM BRAKE.—R. & G. B. Reynolds. June 4.
21,512.—CAR BOLSTER.—A. Ward. June 4.
21,515.—STEAM DRYING CYLINDER.—A. P. Pitkin. July 2.
20,415.—WINDING THREAD.—H. Conant. June 4.

EXTENSIONS GRANTED.

20,153.—RULING MACHINE.—J. B. Blair.
20,172.—TICKET PRINTING MACHINE.—E. M. Hoe.
20,246.—MEAT MINCER.—A. W. Hale.
20,263.—BOTTLE STOPPER FASTENING.—H. W. Putnam.

DESIGNS PATENTED.

6,469 to 6,472.—CARPETS.—H. R. Campbell, Lowell, Mass
6,473 to 6,479.—CARPETS.—J. M. Christie, Brooklyn, N. Y.
6,480 & 6,481.—CARPETS.—H. F. Geotze, Boston, Mass.
6,482 & 6,483.—CARPETS.—J. Hamer, Lowell, Mass.
6,484 & 6,485.—CARPETS.—C. S. Lilley, Lowell, Mass.
6,486.—CARPETS.—D. McNair, Lowell, Mass.
6,487.—CARPETS.—T. J. Stearns, Natick, Mass.
6,488.—ORNAMENTATION.—G. R. Fagan, Philadelphia, Pa.
6,489.—BOTTLE.—H. Sawyer, Chelsea, Mass.

TRADE MARKS REGISTERED.

1,153.—COFFEE.—W. H. Crawford & Co., Baltimore, Md.
1,154.—SHIRTS, ETC.—L. Sternberger, Philadelphia, Pa.
1,155.—TOBACCO.—J. W. Stone, Lynchburg, Va.
1,156.—MEDICAL COMPOUND.—H. A. Tilden, New Lebanon,
1,157.—CHEMICAL COMPOUND.—J. W. Chisholm, N.Y. city.
1,158.—BREAD.—Mac Williams & Pieper, Baltimore, Md.
1,159.—TOBACCO.—J. W. Stone, Lynchburg, Va.

SCHEDULE OF PATENT FEES:

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CANADIAN PATENTS.

OFFICIAL LIST OF PATENTS GRANTED IN CANADA FROM JANUARY 22, 1873, UP TO AND INCLUDING FEBRUARY 14, 1873.

Patents taken by citizens of the United States are marked U. S.

[NOTE.—Under the new patent law, now in vogue, American citizens may patent their inventions in Canada on favorable terms. For full particulars, address Munn & Co., Office SCIENTIFIC AMERICAN, 37 Park Row, N. Y.]

Sharpening cutters, W. H. Daniels, U. S., Jan. 22	2,000
Cutter holder, W. H. Daniels, U. S., Jan. 22	2,001
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Nut lock and washer, B. F. Baker, U. S., Feb. 14	2,066
Nut lock and washer, B. F. Baker, U. S., Feb. 14	2,067
Steam brake, etc., J. W. Gardner, U. S., Feb. 14	2,068
Fire grate, etc., F. Proudfoot, Feb. 14	2,069

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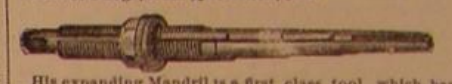

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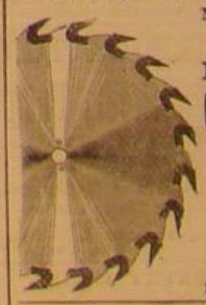

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Vol. XXVIII.--No. 15. [NEW SERIES.] NEW YORK, APRIL 12, 1873. [$3 per Annum, IN ADVANCE.

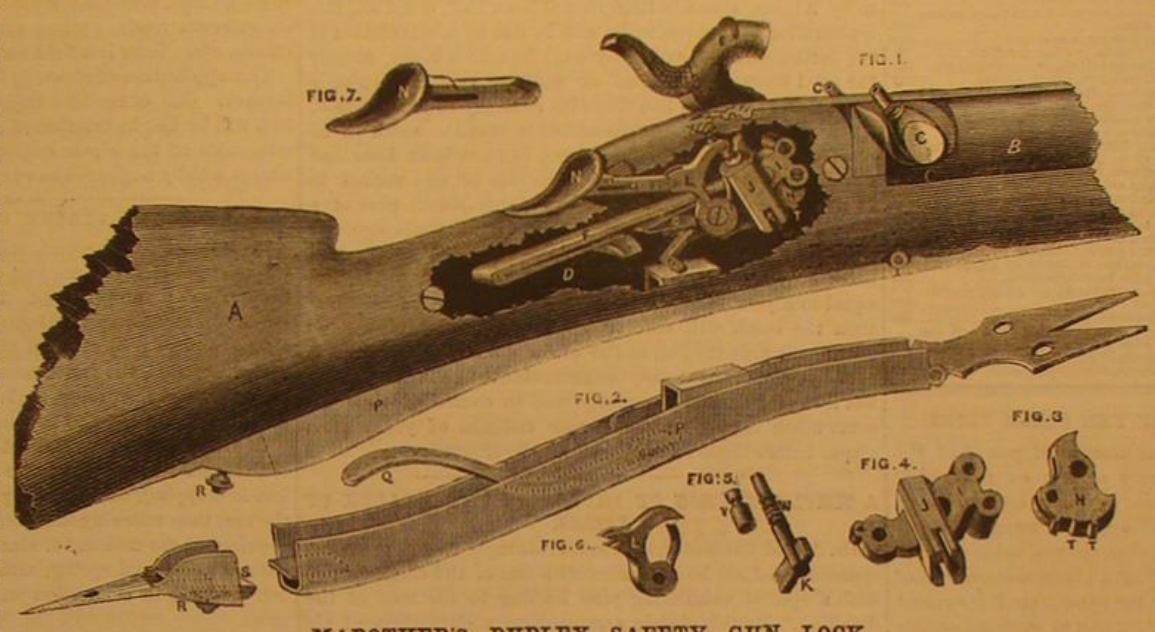
IMPROVED DUPLEX SAFETY GUN LOCK.

We give herewith an engraving of a duplex safety gun lock, patented January 28, 1873, by Dillon H. Mapother, of Louisville, Ky., which, it is claimed, renders the use of firearms perfectly safe to the user. It presents a new principle, in that no single mechanical force will change the lock from a state of rest to one of motion; two forces have to be simultaneously exerted, one of which is involuntarily given by the grasp of the stock. As accident cannot possibly combine two forces acting in different directions at the same moment, it will readily be perceived that only the human hand acting under direction of the will can effect the discharge. The following description, with the aid of the engraving, will render its action plain. When the hammer, E, is down on the cap, premature discharge from any object knocking the hammer up is impossible, as the key, K, fits into the safety notch, T, and holds the hammer perfectly locked in its position. To cock the gun, the thumb of the right hand, pressed lightly upon the upper trigger or thumb shoe, N, by the action of the cam lever, L, depresses the plunger and propels the key beyond the line of the tumbler, H, when the hammer may be raised with the forefinger. It is now again securely locked in its position, as the key fits into the second safety notch, T, while the sear, O, obtains its hold upon the tumbler; the action of the mainspring, F, being doubly prevented, nothing but a duplex or twofold action will release it; accident may act upon one trigger and remove one hold upon the tumbler, but the other will remain. In effecting a discharge, the natural grasp of the handle of the stock acts on the lower trigger, P, detaching the sear, and when an aim is obtained, a touch of the thumb instantly releases the mainspring, and brings down the hammer on the tube. By the action of the graduating screw, X, on the cam lever, the key may be depressed so as to have but a very fine hold on the tumbler, thus constituting it a hair trigger. The locking bolt, S, serves as a support for the lower trigger when drawn back, and, when pushed forward, also securely locks the trigger, preventing its action on the sear: the loaded gun may thus be laid aside with safety; it can be cocked, but cannot be discharged until the bolt is withdrawn. The half cock notch retains the hammer just clear of the cap, and protects both the hammer and cap from explosion and from percussion. This position is of course essential for breech loaders. From this point the gun can be cocked without depression of the plunger, but the hammer cannot be precipitated back on the cap by any accident, or even by intention, until the hammer is brought to full cock.

The invention is applicable to gun, rifle, and pistol, to both muzzle and breech loaders, to either bar or back action locks. In addition to its safety, the inventor claims the following advantages:

The mode of discharge is less disturbing to aim than the old trigger, because the slight push required is directly in the line of the object; whereas, in the old trigger, the pull is directly contrary, and has a tendency to depress the barrel. The discharge is more instantaneous, because the trigger or thumb shoe is as directly in the line of vision as the sight pin; it requires no nervous telegram from brain to forefinger to discharge the piece at the instant the aim is obtained. When the discharge of the second barrel is desired, the transfer is made in half the time that is required in changing triggers with the forefinger. By no possibility can the gun be fired without concurrence of the will, as frequently happens with nervous fingers on triggers in the excitement of the hunt. By no possibility can both barrels be discharged at once, both upper triggers not being in line, and a ridge (between them, in the stock) preventing such an accident. The gun can be handled readily with gloved hands; even buckskin gloves may be worn in the field, which greatly increases the comfort of sportsmen. The gun is more convenient to handle, there being no guards, and the recoil cannot bruise the middle finger, which is often the case on frequent firing. As long as the lower trigger is locked, the gun, though it may be cocked, cannot be discharged; to withdraw the bolt requires an exercise of will, an evidence of intention. These locks but slightly increase the weight of the gun. A double barreled shot gun (30 inch barrels of No. 15 bore) to which they have been applied, weighs but seven pounds; and the use of aluminum, instead of German silver, for the lower trigger, would reduce this; moreover, the increased weight of, say four ounces, is in a position to improve the balance of the gun.

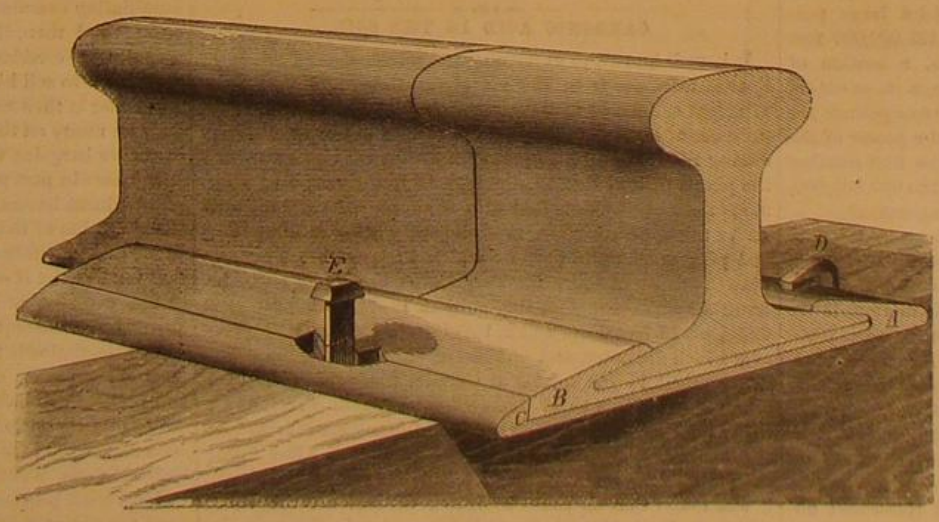
For further information the patentee may be addressed as above.



MAPOTHER'S DUPLEX SAFETY GUN LOCK.

COMPOUND CHAIR FOR CONNECTING RAILROAD RAILS.

We present herewith a novel and effective form of railway chair, which is so constructed as not only to serve as a firm support and means of connection for the ends of adjacent rails, but also to afford a means of tightening the joint in case it should work loose. The advantages of a device thus arranged will be at once obvious to all who have experienced the defects of the ordinary chair now in use, and its superior efficiency will doubtless more than compensate for its small additional cost.



COMPOUND CHAIR FOR CONNECTING RAILROAD RAILS.

In our engraving the bed plate is shown at A, and is constructed with a hook flange on one side and a dovetail, C, on the other. B is the fastening plate, and is provided also with a hook flange, the edge of which is received in the dovetail, C. The last portion is wedge-shaped, so that in driving the two plates together the fastening plate acts as a key. It will be noticed that the rails are firmly grasped by the two hook flanges.

The spikes at D, and the single one at E, secure the chair to the tie. The spike, E, passes through a hole in the bed plate, and engages in one of the three notches—any number may be used—in the fastening plate. When through the wear of the rails the joint becomes loose, this spike, E, may be withdrawn and the fastening plate may be driven up, that is, in the direction from right to left in our engraving. The hold of the chair upon the rails will thus be tightened. On replacing the spike, it will engage with a new notch.

Another arrangement of parts, having the same effect, consists in making the notches at the butt extremity of the plate, B, and, instead of the spike, E, substituting a square headed bolt, headed into the end of the plate, A, at C. When the chair is keyed up, by turning the bolt its head engages in the notches and forms the lock. This is a recent improvement and perhaps more advantageous than the method above described, as it renders the device complete in itself.

As regards the economy of this system, it is stated that the plates, A and B, are rolled in any ordinary rolling mill, and may, consequently, be manufactured at a very moderate cost. They are, as we have shown, adjustable to the rails, so that the latter may always be retained in proper position, thus securing an even tread for the car wheels.

A patent through the Scientific American Patent Agency has been allowed for this invention to Mr. D. D. Eldredge, Post office box 225, Bedford, Lawrence county, Ind., from whom further particulars may be obtained.

Flames from Compressed Gas.

M. F. Benevides, Professor of Physics at the Industrial Institute of Lisbon, communicates to *Les Mondes* a note of his investigations upon the above subject. He states that combustible gases, compressed and burnt in the air, cause some interesting phenomena, which may be readily observed. Among others it may be noted that, when the gas is under great pressure and consequently escapes from the apparatus in large quantities under a high velocity, its flame proper does not begin at the orifice of exit, but at some distance above it. There merely appears at the apertures a slight glow, which is separated by a large obscure space from the luminous jet. The dimensions of this interval depend upon the pressure, rapidity of exit, and quality of gas, while its temperature is quite low. This M. Benevides considers due to the mechanical action of the current of gas, which forces the air back to a certain distance and thereby cuts off the supply of oxygen necessary for combustion. Above the obscure space, the gas, having dilated, mixes with the air, and a luminous jet of high temperature is produced. On increasing the flow of gas, air becomes drawn in with it, and the brilliancy of the flame disappears though the temperature is greatly augmented. Finally, when the aperture is small and the velocity great, the air is crowded away, and ignition will not take place.

In cities in which localities varying greatly in level receive gas for illuminating purposes from the same gas meter, at points above the source of supply effects analogous to those above described may be produced. The reason is that, other circumstances being equal, the rapidity of the escape of the gas is greater in elevated situations because this velocity depends on the difference between the pressure of gas and that of the atmosphere, and the atmospheric pressure becomes less in proportion as the altitude of the point of observation increases. In cities, therefore, like Lisbon, and we may add Boston or Albany, at situations near the level, it often happens that the supply of gas fails during the day, while at more elevated spots there is always a sufficiency. It follows, then, that in order to have the same brilliancy of light, burners and conduit pipes being the same, the opening of the valve regulating the supply must be greater for the low localities than for those on eminences. In positions high above the sea level, if the supply valve be widely opened, the rapidity of escape of the gas becomes very great, and air is drawn in with it; and, consequently, the effect of the Bunsen burner is produced, as before noted.

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NEW YORK, SATURDAY, APRIL 12, 1873.

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ASTRONOMICAL EFFECTS OF THE OCEAN TIDES.

The calculation of the enormous amount of power of the ocean tides, published in a former article, on page 64 of our current volume, being based on figures which are to a certain extent estimates only, may appear to many as exaggerated, and, no doubt, to others as below the real value; certain it is, however, that all will agree that an immense amount of power is here developed, while at the same time it is evident that the tidal wave, which runs from east to west and spends its force on the eastern coast of Africa and South America, not to speak of many islands, must exert some influence on the earth's rotary motion from west to east, tending to cause a retardation of that motion.

But enormous as is the force thus exerted, measured by many millions of horse power, it is a mere trifle compared with the earth's weight, which may be thus computed: Accepting the terrestrial radius, in round numbers, as 4,000 miles, the earth's cubic contents are, according to the formula $\frac{4}{3}\pi r^3$, equal to $\frac{4}{3} \times 3{\cdot}1416 \times 64{,}000{,}000{,}000$ or more than 200,000,000,000 cubic miles. Considering that a cubic mile is equal to 147,197,952,000 cubic feet, the contents of the globe are equal to very nearly 30,000,000,000,000,000,000,000 cubic feet; and as the mean specific gravity of the earth's mass is $=5$, every cubic foot weighs on an average 5×62, or 310 pounds; and the whole weight of the earth is equal to 9,300,000,000,000,000,000,000,000 pounds. As a large portion of this mass moves with a velocity of 133,000,000 feet in 24 hours, or 1,440 minutes, it has, perhaps, a motion of almost a hundred thousand feet per minute, a momentum compared with which the 500,000,000,000,000 foot pounds per minute, which we found, on page 64, to be the power of the ocean tides, becomes rather insignificant. The first number divided by the second giving a quotient of 180,000,000,000, and this forcibly proves its comparative unimportance.

But as even a comparatively small power may in the end manifest its results, if it is only given a proportionately long time wherein to exert itself, the question has been raised: Does not the earth show any retardation in its motion, if we compare its present velocity with that of the most ancient observations which have come down to us? William Herschel, considering that such a question cannot possibly be settled by clocks or time pieces, proposed to use observations on the rotation of planets, in some of which their time of revolution can be determined within a second, by means of marks on their surface. Unfortunately, Jupiter has such a variable surface on his vaporous atmosphere, that all Herschel's observations on the same were labor lost; only the observations on Mars were found to be available, as Venus and Mercury are too near the sun, and therefore, probably, their own revolutions are retarded more than that of the earth, by the solar tidal waves. Herschel observed Mars at intervals of two years, but by counting one rotation less than had actually happened, he obtained the value two minutes too great; Maedler obtained, later, a value which was only one second too great, while finally Professor Kaiser, of the University of Leyden, Holland, by combining many observations, obtained a value which is correct to within one fifteenth of one second. Proctor, of London, sets down the time of Mars' rotation period at 24 hours 37 minutes 22·74 seconds, a value which at some future time may serve as a test for the period of the earth's rotation. Proctor claims that it is correct to within one hundredth part of a second; if so then, if, after a century, the earth's rotation has changed only the one hundredth part of a second, posterity will be able to measure the amount of retardation.

In the meantime human impatience has looked out for other means of measurement, and one has been found in the moon's revolution around the earth. If we calculate the eclipses back for long periods of time, say two thousand years, the calculations do not agree with the actual eclipses as recorded in history; this puzzled the astronomers at first, till La Place tried to prove that the moon must be subject to a periodical accumulation and retardation in its motion, which must be really very minute and only perceptible in long intervals of time, notwithstanding that she travels faster and faster, and will afterwards restore the gain by going slower and slower. Mayer later denied the periodicity of this lunar motion; he only admitted the acceleration, on the ground that the moon was coming nearer and nearer to the earth; and he maintained that in the course of ages she must come down and destroy everything on the terrestrial surface. From La Place's calculation the conclusion was drawn that the period of the earth's rotation had not varied one tenth of a second per century for the last two thousand years; this was accepted and discussion set at rest, till Adams reviewed and corrected the calculations; then came Hansen, who proved by more elaborate researches, concerning eclipses recorded in history, that the moon's acceleration was more than twice as fast as La Place's and Adams' calculations would admit; this was agreed to by Adams, who admitted that at least half, if not all, this acceleration is apparent only, and is due to a retardation in the earth's rotation, caused by what he calls a brake, namely the tidal wave, which must do work in sweeping twice a day around the earth in a direction contrary to her rotation.

The result of the latest researches is that the earth in its rotation has, in two thousand years, lost nearly an hour and one quarter, and is losing now at the rate of one second in 23 weeks, so that our days are one eighty-fourth part of a second longer than they were two thousand years ago. If the rate of retardation is kept up, the length of a day will become equal to a lunar month in 36,000,000,000 years, and equal to a year in 468,000,000 000 years; that means that then the earth will revolve once a year around its axis and behave towards the sun as the moon does now toward the earth, that is, turn always the same side to its source of light; but it is evident that the change will in course of time become much slower, and that some trillions of years must elapse before these full changes will be effected.

A SIMPLE METHOD OF IMPROVING THE HEALTH OF CITIES.

Dr. Alfred Carpenter, of London, strongly recommends the connection of all house drains with one of the chimneys, or with a special ventilating pipe leading to the roof of the dwelling. By this simple arrangement a circulation of air through the sewers is obtained, and the foul gases, instead of entering the house to produce typhoid and other diseases, would be oxygenized, rendered innocuous and dissipated.

In New York, and other cities, there are thousands of unhealthy dwellings, made so by the back pressure of air from the sewer pipes, which would be instantly cured by the use of a few feet of pipe to connect the house drains and water closet pipes with the chimneys. We believe that the passage of a law requiring the insertion of such pipes would be an excellent sanitary provision. We compel the owners of tenement houses to place fire escape ladders upon the outsides of their buildings, as a means of saving life in case of conflagration. But a far greater number of lives might be saved if owners were compelled to put in vent pipes as above indicated. Noxious air from the sewers is one of the main causes of disease and death in all large towns.

CARBONIC ACID IN THE SOIL.

It is well known to every one that plants derive much of their subsistence from the air about them, and that their principal articles of food are carbonic acid and water. The presence of large quantities of the former in the atmosphere during the carboniferous period of geological history caused the plants of that time to attain great luxuriance and enormous size. But plants find also a supply of carbonic acid under the earth's surface, the solid earth being in fact porous and permeated with gas, of which the quantity increases with the depth of soil. Dr. Pettenkofer has made some interesting experiments on this subject in Munich. He first dug a pit 14 feet deep, and in this he placed fine lead pipes of 0·4 inch diameter, and ending at different depths. The first reached to the bottom of the pit; a second went to a depth of 10 feet; a third about 8 feet; a fourth 5 feet, and a fifth 2½ feet. The upper ends of the tubes were carried into the laboratory, and connected with aspirators. After filling the pit with the earth taken out, and pounding it firmly down, it was found that air could be drawn through all the tubes just as easily as if the tubes were suspended in the open air. In the course of from 2½ to 3 hours, from 13 to 16 quarts of air were drawn through the tubes; and the amount of carbonic acid was determined by absorbing it in baryta water. Observations were made at all seasons of the year, and the quantity of carbonic acid was found to be greatest in August and September, when from 14 to 16 parts of this gas were found in 1,000 parts air from a depth of 14 feet. The smallest quantity found at this depth was in January, when 3·46 volumes of gas were found in 1,000 volumes of air. The air nearer the surface contained much less of the gas, except in the months of June and July. The experimentor thinks that this carbonic acid may be produced by organic processes in the soil, being given off by living organisms of a very low order. The fact that the amount decreases as we come nearer the surface is attributed to the diffusion of it into the air, ventilation being less perfect in summer than in winter, as is the case in a dwelling or elsewhere. Nearly the whole amount of carbonic acid present in the atmosphere, he thinks, comes from the soil. It was noticed, by Schulze, in 1871, that when the wind blew from the sea, the percentage of this gas in the air was less than when the wind had travelled over the continent. Roscoe established the unexpected fact that all the furnaces and chimneys in busy Manchester did not perceptibly increase the amount of carbonic acid in the atmosphere of the city; much less could the manufactories scattered over the continent explain the phenomenon observed by Schultze. The supposition that it is everywhere given off from the soil is the only plausible explanation of it. We hope to hear of the experiments being repeated in different parts of our own country, so that the results of different observers may be compared.

STEAM ON THE FARM.

We recently published an engraving of an English steam mowing machine, which, for its simplicity, has attracted much attention. Something has been done in the same line in this country. A correspondent suggests that there is an extensive demand for small portable steamers, for farm use, with attachments to render them applicable to various purposes. For example such machines should be capable of use in working mowers and reapers in lieu of horses; of driving plows, seeders, harrows, saws, grindstones, flouring stones, straw cutters, threshing machines, pumps, drawing wagons on common roads, pulling stumps, operating ditching machines, etc. Here is a field for the ingenious.

The application of steam to farm labor is at present in its infancy. One of the first requisites for its general introduction will be the instruction of farmers in the principles and economies of the steam engine—studies that are at present almost wholly neglected in our common schools.

EUROPEAN STREET CAR IMPROVEMENTS.

In Edinburgh, Scotland, where there are steep hills and where street railways are just coming into use, Mr. Gillespie has devised a safety brake. It consists of a bar, running longitudinally along the bottom of the car. A number of strong prongs project from the bar. The arrangement is such that, when the driver moves a certain lever, the pronged bar drops and the prongs strike upon the pavement, entering between the stones, and instantly stopping the car.

In London, Messrs. Holmes and Taylor have invented a contrivance for storing up the inertia or power of the car lost in stopping, so as to apply that power to the starting of the car, thus relieving the horses of the severe strain now required at the moment of starting the car. The device consists of a torsional spring, arranged under the body of the car, working in connection with gear wheels upon the car axles.

The use of springs for this purpose is very old in this country, and has been tried in various forms without much practical economy. The expense and weight of the parts has proved, on the whole, disadvantageous.

NEBRASKA PATENT LAWS.

A correspondent states that the Nebraska legislature has passed one of those wretched local laws in regard to the sale patents which disfigure the statutes of several other States, and are without force, legal or moral. This Nebraska law enacts, first, that it shall be unlawful for any person to sell or barter, or offer to sell or barter, any patent right, in any part of that State, without complying with such law. Next, the seller of the patent is required to submit a sworn copy of the patent to the Probate Judge of the county, give his name, age, residence, occupation, and go through with such other humiliating examinations as the judge may take a fancy to order; and then, if the judge thinks it a proper case, he may grant a certificate showing that the applicant is duly authorized to sell his patent within the limits of Nebraska. The seller is then required to exhibit the certificate to everybody he meets on the street, if they ask for it. Next, in case the seller bargains with a man for his patent, and agrees to take a note in part payment, he must write or print thereon, in prominent letters, the words "*given for a patent right*;" and the value of the note is to be impaired by being made subject, if transferred to a third party, to all the defenses that might exist if owned by the original receiver. Finally, if the patentee or seller of a patent shall fail to observe any one of these requirements, he is to be deemed a criminal, and on conviction is to be fined five hundred dollars, or imprisoned six months, or both, at the discretion of the court; and is also to be liable for damages in a civil action.

We pity the stupidity of the legislators who could enact such a law It is in direct contravention of the laws of the United States, which declare that the patentee, his heirs and assigns, shall possess the exclusive right to make, use and vend the patented invention throughout the United States and the Territories thereof. But Nebraska, it appears, undertakes to legislate the inventor out of these rights, and take possession of them itself, without so much as offering compensation.

We need hardly say that this law of Nebraska, and similar laws in other States, are all of them unconstitutional, and have been so declared by the United States Courts. We published the decision to this effect some time ago.

Any judge or other person in Nebraska who undertakes to interfere with a patentee in the sale of his patent, under the pretended authority of a Nebraska law, makes himself personally liable to penalties under the laws of the United States.

If the object of the Nebraska legislators is to save its simple minded citizens from the cheats and tricks of designing knaves, who, under cover of pretended patents, pretended

land grants, pretended mines, and fraudulent pretences of various kinds, go roaming about the country plundering whomsoever they can: if such is the object, surely there must be some other way to its accomplishment than interference with the vested rights granted to individuals by the laws of the United States.

A much better plan would be the passage of a law by the legislature authorizing the Governor of Nebraska to purchase from the patentee, on behalf of the State, the right to every new and useful patented invention that might be presented, all citizens of the State to enjoy the free right of use thereof. This would relieve the citizens of all necessity of buying patent rights, the United States laws would be complied with, the useful arts would be splendidly encouraged, and Nebraska soon become the most intelligent, wealthy, populous and prosperous State in the Union.

A MUNIFICENT GIFT TO SCIENCE.

Some time since Professor Agassiz in an address before the Legislature of Massachusetts called the attention of that body to the need and value of a summer school for the instruction of both teachers and students in natural history. He also suggested that, during the coming summer, a session should be held on the island of Nantucket. These remarks attracted the attention of Mr. John Anderson, a wealthy and well known tobacco merchant of this city, who with great munificence has donated an entire island for the purposes of the institution, supplementing his gift with a fund of $50,000. The island, which bears the name of Penikese, is of about one hundred acres in extent and is situated in the Elizabeth group, at the entrance of Buzzard's Bay, on the southern coast of Massachusetts. It hss been largely improved, and contains several buildings valued at $100,000, while the fertility of its soil is such as to render it possible to raise sufficient produce to pay all expenses of the school.

Professor Agassiz considers that the site is eminently suited for the purpose as affording ample opportunity for original investigation as well as instruction. The institution will be carried on throughout the year, in connection with the museum of Cambridge, and measures will be speedily taken to prepare the buildings for use.

ECCENTRIC INVENTORS.

If any one should undertake to write a volume on the subject of inventors—"their vagaries and vicissitudes" would be a "taking" title, as publishers express it—we believe that a tome as ponderous as Webster's dictionary might be produced and yet not exhaust the topic. As a class, they are looked upon as enthusiasts, fanatics, seekers after will-of-the-wisp theories, until some day the public wakes up to the fact that one out of the million has immortalized himself and conferred incalculable benefits on the human race. Then, if it cannot crush him or deprive him of the result of his labors, it bows down to him, pours gold into his pocket, erects statues to his memory, and complacently absorbs his glory under the grand title of our "national genius." Meanwhile, the other nine hundred and odd thousand continue to be "visionary monomaniacs."

The popular notion of an inventor is admirably depicted in a comedy, written by a well known literary lady and recently produced at one of the theaters in this city. The principal character is a childish old man who has invented a flying machine, in his attempts to perfect which he has swamped a fortune. The action hinges on the efforts of his daughter to save him from further waste and to protect the family homestead, which, it seems, her father mortgages to obtain money to pursue his scheme. Though the play has not been successful, to this one character we can award hearty praise. The utter indifference to every subject save his invention, the desire to sacrifice everything, even the roof over his head, for the "benefit of mankind," the earnest catching at every word of encouragement, the delight of the old man when the wily lawyer who is plotting against him promises assistance, and his total despair when he finds his means all gone and himself unable to put "the very last and finishing touch" to his device, were most graphically depicted; an old friend was on the stage before us, repeating familiar words.

Fortunately, the eccentricity of genius is the exception and not the rule, while it is the prominence which individuals unwittingly give to themselves that leads them to be regarded as types of a class. We constantly hear of schemes as impracticable and as wild as the search for the philosopher's stone or the elixir of life. The quest of perpetual motion is indeed our modern alchemy. Often we learn of instances of labor so patient, and confidence so implicit in future triumph, that the very pathos of the case disarms condemnation. There is an old man who haunts the halls of Congress in Washington; he has done so for years, with a faith which is wonderful, if not sublime. He is over seventy years of age, always neatly dressed, though there is a tinge of mild decay now coming over his raiment, and generally wanders about with a bundle of pamphlets under his arm. He is ready to explain his theory to any one, and advances his views in the mildest and most deferential of terms until some person ventures to doubt their practicability, when a tigress robbed of her whelps could not be more incensed. His invention is something about applying cement to the banks and bottoms of canals, so that the earth cannot be washed away, while the cutting may at the same time be easily kept clean. The old man believes most implicitly that some day the government will adopt his system and, by some mysterious process in the committee rooms, an appropriation will be awarded him. Session after session passes and still he waits; nothing wearies him, and rebuffs are of no avail. Recently he has been villanously swindled by two men said to be high in political position, who have taken his money and promised to assist him; but they have done nothing except put him off with lying excuses, and Congress meets and adjourns without knowing of the existence of either the inventor or his ideas. Thus he will continue, pouring his scanty means into the hands of these harpies, and coming from his home in Ohio to Washington every winter until death overtakes him, as far at the end as at the beginning from the realization of his wild phantasy. There is a humorous as well as a grave side to the subject: perhaps the majority of cases would excite laughter before pity. A metaphysical genius with unkempt auburn locks and dilapidated garments infests newspaper offices and the Liberal Club in this city. He is ready at all times to argue anything, but has a particular fondness for metaphysics and squaring the circle. For accomplishing the latter, he has invented a new process, which consists in considering the difference between the circumference and the circumscribed polygon as an infinitesimal quantity too small to be noticed. It is needless to state that by this method he arrives at, to him, perfectly satisfactory results.

Another instance is that of a recent exile from Erin who, for some time past, has been seeking to secure the adoption of his invention by Congress. It was suggested at one time to fire cannon at different villages throughout the country to warn farmers of the approach of a storm. This idea our Irishman had improved upon, and he claimed that his signal could be heard around a radius of twenty-five miles from his machine. The device was economical, simple, supplied a want long felt, etc., etc., the usual formula. He worried the Committee of the House on commerce to procure him an appropriation—a hundred thousand dollars or so—but persistently refused to tell what his invention was. He "didn't propose to let his secret out and be robbed, but wanted the appropriation first." Finally he consented to allow the Light House Board to investigate the matter.

It was discovered that the device consisted in a huge funnel with the little part down and the big part up. The little part was to be fitted with a whistling apparatus and arranged upon a framework at some distance from the ground. When the telegraph should bring intelligence of a coming storm, an immense plug, hanging above the funnel, was to be loosened, when it would descend with great rapidity—pile driver fashion—into the funnel, forcing the air into and through the lower small part of the machine and thus produce a sound of stupendous volume which would be audible for twenty-five miles. The Board heartlessly reported against the invention, and the inventor was last heard of endeavoring to convince the public that the examiners had been bribed by an envious rival.

THE IGNITION OF COMBUSTIBLES BY OVERHEATED STEAM.

To the Editor of the Scientific American:

From time to time, I read communications in your journal which lead me to believe that you are not now as sure as you were that the theories I have heretofore advanced in relation to the title subject of this letter are "absurd." I now have the satisfaction to be able to forward to you an extract from the log of the United States steamer, Alaska, which I have been able to obtain by favor of the Secretary of the Navy, Hon. Geo. M. Robeson, giving an official account of a fire which occurred on that vessel on January 19, 1870, a more full account of which was published in the New York *Sun* soon after; to which account I have frequently referred in the discussions which have taken place before the Polytechnic Club of the American Institute, and I forward this to you at the earliest opportunity, in response to the oral demands you have frequently made on me for facts:

"January 19, 1870. 4 to 8 A. M. Fires very low. At 7.50 discovered that the felting over No. 2—forward starboard—boiler was on fire. Led a stream of water to the same, and sent word to the officer of the deck. (Signed)
EDWARDS FARMER, 1st Assistant Engineer.

"From 8 A. M., to Meridian. Felting found to be on fire on forward starboard boiler; was not fully extinguished till 11 A. M. Hauled fires in forward starboard boiler at 9 A. M., and in all the others at 11 A. M. Stopped engines at 9.20 A. M. (Signed) JAS. P. SPRAGUE,
1st Assistant Engineer."

The log further shows that, next day, when the lead plates were removed, it was found that the felting on all the boilers was charred, although the worst charring was found on boiler No. 2. It seems impossible to believe that the felting on any of these boilers, securely encased in sheet lead, was to any degree saturated with oil, and consequently your ingenious hypothesis of spontaneous combustion is not admissible in this case. NORMAN WIARD.

Washington, D. C., March 15, 1873.

REMARKS.—The theory held by Mr. Wiard is that a prolific cause of fires is the superheating of steam in boilers and steam pipes—such superheating being occasioned by low fires. For example, at night, when fires are hauled, and the circulation of steam rendered *nil*, Mr. Wiard thinks that the small quantity of steam in the boilers, above the water, and lack of circulation promote superheating, and that the upper part of the boiler and adjacent steam pipes become so hot as to readily ignite wood work or other combustibles.

We have had occasion to point out to Mr. Wiard the extreme difficulty of heating up steam to the igniting temperature, nearly 900° Fahr., under any circumstances; and have expressed the opinion that it was almost impracticable to do so, in ordinary steam boilers, with banked fires, as he claims. This is the nub of our difference with our correspondent, for whom, personally, we entertain the highest respect. In most of the examples of mysterious combustion, where steam boilers and pipes were used, it has appeared on careful examination that the fire was probably due to spontaneous ignition, or escape of gas from furnace doors, not to superheated steam. Mr. Wiard has claimed to possess positive personal knowledge of many examples of fires caused by the overheating of steam as he alleges. We have invariably requested him to give us names and places, in order that we might personally verify the facts, and by their publication in the SCIENTIFIC AMERICAN enable engineers and owners to take warning. But although our correspondent has frequently promised to furnish the necessary data he has never, until now, done so except on one occasion, when he gave us an address in this city, where he said we might call and learn the facts of a case of superheated steam ignition, provided we would agree not to publish the matter. The reason assigned for withholding publication was that the owners were afraid that the insurance companies would refuse to take risks on the property. We declined to investigate unless we were permitted to publish the facts.

Mr. Wiard then assured us that the Fire Marshal in this city was in possession of facts pertaining to many examples of fires occurring here, caused by superheated steam, to which we might have access at any time for publication. We at once applied to the Fire Marshal, but were unable to ascertain that he was in possession of information in a single case, where fire could be traced to superheated steam.

We have heard nothing more from Mr. Wiard until now, and here he gives us the latest proofs of his pet theory. But to our minds they are not convincing. We understand from this report that, at the time of the fire, the engines of the vessel were in motion, and the fires low, which indicates the circulation of steam at a low temperature, and forbids the supposition of superheating.

Mr. Wiard thinks it impossible to believe that oil could have been present in the felting, thus causing spontaneous combustion. But he gives no reason why such a belief is impossible. We have published examples of the spontaneous ignition of clean cotton fibers, without oil, under the favoring influences of a gentle heat. We recently published a report of the engineer of the Providence Water Works, giving an account of the ignition of the engine felting and wood covering at that establishment, on the occasion of an increase in the boiler pressure, and the consequent increase of the steam heat. He made no mention of the presence of oil. But a subsequent report, by another engineer, stated that the felting and wood were both saturated with oil, and that the fire was the result of spontaneous combustion. What we need in all such cases is to know all the facts, and then an intelligent conclusion may probably be reached.

A NEW MITRAILLEUSE.

Interesting trials have quite recently been made at the Holske Machine Works, No. 279 Cherry street in this city, of a new mitrailleuse invented by Mr. J. P. Taylor, of Tennessee. The experimental gun, the first constructed, was built at the above establishment and possesses a number of entirely novel features, well calculated to make it a very formidable weapon. It has twenty-four barrels, which by simply turning a crank may be discharged *en fusillade* or all at once. The loading mechanism is especially ingenious and consists in a magazine of cartridges, placed in rear of the gun, from which four rotating chambers, are fed in succession. The contents of each chamber, as it comes even with the ends of the barrels, are discharged in turn until the reservoir is exhausted, when a new and filled receptacle may be quickly substituted: 700 rounds per minute can be fired by fusillade or 1,000 in broadside. The machinery is simple and so arranged as to be well protected from the effects of shot striking it. The gun, which is exciting no small degree of interest in military circles, is at the present time undergoing a series of careful tests, the results of which, together with a full description and engraving of the piece, will shortly be published in the SCENTIFIC AMERICAN. The workmanship displayed in the production of this first specimen of the arm is excellent, and reflects the highest credit upon the Holske Machine Company.

Death of Charles Knight.

Charles Knight, the celebrated editor and publisher of illustrated works, of London, died recently in the 82d year of his age. His various publications of useful information are known throughout the world. Among them are the "Library of Entertaining Knowledge," "Family Library," "Penny Magazine," "Penny Cyclopædia," History of the People," etc.

The Laundry.

A correspondent, J. D. K., points out the mistake made by many housekeepers in using only warm water in washing clothes, under the idea that too great heat sets the dirt. He asserts that half the labor of rubbing may be saved by using a high degree of heat, and for this treatment, a washing machine of some sort is absolutely necessary; and deprecates the use of chemicals as destructive to the fabrics.

M. BOILLOT announces that, by causing the electric current to pass through a vessel containing a mixture of sulphur vapor and oxygen, that he has determined the combination and made the synthesis of sulphuric acid.

THE perihelion of Venus, that is, the moment in its revolution when the planet is nearest the sun, took place on the 7th of last month. Its distance from the sun was then 65,338,824 miles.

TELEGRAPH POLES.

In India, Central Asia and Australia, where great telegraph lines have been erected, iron poles have been especially made, which have answered all constructional requirements and which have since proved to be the most economical means of carrying wires above ground.

On the application of iron to this purpose, Major Webber lately read a paper before the Society of Telegraph Engineers in England, in which he adverted to the different forms of metal poles proposed. Some are constructed like railway signal posts, others like split tapered tubes, telescopes, lattice and ribbons. Others again have been made of multiple iron bars of T and H sections or of cast and wrought iron tapered tubes, connected by socket joints. As a general rule no one design is applicable to all situations, for on ordinary roads the mathematical curves of a railway are not met with, but in their stead, every abrupt angular change or tortuous winding. The poles should be strong enough to carry the weight of the wire at the requisite hight from the ground without bending, and rigid enough to resist the pressure of wind. When placed in the ground straight, they will require no side support, but when at an angle, they will hardly resist the lateral strain due to the wires. A wooden pole, unless placed so as to partially convert strain into thrust, cannot long resist strain with the resistance furnished by the ground alone. The difficulty lies, not in making a pole with the necessary strength, but in obtaining a sufficiently unyielding mass to hold it upright against the horizontal strains to which it is subjected.

Lieutenant Jekyll, R. E., having analysed the forces to which poles are subject, considers a stay superior to a strut in affording support. Where stays or struts cannot be fixed at the same hight as the wire, it is better to attach them above than below it. An iron loop at the arm bolt would form a good means for the attachment of a stay; the loop should be put on inside the arm and be galvanized. The defects of struts are sometimes remedied by anchoring or foot-staying the pole and by bracing the pole and strut together in the middle with twisted wire; though even this precaution does not prevent the top from bending.

When local circumstances preclude the use of either stays or struts, trussing may be employed with advantage. The pole for this purpose is supported horizontally by a crutch at each end, in which position it sags slightly in the middle. A block of wood about two feet in length and the same thickness as the pole, is halved into and spiked to the butt of the pole at right angles to its length. A spur about 1 foot in length is fixed on the side of the pole, half way between the ground line and the top. An ordinary stay rod is grooved into the side of the butt and passed through the block at the bottom, and an iron loop is attached to the bolt of the top arm. A twisted wire stay is then made between the loop at the top and the eye of the stay rod at the bottom, which, when tightly secured, is stretched over the spur as a bow is drawn. It will then be found to be quite tight and to impart a slight bend to the pole, which can be further increased if required by screwing up the nut at the end of the stay rod. The block at the bottom may be bolted side by side to the pole, and a four-armed spur is recommended. The truss wire must be placed on the same vertical plane with the resultant of the wire strains. The ground, and especially near the foot, where blocks should be used, must furnish the necessary support. In cases of withstanding exceptional pressures, double or A poles are sometimes used.

Mr. W. Siemens considers that in the employment of iron poles a buckled wrought iron foot plate is of advantage, as affording a much firmer foundation. The portion of the post which is partly buried in the ground and therefore exposed to the simultaneous action of moisture and air, is made of cast iron and is of tubular form. This tube is fastened to the buckled plate by means of four bolts, and is provided at its upper end with a suitable pocket to receive the upper tube, which is made of wrought iron. The shape is approximately parabolic. The tubes are cemented with a mixture of sulphur and oxide of iron. 180,000 poles, thus arranged, have been erected by the Messrs. Siemens in South America, with satisfactory results. They are not as cheap as wooden poles in the first outlay, but are of course not subject to dry rot.

Continuous Railway Brakes.

Mr. W. H. Fox, C. E., recently read a paper on the above topic before the English Society of Engineers. His conclusions are that every engine and carriage should be fitted with brake apparatus capable of reducing it from a speed of sixty miles per hour to a state of rest in a distance not exceeding 220 yards on a level, in ordinary weather; that a retarding force of 18 per cent of the weight of the train is sufficient to do this; that cast iron is generally more suitable than wood as a material for brake blocks; and that experiment shows that a pressure of 2¼ tuns is required to be applied to the cast iron blocks fitted to each of the four wheels of a carriage weighing 10 tons, and 1·8 tuns if wooden blocks be used in like manner. The author considers that the atmospheric brake complies with nearly all the conditions necessary to be fulfilled by a perfect continuous brake.

MAPLE SUGAR as an article of merchandise is in a fair way of extinction. The maple forests of New England are being yearly cut down and converted into broom handles. Thousands of splendid trees, monarchs of the woods, which have for a generation yielded full quotas of sweet sap, are annually felled. At the present rate of destruction, maple sugar and maple broom handles will, before long, be unknown in trade.

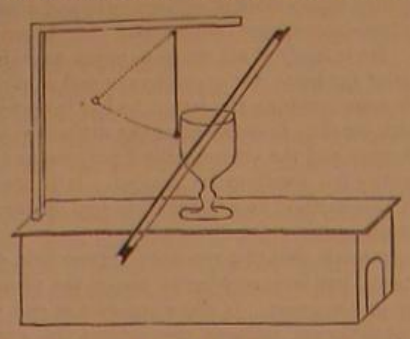
SOUND AND HEARING.

Professor Louis Elsberg, of the Medical Department of the University of the city of New York, lately delivered a lecture at the Cooper Union in this city, which is reported in the *New York Tribune* as follows:

The speaker said that sound was vibratory motion of matter, appreciated by the hearing organ. This fact could be illustrated in an endless variety of ways.

SOUND VIBRATIONS.

In the experiment which he introduced at this point a violin bow was draw across the the rim of a tumbler firmly



fixed in a support. A sound was produced, and a wooden ball suspended at the side of the tumbler was thrown to a distance. This showed that vibration of particles of matter, taking place a certain number of times within a certain time, produced sound. To become sound, vibration must take place at least 16 times per second. We can cause a sounding tuning fork, he said, to write the history of its motion by its own autograph, or its phonautograph, as it is called.

SOUND WRITING.

In this experiment, a tuning fork with a thin piece of sounding brass attached was struck, and then drawn over a

piece of blackened paper. A waving line appeared on the paper where the thin brass had scraped off the lampblack. By noting the time we take to write, said the lecturer, we may determine the number of vibrations of the particular sound. In this case you would find 48 points made in one quarter of a second, hence the sound of the tuning fork is G of 192 vibrations in a second. The speaker then went on to show that the forces—sound, heat, light, and electricity—were all the result of vibrations, and could be converted one into another. The difference between noise and sound was declared to be that, while the latter was the result of regular, the former was produced by irregular vibrations.

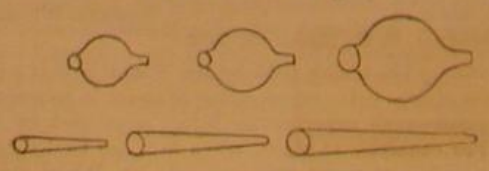
I have stated the limits of audible sound to be the rates of vibration of 16 and 38,000 in a second, which embrace more than 11 octaves, but those of effective musical sounds are much less. The clangs used in music are almost never lower than 32 vibrations in a second (the lowest C on the pianoforte), thus comprising seven octaves.

THE SIREN.

Essentially, every siren consists of a rotating perforated disk, against one or more points of which a current of air impinges. Whenever the air strikes a hole it passes through with a puff, and when the puffs follow each other in sufficiently quick succession they combine, just as any other vibrations, to form a sound of low or higher pitch according to their frequency. When the rate of revolution and the number of perforations of the disk are known, the rate of vibration of the sound produced becomes known.

HELMHOLTZ'S RESONATOR.

Helmholtz has invented a method of analyzing a sound, namely, by means of so called "resonators." These are hollow bodies, one end of which is placed into the ear;



they are so easy of application that any one can make use of them. If properly attuned, they at once reveal the presence of their particular tone, if contained in the sound or sounds under examination. By their employment we can demonstrate, beyond cavil or doubt, that every sound as it generally occurs in nature, as it is produced by most of our musical instruments or the human voice, is not a simple, single sound, but a compound or composite one, composed—aside from a usual admixture of noises—of a number of tones of different intensity and pitch, all of which different tones combined are heard as one.

THE HEARING APPARATUS.

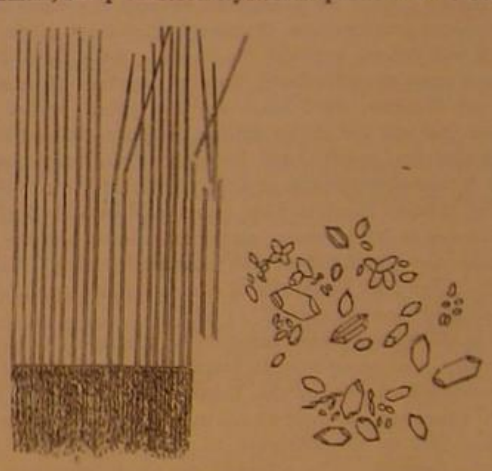
The ear is divided into three divisions, outer ear, middle ear, and inner ear. The outer ear consists of the projecting portion on the side of the head, and the external auditory canal. This canal ends blindly, being entirely closed by the membrane of the drum, or the external drumhead. This drumhead, also called *tympanic membrane*, or membrane of the tympanum, forms the partition wall between the external and the middle ear.

The middle ear is called the tympanum, the Latin word for drum. Like every other drum, that of our ear contains air, and has, also, a vent hole, or, rather, a long narrow tube running to the posterior part of the nose and throat, the—Eustachian tube, named after Eustachius, the physician who discovered and first described it—by which communication is established between the air of the middle ear and the air of the atmosphere entering the nose and mouth. The other walls of the drum are bony; and across the cavity there extends a chain of three little bones, the hammer, anvil, and stirrup, respectively so called from their shape; the hammer being imbedded in the outer, and the stirrup planted against the inner, drumhead.

The internal ear is the most complicated part of the hearing organ. It is a closed cavity, containing watery liquid, a space of such intricacy that it has received the name "labyrinth." It is situated in the hardest portion of all the bones in the body, in the stony portion of the temple bone; and it is here where the terminal expansions of the nerve of hearing are. In the water swims the membranous labyrinth, a closed bag of delicate elastic tissue, also containing water, and having the same shape exactly as the bony portion of the labyrinth in which it swims, but which it no where touches. In this membranous labyrinth, a branch of the auditory nerve is spread out.

OTOLITHS AND FIBERS OF MEMBRANA BASILARIS.

The auditory nerve consists of several thousand microscopically fine threads of nervous fiber, held together by connective tissue, and has its origin in that part of the brain called the *medulla oblongata*, which is just at the top of the spinal marrow. It passes through this, the internal auditory canal of the skull, and before entering the labyrinth divides in to two branches, of which one goes to the vestibule and one to the *cochlea*. The vestibular nerve sends two bundles of filaments into the vestibule, where numerous very small, sharp cornered crystalline particles of carbonate



of lime, the so called otoliths or stones of the ear, are situated adjacent to the nerve threads; and, also, a bundle of filaments to one end of each semicircular canal, where between the terminal nerve threads a large number of exceedingly fine, sharp pointed elastic bristles grow up.

Waves of sound emanating from a sonorous body and propagated through the air are caught up by the outer ear and strike the outer membrane of the drum. Through the series of bones, the vibrations are transmitted and concentrated on the oval membrane, or inner membrane of the drum. Each movement of the oval membrane is transferred to the water of the labyrinth, and this transmits it to the membranous labyrinth and *ductus cochlearis*, where the nerve terminations are spread out. The greater the intensity of sound, the greater will be the extent or width of the vibrations received by the outer drumhead and finally transmitted to the nerve; the longer in duration the sound, the longer will be continued the vibrations conveyed to the nerve; we are therefore able to become conscious of degrees of loudness and durations of sounds. A noise, that is, non-periodic vibrations, excite the vestibular nerve; if evanescent, they are accepted and prolonged by the otoliths, which vibrating mechanically excite the adjacent nerve filaments; if continuous they are taken up by covibration of the bristles and thus conveyed to the nerve. Just as the untouched tuning fork or piano string is thrown into covibration in sympathy with a sound of the precise pitch to which it is attuned, so each of the microscopical fibers in the *cochlea*, being attuned to particular pitch, responds by sympathetic vibrations to the vibrations emanating from a corresponding tone and from that tone only.

"Within the ears of men and without their knowledge and contrivance" this harp of many thousand strings "has existed for ages, accepting the music of the outer world and rendering it fit for reception by the brain." For the motion mechanically excited in the nerve substance of either the vestibular or *cochlear* nerve is conveyed along the nerve fiber (probably somewhat as electricity is conveyed along a wire) to the brain; and here the physical effect of the motion—nerve excitation—is mysteriously transmuted into the physical or intellectual state of perception—consciousness of sound.

Visit to a Saw Manufactory.

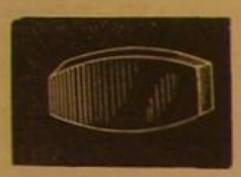
To the inexperienced observer a wood saw is merely a notched steel plate, of no particular character or design, and least of all does it occur to him that it requires any special knowledge or skill to make one. This impression would be speedily dispelled if he visited a workshop where such tools are made; he would then discover that no amount of labor is too great, research or study too severe, to be expended in improving and advancing the character of this simple implement. We recently went through Disston & Son's saw factory, employing one thousand men. It is said to be the largest of its kind in the country, and the various processes there witnessed were so interesting that we propose detailing them to some extent, so that our readers will have clear ideas of the amount of labor necessary to produce a saw.

In this factory all the processes are carried on, from the raw material to the perfect tool. The steel is melted and cast into ingots. Sheets are rolled therefrom, and all the various operations necessary and requisite to fit it for its duty are performed; so that, when it is finally pronounced good by the inspector, it is ready to go to the hands of the mechanic.

THE STEEL.

Saw blades cannot be too good; the various operations they have to pass through "punishes" the steel so much, so to speak, that unless it is entirely uniform in quality and homogeneous throughout, it will never be satisfactory, or do good service; therefore in this concern the proprietors make their own, so that they can be sure of its quality.

The process of making steel is so well known in general to our readers that we will merely say it is here melted in crucibles as in all other steel works, and rolled into sheets subsequently. The ingots for cross cut saws are of peculiar shape, however, like the sketch, and after being cast are subjected to a thorough forging under heavy hammers to render them tough and uniform throughout. Circular saws are also formed from ingots varying in weight from ordinary sizes up to 300 pounds. These are forged out under very heavy steam hammers, and subsequently reduced to the proper thickness by rolling in the ordinary way. After being rolled, they are laid out and brought to the proper size and then straightened into perfectly flat disks. This straightening is an art, or a branch of the art, peculiar to itself, as any inexperienced person can readily discover by undertaking to straighten, or "take the buckle out," of a piece of sheet metal. He will straighten one edge and make the other crooked, or the center will bulge out; in short, all his labor comes to nought, for the more he hammers it injudiciously the more mischief he does, and he will acknowledge that there is skill and judgment required for so apparently simple an act as straightening a saw plate.



Toothing the saw, in the case of the circular and larger blades, is done under a hand press by punching them in an obvious manner; but with the ordinary carpenters' saws, and those for wood sawing, the teeth are cut in a machine with extreme rapidity. They are fed through in front of a rapidly revolving cutter, at a certain speed, which nicks out one tooth at every revolution, so that the rapidity with which the teeth are made is marvelous to the uninitiated. The attendant stated that the average rate was about twelve saws per minute.

TEMPERING AND OTHER PROCESSES.

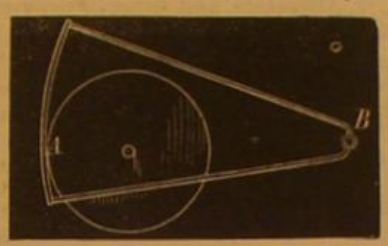
When the saw blades have been passed through the necessary processes previously, they are tempered, ground and polished. The hardening is done by plunging the heated plates into oil baths. The tempering is quite a different and distinct operation, and one extremely interesting in all respects. The thin plates leave the oil baths at a vitreous hardness, glass hard in fact, so that when struck over an anvil they will fly into fragments. This quality has to be taken from them and the requisite elasticity and toughness imparted instead.

Further, when the blades come out of the oil baths wherein they are hardened, they are more or less buckled or crooked, some of them much more than less, and any one but an expert would say that the material was spoiled; but this defect is soon remedied. The hardened plates are removed to a burning fiery furnace quite as uncomfortable as the one of old wherein Shadrach and his brethren tarried awhile. In this furnace there is a cast iron disk made perfectly true on its upper face and supported by a vertical shaft. This shaft is capable of being raised and lowered with the die by a hydraulic ram beneath. Over this die is another—the two constituting a pair of highly heated platens, or hot press. When the die is hot enough, the previously hardened saw blades are placed on it, a dozen or so at a time, and the two are brought together with a force of six tuns, which has the effect not only of drawing the temper of the blades to a proper degree of toughness, but also of taking out all the warp and curl, so that they are to the uninitiated observer "good enough;" they are not good enough for the critical workmen, however, who show you that, although apparently correct and true, they are still far from perfect.

The plates leave the hot dies of a dull dead black, and have to be polished and otherwise brought to a better finish. The polishing is done with emery, in machines or rubbers with a reciprocating motion which imparts that fine straight grain observable in the blades. This operation also has the effect of taking the spring out of the blades, so that, if bent or twisted by accident in using them, a permanent injury would result. They are therefore put through another process, which is merely heating them, in an oven, to a straw color. This restores all the stiffness lost in polishing and handling them after they were tempered. The color put on them in the oven is removed by washing them with acid. After this they are immersed in an alkali to destroy the effects of the acid, dried in sawdust and handed over to the handlers.

These are briefly and superficially the processes which the ordinary hand saw goes through before it is ready to use. We have not attempted to describe them in detail, as it would occupy too much space. The actual routine is as follows: The blade taken in the ingot of steel is first rolled into sheets, trimmed into shape, toothed, filed, hardened, tempered, straightened, ground, hammered, drawn, polished, blocked, rubbed, set, stiffened, sharpened, handled, inspected and sold: nineteen separate and distinct operations, requiring care and experience before it comes to be handled. We may say here what we omitted to say previously, that the temper imparted in the factory under notice is simply exquisite. The old "Toledo blades," so much vaunted, may no longer be held up as models of excellence in this respect. "As fine as an American saw" must hereafter be the standard of comparison. A thin steel ribbon, like a sword blade, may indeed touch heel and point and be nothing extraordinary after all; but when it comes to a saw blade only thirty inches long and an average of five inches in width, to temper this so that it will touch heel and point is indeed a feat worthy of notice. Not a feat, for that implies something out of the common; whereas in these saws the boys took any one of them indiscriminately and drew the foot across the blade, bending it heel to point, and exhibiting it after this severe strain without a curve or a crook in it.

Circular saws are ground as they are used in the mill. They are suspended vertically and ground on both sides at once, the other processes they pass through being identical with those previously described. Mill and cross cut saws are ground on a curious looking apparatus which is in fact a quadrant. The saw is held on the arc of the quadrant, as at



A, which receives a vibratory motion on its axis, B, by suitable mechanism, and the stone revolves against it, having, in addition, a sidewise motion imparted, so that it travels across the face of the saw, making it wholly equal in all parts.

The handles are made of domestic woods, chiefly beech and apple, and are first sawn out on a belt saw and afterwards rounded, rasped, and bored in a manner that will be readily comprehended by most workmen. There is nothing in this department worthy of special comment.

About twelve thousand dozen saws, chiefly hand saws, are made in this establishment per week. This vast quantity goes all over the United States and elsewhere. We were not told at the factory that English goods had been driven out of the market by the American manufacturers, but we were so informed elsewhere. And we can readily believe that, if one saw factory makes twelve thousand dozen per week, to say nothing of a number of others in the business in this country, the demand is enormous.

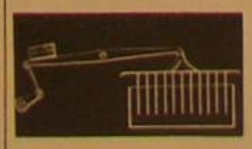
A useful suggestion for a book mark: A piece of card should have two cuts, meeting at an angle thus:

It should be inserted at the fore edge of the book, and will then be thus: and will point to the place desired to be marked.

A Rapid Evaporator.

S. suggests, for rapid evaporation at a low temperature, an arrangement using the principle of the bellows for displacing the air charged with vapor.

A pan (a large shallow one is preferable) with a cover suspended from a horizontal lever, the lever moving vertically on a pivot at or near the center, is to be arranged with the other end of the lever weighted to counterbalance the cover and the blades. The blades are flat pieces of board or metal, as near together as may be desired, attached to the cover along its whole length and breadth and hanging from it, side by side, extending to the bottom of the pan when the cover is down; when the cover is lifted up, they are lifted with it, covered with the fluid; at the same time, the air is drawn in to fill the spaces and is expelled again, as the cover descends, charged with vapor, which, being heated, rises outside, giving fresh air. The lever, worked with a crank, requires little power on account of the weight which counterpoises the cover and blades.



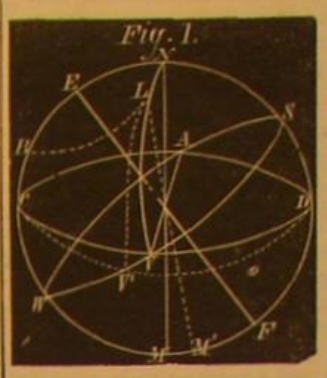
THE crude ammonia salts resulting from the purification of coal gas are frequently found to contain sulphocyanates which render them unfit for manure. In some cases the amount of sulphocyanate of ammonia present was sufficient to destroy the crops where it was applied

Correspondence.

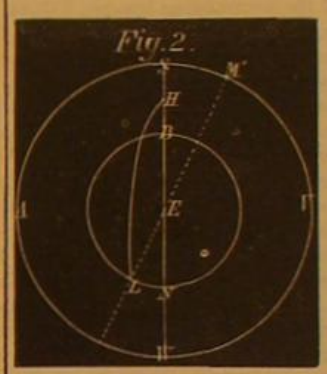
Retrograde or Direct Motion of the Sun.

To the Editor of the Scientific American:

After carefully perusing the article, under this title, in your issue of March 15, I come to the conclusion that your correspondent is wrong in some of his views. He has confounded the effects of precession on the duration of the seasons, with that on the apparent motion of the stars. I will try to make the difference apparent. Let the circle, V S A W, represent the ecliptic whose poles are E, F, and the circle, C V D A, the equinoxes whose poles are N and M; then the circle, N D M C, will represent a solstitial colure. If we suppose that the sun's apparent path, starting from V, is toward S, then V will represent the vernal and A the autumnal equinox. V is continually advancing toward W, a direction opposite to that of the sun, at a rate equal to an angle of 50·1″ (subtended from the center of our figure) per year, causing the sun to reach the equinox 20′ 19·9″ sooner than it would if the equinox had remained stationary. The tropical year is thus made shorter than the sidereal by 1 in 25868.26 +; and were our civil year dependent on a complete revolution around the sun, instead of the return to the vernal equinox, the seasons would go the whole round of the year in 25,868 years. This is the effect that precession has on the duration of the seasons. But when V has reached V′, N will have arrived at L, travelling toward B, completing the circle in the same length of time.



Now in Fig. 2, suppose E to be the pole of the ecliptic, N the pole of the equinoctial, and H a star anywhere outside the circle, N L B. A meridian of the earth, at N, would come under the star again after one complete rotation of the earth on its axis, if N were at rest; but when N arrives at L, the solstitial colure will have taken up the direction L M′, so that a meridian of the earth, again coming to it, will be beyond the star at H. As time accumulates, this difference will increase until, the pole, N, having made a complete revolution around the center, E, the star H will have failed to come to the meridian once, thus losing one day in 25,868 years. This latter is the effect of precession on the apparent motion of the stars.



The retrograde motion of the equinoxes is real, and does not necessarily involve the idea of a direct or other motion of the sun, as your correspondent claims. In reality that luminary is nearly stationary as regards the earth. Indeed a motion of the sun from perturbation or any other cause could not take place without sharing such motion with our planet, because, the earth being held in place with respect to the sun by force of gravitation, this force would exert the same influence whatever position the sun took up. C. H. B.

St. Elie, Canada.

The Atmosphere and the Milky Way.

To the Editor of the Scientific American:

Perhaps the following remarks, on the possibly new question of the effect of the atmosphere in causing the apparent course of the Milky Way to vary, may be of some service to science, and particularly in the branch of meteorology. First let me draw attention to what the late Dr. Dick says with reference to the course of this grand nebula in the heavens. In his "Celestial Scenery," he observes that "about the middle of August at nine o'clock in the evening, it may be seen stretching in an oblique direction over the heavens, from northeast to southwest; and its apparent motion along the heavens may be traced with that of the other constellations. At other seasons of the year and at other hours of the night, its position will appear somewhat different." During the winter season of 1871–2, distinguished as it was by great atmospheric disturbance and snowy vaporous charged air, during many days, (from the month of December, 1871, through January and February, 1872) I did not fail to remark that the S. W. end of this great nebula had moved in the arc from S. W. to W., thence to N. W., until finally, in the first week in March, it pointed nearly north, and the other part, nearly south; in other words, this nebula laid apparently across the heavens from north to south. Further, the northern end assumed, in March, a decided sharply defined and brilliant aspect. The apex of the arch was very much bent to the west; and there followed (whether by coincidence or otherwise is the question) a succession of northern and easterly winds both before and after the great gale of March 18, when the barometer was down to 27·90. Sailors regard (and rightly I believe) the dimness or brightness of the southwest branch of the Milky Way as an indication of the quarter whence wind is coming, so the remarkable phenomenon is that the nebula becomes a celestial barometer. This year

the Milky Way is apparently pursuing the same course, laying by last observation about north and south; but it is more dim and milder in appearance than it was last year, and the weather has followed these indications.

May I suggest that, as the atmosphere is more disturbed, a disturbing effect appears on the apparent course of the Milky Way? We know that water will cause an oar or stick put into it to appear as if broken; so that it may be that the atmosphere laden with aqueous and snowy matter, in suspension but not always positively visible, will exert a like effect. The question is an interesting one.

DELTA.

Halifax, Newfoundland.

A Test for Phrenology.

To the Editor of the Scientific American:

Scientific tests are now all the rage, and are applied to a locomotive boiler as well as to a plowman's prayer; I therefore venture to lay before you a test for phrenology, which I believe to be both novel and scientific. Its infallibility rests on the fact that the brain of man, as well as his body gives off more heat when in a state of activity than when in a state of rest; and that this surplus heat can, and has been, measured in both instances by means of the thermo-electric multiplier. The *modus operandi* is as follows: you get a subject, or a patient, or what is better, a person who is willing to be both, and set him to read a novel, or to do some light work, such as shelling peas, etc., which requires no thought or exercise of brain power. You then apply a delicate thermo-electric pile (which is connected with a multiplier) to one or more of his bumps (having previously seen that there is no local inflammation of the parts). You then carefully note the degree of heat shown on the multiplier in each instance (say of the bumps of imitation and constructiveness). This being done, you set the subject to copy a drawing or some writing, and again apply the electric pile to the bump of imitation. Now if the instrument shows an excess of heat above that noticed in the first instance, or even if it shows any excess of heat, in the particular spot known as the bump of imitation, above that of the surrounding bumps: I think, sir, that we may conclude that phrenology is not altogether a farce, and that the bump in question is the seat of the greatest activity in the brain during the action of imitation. We can also try the bumps of constructiveness and amativeness by setting the subject to write a love letter or the bumps of veneration and calculation by setting him to say his prayers and add up a row of figures. If you think there is any difficulty in getting the subject to be patient and tractable under the test, I advise that he be mesmerized before proceeding. I have not tried the experiment myself, but I think that some of your scientific readers may be induced to pursue the investigation, the results of which, I feel confident, would be interesting, not only to the readers of the SCIENTIFIC AMERICAN, but to the world at large.

G. D.

San Francisco, Cal.

Ignition by Steam Pipes.

To the Editor of the Scientific American:

I understand the question at present under discussion to be whether pipes containing saturated steam can ignite wood, and not, as E. R. Dingley in your last issue puts it, will superheated steam fire inflammable substances.

He says that he ascertained by the indicator that (as might have been supposed) his Howard sectional boiler was working over water, and he therefore attached a superheater, with which he succeeded in setting the building on fire. Nothing could be more natural than this, for common prudence would have suggested covering the pipes with non-conducting cement and removing all wood work at least 2 inches, by which precautions perfect safety would have been insured. M. M., of Franklin, Mass., (in the same issue) also falls into error in supposing that he was using saturated steam, when, in fact, his upright tubular boiler might (especially when the outflow of steam was partially checked) superheat the steam enough to ignite thoroughly dried or charred wood. Superheated steam is highly economical and advantageous, as is proved by its extensive use in many branches of manufacture. Like other heated substances it must not be taken where it may do damage; but the adoption of the safeguards before mentioned render its use perfectly safe and easy.

In my own practice, and after careful inquiry, I have failed to obtain an authenticated instance of wood burned by saturated steam as ordinarily used, its only effect being to render the wood dry and more liable to ignition by a spark.

HENRY W. BULKLEY.

New York city.

To the Editor of the Scientific American:

I have read two articles in your paper relating to ignition of wood by steam heat. I have used steam for years to dry gunpowder; our dry house is arranged with four lines of pipes running upon three sides. The powder is placed in trays, which are set one upon another, reaching from six inches from the floor to the ceiling. It cannot be moved when dry without dust, which arises and of course settles upon the pipes. We have no knowledge of an accident ever occurring from ignition in fact, powder has been often placed upon steam pipes in our engine room (when the pipes were the hottest) to test it. There is not heat enough to explode it.

SUPERINTENDENT MIAMI POWDER COMPANY.

Xenia, O., March 14, 1873.

Quartz Mining in California.

To the Editor of the Scientific American:

The quartz ledges or veins of California are from 1 inch to inches in width, some of the wide veins being very rich, producing quartz that will yield fifty dollars per tun. In the stamp mill process, if water power is employed for pumping, hoisting and milling, quartz that will yield three dollars per tun will pay expenses; quartz that will pay ten dollars per tun is considered good rock, and, if mined and milled with economy, will pay a dividend to the stockholders. Quartz is mined in the same manner as lead and copper ores. A shaft is sunk in the ledge to any desired depth and drifts or levels are made at every 60 or 100 feet. Those levels are run, if the quartz will pay, to the boundary line of a claim. The quartz when hoisted to the surface is dumped in the mill house and broken into small pieces about the size of a man's fist. It is then fed into the mill which crushes the rock fine enough for it to pass through a screen of about one hundred holes to the square inch; water is fed into the mill with the rock, and, with the rock when crushed, finds its way through the screen. As soon as the water and quartz sand leave the screen, they pass over electro-silvered copper plates, which are about 13 inches wide and 25 feet long for every five stamps in the mill. These silvered plates are first cleaned with sulphuric acid and then coated with quicksilver; and as the water and quartz sand pass over the plates, the gold adheres to the quicksilver, and the sand and water run off into a concentrator, the office of which is to separate the quartz sand from such fine particles of gold as do not adhere to the plates, also to separate the base metals, if any. Quicksilver is fed into the mill with the quartz and water in quantities to suit the richness of the rock. The quicksilver and gold adhere to the silvered plates and are allowed to accumulate until a thickness of from one sixteenth to one quarter or one half inch is reached. The amalgam is taken off with pieces of hard rubber, and then retorted; after which the quicksilver can be used again, and the gold is ready for the mint.

GEORGE PHILLIPS.

Alleghany, Cal.

Alligator Dentistry.--Cement for Setting the Teeth of Alligators and Other Purposes.

To the Editor of the Scientific American:

Having accidentally used a cement which may be new and of value to some of your readers, it gives me pleasure to offer it in return for the many valuable hints I receive from your journal.

Being desirous to preserve as a curiosity the skull of an alligator of uncommon size, I found, to my regret, that, after boiling the flesh from the hideous thing, all the teeth dropped out. The only two substances at hand which seemed to be adapted to the purpose of resetting them were sulphur and beeswax. On trial, however, neither of them would answer. The sulphur was too brittle and the beeswax too soft. It then occurred to me to combine them, and the result was a cement admirably adapted to the purpose. I used half of each ingredient, but it may be made harder by using more sulphur, or softer by using more wax. After pouring the melted compound into the cavity and replacing the tooth, it became perfectly solid and fast in a few seconds, without cracking or shrinking.

It is a beautiful material for taking the impressions of medals, and can no doubt be used in the arts in many other ways. Judging from the ease with which it is cut with a knife, the substance, in proper proportions, can doubtless be turned in a lathe and polished.

The alligator was 14 feet long, the skull, 23 inches long and 13 inches across the jaws at the widest part.

WM. W. BLACKFORD.

Powhatan, La.

Construction of Dwellings.

To the Editor of the Scientific American:

I notice in your issue of March 22 a communication signed J. H. L., Cincinnati, O. From my experience I can say that the idea is a good one, if he will make one addition which is very simple.

In filling between the scantling, I place and nail fast at each end a piece of inch board, after having laid up about sixteen inches of bricks; bats or halves will do. These pieces may always be found about a new building, and the rougher they are, the better. The pieces should be nailed flush with the brick and scantling.

A. W. BOUCHARD.

Cincinnati, O.

To the Editor of the Scientific American:

On page 180 of your current volume, J. H. L. recommends his style of building for others to follow. Having had experience in building during the last thirty years, I would advise them not to do it, for the reason that the studding will shrink unequally with the filling-in, and cause the walls to crack where the wood and brick join. Let him fur out the studding half an inch and lath so that the key of the plaster joins the filling in. That will prevent the rats and mice getting in.

J. G. M.

Morrisania, N. Y.

Vermin in Grape Vines.

To the Editor of the Scientific American:

It is a common complaint in this city that grape vines are so infested with worms as to spoil the crops of most years. I was so troubled until last year, when I determined to rid myself of this pest.

I obtained from a cigar manufacturer two handfuls of tobacco stems, upon which I poured a quart of boiling water. When cool, I applied the liquid to the infected buds, young leaves and embryo fruit, copiously, by means of a syringe which I constructed of a piece of tin tube with a perforated end soldered to it, and a wooden rod packed with flannel and worsted to form a piston.

In consequence of the above treatment, I had an unprecedented crop of grapes last year, as was also the case with my neighbors who followed my advice, and I have no hesitation in recommending it as an infallible cure for worm in the vine.

ALEXANDER DOUGLASS.

The Bars at the Mouth of the Mississippi.

To the Editor of the Scientific American:

I suggest the following plan to get rid of the bars at the mouth of the Mississippi: 1. Let the bars take care of themselves. 2. From the nearest point of the river to deep water, run a broad ship canal to the Gulf, and provide it with a lock to prevent the river using it as its channel.

J. A. VRYDAGH.

Terre Haute, Ind.

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 months of December, 1872, and January, 1873:

During the months of December and January, there were 2,101 visits of inspection made, and 4,111 boilers examined—1,576 of these were carefully examined internally, and 322 were tested by hydraulic pressure. The number of defects in all discovered were 2,272, of which 515 were regarded as dangerous. These defects were as follows:

Furnaces out of shape, 128—37 dangerous; fractures, 233—120 dangerous; burned plates, 124—60 dangerous; blistered plates, 335—50 dangerous; accumulation of deposit, 492—43 dangerous; incrustation and scale, 470—38 dangerous; external corrosion, 128—12 dangerous; internal corrosion, 52—10 dangerous; internal grooving, 53—4 dangerous; water gages defective, 87—17 dangerous; blow-out defective, 61—13 dangerous; safety valves overloaded and out of order, 67—20 dangerous; pressure gages defective, 213—30 dangerous; boilers without gages, 55—9 dangerous; deficiency of water, 16—12 dangerous; broken braces and stays, 75—36 dangerous; boilers condemned, 31.

The defects enumerated above are such as are usually found in these reports. Boilers that are not carefully watched are liable to rapid deterioration. It must be remembered that boilers are under heavy pressures—that there is an internal force contending continually with the surrounding iron for the mastery. Irregularities and disturbances favor the internal force, and weaken the surrounding resistance. Hence it becomes of the utmost importance that the safeguards of the boiler be kept, as near as possible, in perfect condition.

The neglect to do this is often followed by serious consequences. A case has recently come under our notice, where an engineer (?) was running a boiler with the gage cocks entirely stopped by incrustation and corrosion. The water gage connections were filled up so as to render it worthless, and the safety valve was in a very dangerous condition. In another case, the safety valve was so near the timbers of the floor overhead that it could not lift. Numerous cases of broken and loose braces and stays have been found. In one case, when the boiler was working under a very heavy pressure, the front head was cracked (the stays being broken), and, at every revolution of the engine, it vibrated to the varying pressure. Blisters have been numerous, though in comparatively few cases dangerous; but some have been very bad indeed, and the thin leaf that resisted the internal pressure was saved only from its small area. Pressure gages have been found in very unsafe condition, their variations being from —57 to +13. The great variations have been found principally in iron works. The worst cases were as follows: —10, —15, 30, —35, —57. These, it will be seen, are all heavy. Hence the steam users were running a pressure, in excess of that indicated by their gages, corresponding to a pressure indicated by the addition of the above errors. Thus, we will suppose that a steam gage, indicating 80 lbs., upon being tested is found to be —57 lbs., or 57 lbs. heavy. It will be seen that the actual pressure would be 137 pounds, which doubtless would be beyond the limit of safety.

The comparatively numerous explosions of steam boilers in iron works and rolling mills, the past year, would seem to indicate that there was a great want of proper attention to the condition of boilers on the part of both proprietors and engineers.

We were recently called upon to test and correct a steam gage which was used on a boiler exposing many lives. The gage, upon examination, was pronounced worthless and condemned. Its variation at 20 lbs., 15 lbs. heavy, and the error increased as the pressure was increased. Upon investigation, it was ascertained that the boiler was in a very dangerous condition. It had been condemned by an inspector nearly a year previous, and yet had been kept at work at an indicated pressure of 60 lb.—or an actual pressure of between 80 and 90 pounds. We regard this a case of criminal carelessness.

Hydraulic Apparatus for Store Shutters.

A plan for closing store shutters by hydraulic power has recently been invented in France. The shutter, composed of horizontal iron laths, is suspended from below on two chains, one of which, after passing over a pulley, supports a piston moving in a hydraulic cylinder. By turning a cock, the water flows from under the piston, which, by its excess of weight, raises the shutter. When the reverse operation is performed, the cock is turned so as to admit the water in the lower part of the cylinder, the piston rises and the shutter falls.

THE first public library at Rome was founded in the year 167 B. C.

SCIENTIFIC AND PRACTICAL INFORMATION.

MINE VENTILATION.

Mr. G. L. Scott has placed a new plan for mine ventilation in successful use in Wales. The arrangement consists of a number of plain iron cylinders placed laterally to the upcast shaft, which is sealed, and applying a steam jet to each cylinder, on the plan of the injector.

A WATERFALL IN VENEZUELA.

Mr. Brown, the government surveyor in British Guiana, has recently discovered, near the head waters of the Massarund, what appeared to be an immense river descending bodily from the N. W. fall of the great precipice of Reraima mountain. The summit of this cliff is known to be 2,000 feet in hight, and the river, after tumbling sheer down that enormous wall, rushes over a glacis of about 3,000 feet at an angle of not less than 46°. According to the Indians, the fall belongs to the Caruni river, a tributary of the Orinoco, and is in the territory of Venezuela.

THE TEMPERATURE ABOVE THE CLOUDS.

M. Tissandier states that in a late balloon ascent from Paris he reached a hight of 6,560 feet above the earth, where, having passed through layers of clouds, he found a bright sunlit sky and a temperature of from 63° to 65° Fah. When descending and re-entering the clouds, which were in a highly electric state, the temperature decreased to 27°, and the balloon was surrounded by small crystals of ice.

A NEW AGENT FOR DESTRUCTION OF HAIR.

Professor Böttger states that sulphhydrate of sodium is now acknowledged as an agent destructive of hair. This sulphhydrate of sodium attacks the substance of the hair still more energetically than that discovered by him thirty-four years ago, the nauseous sulphhydrate of calcium with the odor of sulphuretted hydrogen. This new agent can be readily obtained in a very convenient form by rubbing together intimately 1 part by weight of crystallized sulphhydrate of sodium with 3 parts by weight of fine purified chalk (carbonate of lime) to a fine powder. By moistening this mixture, which keeps for an unlimited length of time in well closed glass vessels without suffering decomposition, with a few drops of water to a thick paste, and placing it in a layer of the thickness of a knife back upon a hide covered with hair, it will be seen that the thickest hair is changed within a few (two or three) minutes into a soft mass easily removed from the skin with water. By prolonged action the skin itself begins to corrode.

TESTS FOR FUSEL OIL.

A practical and reliable test for this extremely poisonous substance, which sometimes contaminates spirituous liquors, is so desirable that we are not surprised at the number of tests which have been proposed. The following are two of the principal ones: M. Bouvier proposes putting a few pieces of iodide of potassium in a long test tube containing alcohol, slightly shaking it. If the alcohol contains from ¼ to 1 per cent of fusel oil, a perceptibly light yellow color soon appears. Professor Böttger, however, showed that many specimens of alcohol which contained no fusel oil still gave this color reaction, owing to the presence of some acid, probably acetic, in the alcohol, which decomposes the iodide of potassium, setting free the iodine. Fusel oil alone, on the contrary, is not able to decompose iodide of potassium even when boiling. A far better test is permanganate of potash, which is much more readily decolorized by fusel oil than by ordinary alcohol.

BISULPHIDE OF CARBON IN ILLUMINATING GAS.

Harcourt has found that, on passing illuminating gas through a pipe heated to redness, the bisulphide of carbon combines with the hydrogen, forming sulphuretted hydrogen which is removed in the ordinary lime or iron gas purifiers. A sample of gas which contained 30 grains of sulphur in 100 cubic feet of gas was conducted through a tube heated red hot and then through a purifier charged with oxide of iron. On testing it afterwards, it was found that the amount of sulphur was reduced to 5 or 6 grains in 100 cubic feet. This method of purifying gas seems simple enough, but at present a practical method of performing it on a large scale is wanting.

NEW PROCESS IN STEEL MAKING.

MM. Bajault and Roche have devised a process of steel manufacture based on the partial decarbonization of the iron under the influence of a rich oxide of the metal. This method has been known for some time, but has not been put in practice on account of the deterioration it caused in the sides of the crucible. In the process of the above inventors, the iron and mineral are placed in metallic molds and brought to a red heat in special furnaces. The reaction is produced and the melting does not take place until after the transformation. Ingots are thus obtained, melted in crucibles or in a reverberating furnace.

ACETIC ACID BY SYNTHESIS.

M. Thénard placed in a glass receptacle a mixture of carbonic acid, CO^2, and proto-carburet of hydrogen, CH^2, through which the electric current from a Ruhmkorff coil was allowed to pass. Under the influence of the electricity, the absorption of the gases commenced almost immediately, became more and more marked and finally gave rise to a colorless liquid which could be none other than acetic acid, C^2O^2.

IS THE MOON INHABITED?—A correspondent, N., states his belief that, as man existed on the earth during the glacial period, it may be found that the moon, notwithstanding the intense cold, may be inhabited. He does not consider the fact that the satellite has no atmosphere, and no moisture to sustain vegetable and animal life.

Amateur Cooperage.

Putting a hoop on the family flour barrel is an operation that will hardly bear an encore. The woman generally attempts it before the man comes home to dinner. She sets the hoop on the end of the staves, takes a deliberate aim with the rolling pin, and then shutting both eyes brings the pin down with all the force of one arm, while the other instinctively shields her face. Then she makes a dive for the camphor and unbleached muslin, and when the man comes home she is sitting back of the stove thinking of St. Stephen and other martyrs, while a burnt dinner and the camphor are struggling heroically for the mastery. He says if she had kept her temper she wouldn't have got hurt. And he visits the barrel himself, and puts the hoop on very carefully and adjusts it so nicely to the top of every stave that only a few smart knocks apparently are needed to bring it down right, when he laughs to himself to think what a fuss his wife kicked up over a simple matter that only needed a little patience to adjust itself, and then he gets the hammer and fetches the hoop a sharp rap on the side, and the other side flies up and catches him on the bridge of the nose, fills his soul with wrath and his eyes with tears; and the next instant that barrel is flying across the room accompanied by the hammer, and another candidate for camphor and rag is enrolled in the great army that is unceasingly marching toward the grave.—*Danbury News.*

Longitudinal Rail Support.

Mr. Wm. S. Huntington, in the *Railroad Gazette*, gives the following plan of rail support: He says that a good arrangement is to lay cross sleepers in the ordinary manner (except with a little more care) and place thereon stringers or rail plates, say 8 by 12 inches and of any convenient length, but breaking joints with the rail. The cross ties and rail plates should be of sawn or very nicely hewn timber, to insure a perfect bearing of the plate on the cross tie. The most efficient manner of securing the plates to the sleepers would be to spike cast iron brackets to the sleepers and also to the plates. On very sharp curves it might be necessary to use shorter plates than on straight lines, in order to bring the rail in the center of the plate. With this arrangement it is considered that the sleepers could be entirely covered with ballast, which would render them more durable than when only partially covered. Most kinds of timber suitable for sleepers would remain sound more than twice the ordinary length of time. They would be relieved of the destroying influences of the weather and the rotting effect of contact with the rail. More perfect drainage would be secured, the rail would be held in line, and, if the ends of the plates were placed in contact, all creeping of the rails would be prevented.

Standard Car Journal Bearing and Key.

A committee appointed by the Master Car Builders' Association to determine the most suitable form and size of railway axles, oil boxes and journal bearings, in order that a uniform standard may be adopted, state that larger axles, longer and larger journals and larger oil boxes than are now in use are desirable. A large axle, it is considered, would tend to lessen its liability to break: an increase in the length and diameter of journals would distribute the friction over a larger surface, facilitate lubrication and avoid delays by hot boxes.

The following specified sizes of journals and axles for all new work, both for passenger and freight cars and also for old cars as far as practicable, is recommended. Length of axle between outside collars, 6 feet 10 inches. Thickness of collars, ¾ inch. Diameter of axle at wheel seat, 4½ inches. Diameter of axle at center, 4 inches. Length of journal, 7 inches. Diameter of journal, 3½ inches.

The Employment of Women.

L. W. E. writes to dispute some statements in our article on page 97 of the current volume, especially those to the effect that women have lost some of their employment by men invading their avocations, and that women are entitled to some recompense for the wholesale robbery. "Have not these same women robbed editors, clerks, lawyers, physicians and lecturers, about as much as they have been robbed? The statistics of New England show that, while men have devised methods to add to their wealth, the ability of women to earn a livelihood has diminished. If, as is sometimes claimed, woman is man's equal, why does she not devise methods to add to her wealth, or show her ability to fill the clerkships and offices that she so thirsts after?" He asserts generally that women have enough fields of employment open to them, if they will only enter in and labor.

Improved Submarine Lamp.

M. Pasteur has discovered that the vitiated air discharged by divers contains oxygen enough to support the flame of a a petroleum lamp. He accordingly connects, with the flexible escape pipe of a diver's helmet, a suitable lamp of the above description. The lamp may be carried in the hand of the diver or attached to any part of his person. The flow of the escaping air from the helmet through the lamp gives a bright flame, enabling the diver to see in all directions, rendering the employment of the expensive electric light no longer necessary.

E. T. C. says: "some of my brother wood workers may not know that the difficulty of finishing a small piece of green wood, as is sometimes necessary, may be overcome by scorching the piece after it is shaped out. A few lighted shavings will do, and you can then file and sandpaper without trouble."

Ozo-benzine---A New Explosive.

MM. Houzeau and Renard state, in *Les Mondes*, that by causing concentrated ozone to react upon pure benzine boiling at 178° Fah., a solid body is formed of gelatinous appearance to which the name of ozo-benzine has been given. The formula is $C^{12}H^6$ (C^2 6 H^6). Dried in *vacuo*, the substance becomes solid, white, amorphous and highly explosible. It detonates with violence under the influence of shocks or heat. A few grains exploded in the laboratory shattered the glass in the windows. It is very unstable, and when left either in air, carbonic acid, or even in a vacuum, it changes rapidly. Among the products of the aqueous decomposition of ozo-benzine, is noted the presence of acetic and formic acids, and also that of a solid acid, very soluble, becoming colored brown by potash or soda. Another composition is also formed which has an agreeable odor and no acid reaction.

It has also been noted that a mixture of bicarburetted hydrogen and ozone detonates violently without the action of light, heat or electricity. The ozone must be *strongly* concentrated.

A Texas Invention.

The following letter was received at the Patent Office recently:

To the Commissioner of Patents:

SIR: I will trouble you with the description of an article that I have invented for the purpose of extracting such substances as money from the stomach. If it is not already patented to some other inventor I want a patent. I am the inventor of the instrument that I claim. I was called on by a Dr. ——, who had a patient, a little girl five years old, that had swallowed a half dollar, and it had been in the stomach three days. I went to work and made him an instrument with which he took out the half dollar at the second trial. I know a doctor who says that he was called to a case of a similar kind, and the patient died. I want to know what it will cost to get out a patent and how to go about it. If you will furnish me with the instructions I think are necessary I will go to work at once to complete it. I know that my work is a complete success, and no humbug about it. Please address —— ——, Texas.

A Pneumatic Sewing Machine.

A sewing machine motor, invented in England by Joseph E. Holmes, consists of a sewing machine having, below the table, a train of gear wheels and an air pump, operated by a crank, the pump being used to exhaust the air from a cylinder, underneath a piston which traverses the cylinder. The exhaustion of the air causes the piston to descend and drive the sewing machine. If a vacuum equal to 14 lbs. to the inch can be obtained, the piston being 9 inches in diameter, the pneumatic pressure on the piston will be 890 lbs., equal to a weight of that amount falling say three feet, the hight of the sewing machine table under which the piston is placed.

This device strikes us as a rather complicated method of applying and storing the power exerted by the individual in turning the crank. The coil spring would be simpler and cheaper. We have seen sewing machines driven by springs that operated well. In fact, we gave an illustration of such a machine in our last volume, at page 134.

The Great Suspension Bridge between Brooklyn and New York.

At a recent municipal investigation into the affairs of the above bridge company, State Senator Murphy, who is one of the directors and subscribers, was examined, and among other statements he gave the following particulars:

The piers are a success. One deflected only three eighths of an inch, and the other five eighths of an inch,—a most remarkable circumstance in such a work. The work cost us a little more than we expected, because of the increase of five feet in the hight ordered by the United States Government authorities. It may cost us $1,500,000, more than we anticipated, that is, for the bridge itself $9,000,000 and land $2,500,000, or a total of about $12,000,000. We have got to take all the land under the works on both sides of the river, but we can utilize it. On the Brooklyn side it would be a splendid place for a market.

Silicic Acid as a Mordant.

It is known that amorphous silica possesses considerable power for absorbing certain colors, especially certain aniline tints. Cotton impregnated with a silicate solution takes color rapidly and permanently. The best means of attaining this result is to treat the cotton with a solution of water glass and then to precipitate the silica in the fiber by means of an acid before placing the cotton in the dye. As regards freshness and beauty of shades, cotton thus prepared is much superior to that acted upon by tannic acid as a mordant. M. Reimann, the inventor of the process, is making experiments in order to fix aniline colors on glass, by previously attacking it with hydrofluoric acid.

ALL new subscriptions to the SCIENTIFIC AMERICAN will be commenced with the number issued in the week the names are received at this office, unless back numbers are ordered. All the numbers back to January 1st may be had, and subscriptions entered from that date if desired.

THE *Spectrum* is the name of a new quarto paper published by the students of the Institute of Technology, Boston, Mass.

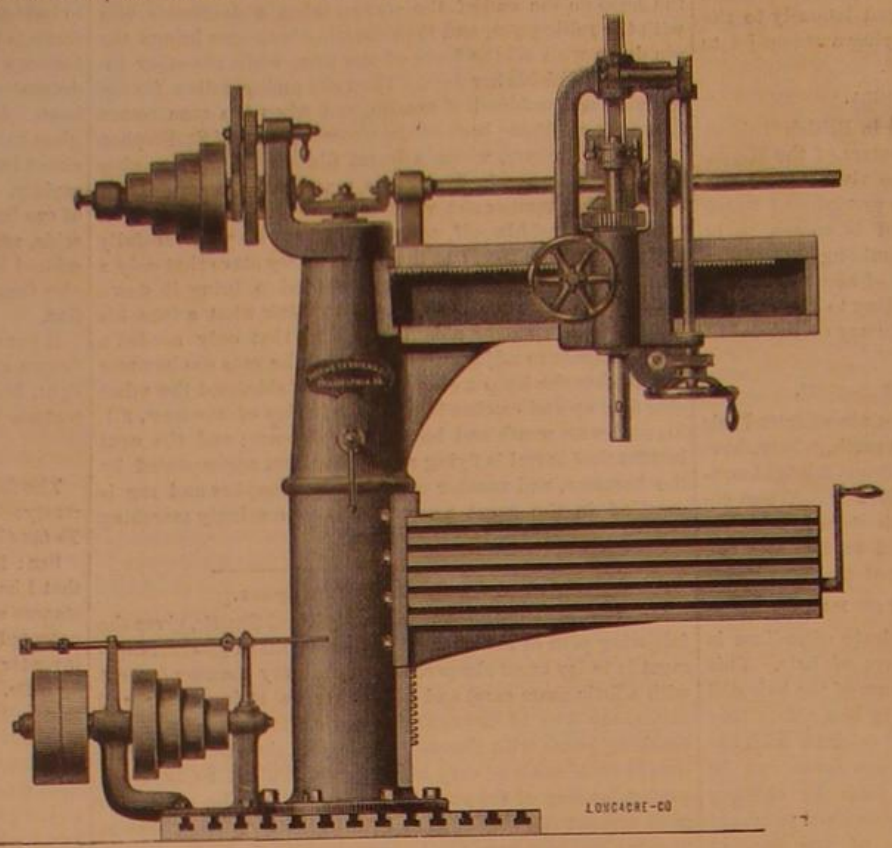
THE archer fish, *toxotes jaculator*, supplies itself with food by spirting drops of water at flies, as they rest upon grass stalks on the edge of the stream. The fish seldom fails to hit and bring down the fly at which he aims.

IMPROVED RADIAL DRILLING MACHINE.

The accompanying illustration shows a radial drilling machine, designed and constructed by Messrs. Thorne, De Haven & Co., Philadelphia, Pa., patents for the novel points of which have been applied for. Among the most prominent of its many excellent features are the following The countershaft is on the base and the driving cone on top of the post, to facilitate changes of speed. The table has T slots on the top and side, and can be raised and lowered to suit the thickness of the work. It is held to the post by V-shaped gibs, thus reducing the leverage on the post when drilling on the table. The saddle carrying the spindle is traversed by a rack and pinion. The spindle is counterbalanced to prevent its dropping, in case of any lost motion, through a hole, before it is quite finished, or into a blow hole, a fruitful source of breaking drills. The feed to the spindle is obtained by a rack and pinion operated by a tangent wheel and worm. There is a self-acting feed with three speeds, which is thrown in by a friction clutch.

It will be seen that means are here afforded for fastening work, in which a number of holes is to be made, firmly to a table adapted to the purpose, and for bringing the drill in proper position for drilling each hole without moving the work. This, it is claimed, can be effected, no matter how small the piece to be operated on may be. The holes are made accurately, and the danger of breaking drills through the turning of the plate is necessarily avoided. The machine is, it is stated, in every respect as stiff and, to a certain degree, in this particular superior to the ordinary stationary apparatus. There is a long thick bearing, where the arm rotates on the post, which effectually prevents any springing, while any amount of stiffness may be given to the table.

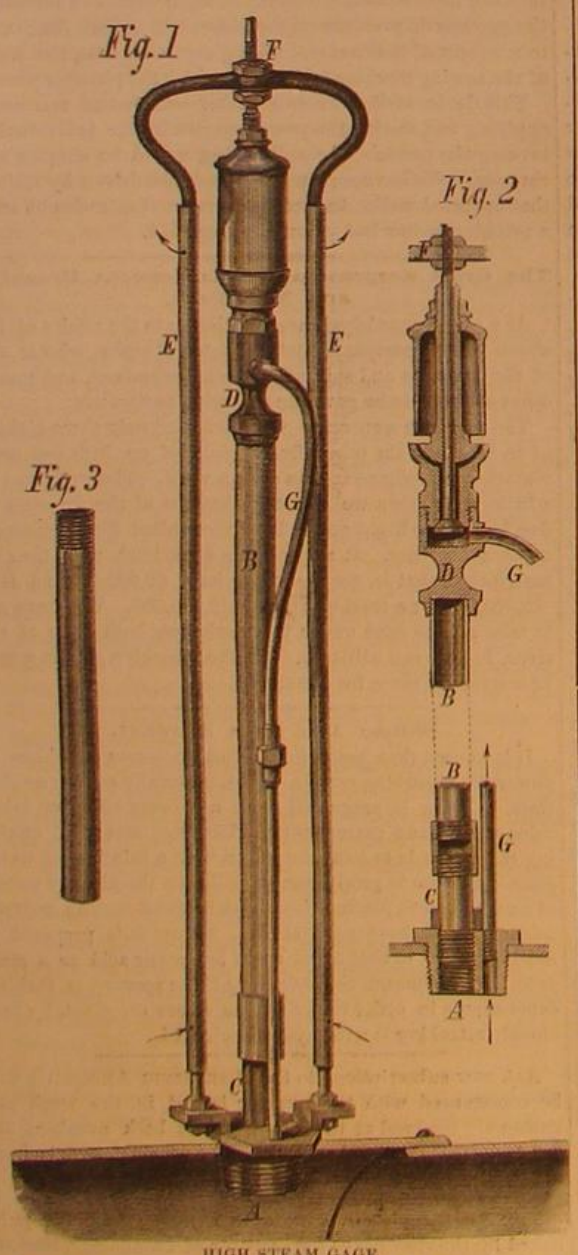
For further information address the manufacturers, 21st street, above Market, Philadelphia, Pa.



RADIAL DRILLING MACHINE.

HIGH STEAM GAGE AND LOW WATER REGISTER.

We present herewith illustrations of a new form of high steam gage, and also of a novel device constituting a low water register. These inventions, though they may be arranged in combination, as will be explained further on, are also constructed and used separately, and we therefore thus describe them:



HIGH STEAM GAGE.

The high steam alarm, Fig. 1, is inserted in the upper shell of the boiler, and communicates with its interior at A. B is a brass tube, the lower part of which is surrounded by a pipe, C, of non-conducting material, and is hermetically closed at D. The alarm whistle is situated as shown, and its valve has an inverted stem, which passes up through it and is secured by the two nuts, F, on the side tubes, E. Through the latter a current of air is allowed to circulate, entering and leaving through the perforations at top and bottom, and in the direction indicated by the arrows. G is a pipe serving to conduct dry steam from the boiler to the alarm.

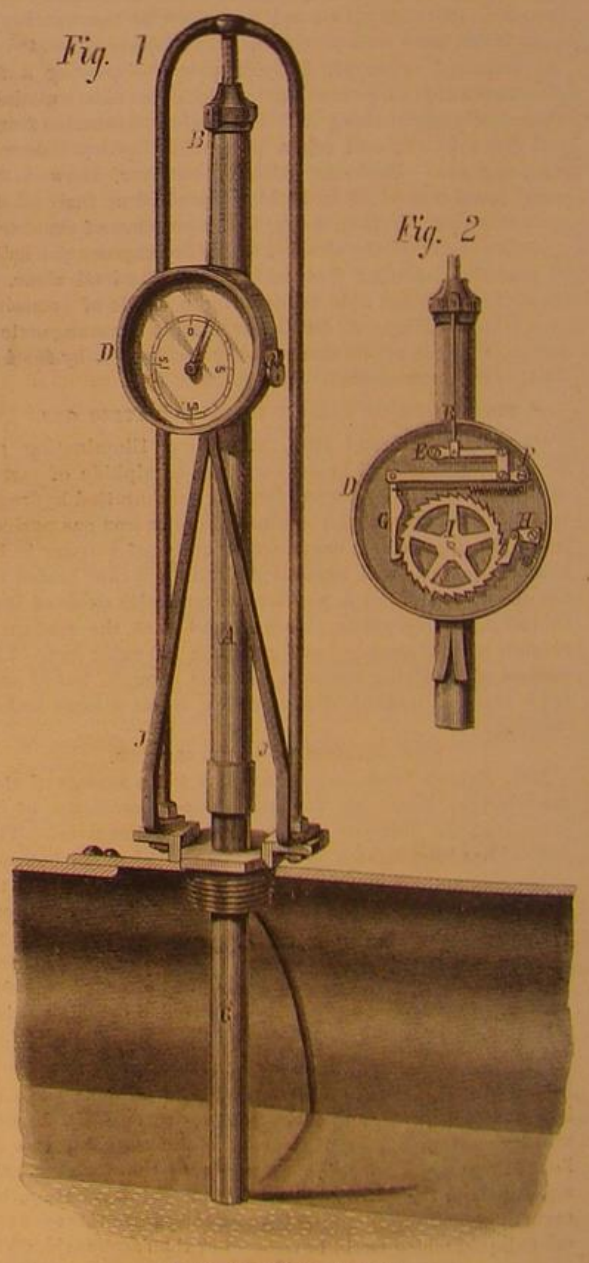
Let it be supposed that the whistle is required to sound whenever the steam pressure exceeds 60 pounds. As the steam is generated, it at once escapes up through the pipe, G, and the alarm blows. The nuts, F, must then be tightened, screwing up the valve until the escape ceases, and this must be continued until the steam gage shows 60 pounds. By this simple adjustment the high steam gage is made ready for instant service, as is evident from what follows. As the pressure of steam increases, its temperature also augments, consequently greater heat is applied to its containing vessel which, if of proper material, proportionately expands. This is the case with the tube, B. As the steam pressure rises above 60 pounds, say to 63 pounds, the tube is caused to elongate, and its upper extremity, rising, carries the whistle up with it. But the valve stem is held rigidly by the rods, E, to which it is screwed, and which do not expand because they are kept cool by the air within them. Therefore the valve seat is raised from the valve and the port opened. Steam from the tube, G, then enters the whistle, which continues sounding until the pressure falls, and the tube, B, contracts. The non-conducting envelope on the bottom of the latter serves to prevent it from being affected by the high temperature of the adjacent parts of the boiler, consequently, the sensitiveness of the tube is measured by nearly the entire expansibility of the metal, instead of the small residue of that property which would otherwise remain. This is an important advantage, and is claimed to obviate one of the principal difficulties encountered in the use of gages based on a similar principle.

In our second illustration, we have a low water register which indicates, by means of a dial and pointer, not only each time the water falls below a fixed level, but also keeps a record of such depressions. It will be seen that this is a sort of tell-tale device which, if placed on a boiler and so arranged as to be unalterable by the engineer, will at once give evidence of not only whether he has been derelict in keeping plenty of water, but how many times he has neglected this duty. In operation the invention is very similar to the one above described. There is an isolated expansion tube, A, Fig. 1, closed at the top, which, however, is here prolonged by a pipe, C, which extends down into the boiler to the desired low water level. D is the indicator dial; B is an iron rod which is suitably fastened to the top of the tube, A. This rod enters the box of the registering apparatus and connects through a series of multiplying levers, E F, with the pawl, G. The latter, as shown, engages with the ratchet wheel, I. H is another stop so arranged as to prevent the wheel turning but in one direction. The pipe, A, is supported and guided during its expansive movement by a pin which extends up from its top and works freely through an orifice in the upper portion of the side rods. This last mentioned part of the device, it will be noticed, is represented as curved, but the experience of the inventor, as well as a careful test which is below referred to, has proved that more advantageous results may be gained when it is made straight. The dial is supported by the rods, J J.

As steam is generated in the boiler, water is necessarily forced up. The tube, A, is thus kept filled until the water in the boiler gets below its lower end. Its contents then run out and steam enters, which, being so much hotter than the water, instantly causes the tube to expand. The register, D, being rigidly held, cannot move, so that the tube, as it rises, pulls upon the rod, B, and thereby moves the levers, E F, which raise the pawl, G, which, in turn, carries the wheel one tooth in advance. This is, of course, indicated by the pointer on a suitable scale on the face of the dial. On the pawl, G, is a cam projection which, when the former is caused to rise still further by the continued expansion of the tube, takes against a stop and prevents the pawl from engaging with the tooth next above. This device prevents more than a single movement of the wheel each time the water becomes low.

The high steam gage can be readily converted into a low water alarm by adding to the tube, B, the extra piece, Fig. 3, and the dial may also be placed in position if desired. As regards the practical utility of these inventions, we annex the following extracts from a report of tests recently made by Professor R. H. Thurston, of the Stevens Institute. This well known expert says, in relation to the low water register, that its action was, in every respect, satisfactory, and then states that, in the case of the high steam gage, he at first doubted "whether it could be possible that the slight change, in the length of the central tube of the instrument, produced by so slight a change of pressure as the inventor claimed, could be relied upon to give an alarm, even were it possible for any change of pressure to do so. I am now willing to report that it will. By repeated experiment I find that, by delicate adjustment of both the whistle and its valve, a change of even two pounds pressure will cause an alarm. . . . . I believe the claims of the inventor to be substantiated by my experiments."

Scarcely a day passes without the news of a more or less disastrous boiler explosion reaching us, and the records of such calamities during the past few months show that in nearly every case the cause of the occurrence is the incompetence or inattention of the person in charge. In such cases, the value of an automatic safety apparatus and an unalterable register becomes doubly apparent; and the inventor of the two devices herewith described has certainly devoted his talent to one of the most pressing needs of the engineering world. The importance of this subject cannot be overrated, as the columns of the SCIENTIFIC AMERICAN, with their sad accounts of death and destruction in all parts of the country, fully demonstrate.



LOW WATER REGISTER.

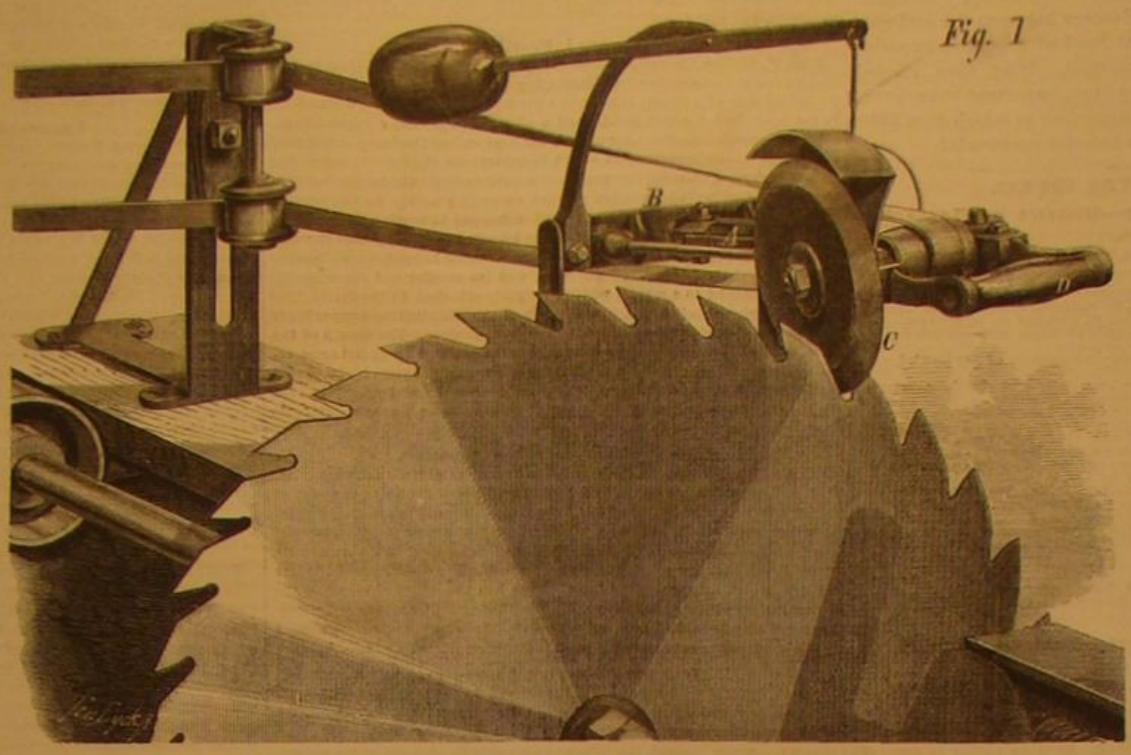
Patented August 27, 1872. For further particulars address the inventor, Mr. W. S. Belt, Cincinnati, Ohio.

FLEXIBLE SAW AND TOOTH FILING APPARATUS.

This invention consists in an abrading wheel of emery or corundum, hung upon a flexible frame and set in rapid motion. By means of a handle, it is controlled by the operator, and may be placed at any angle to the article to be filed. The device is especially applicable to the gumming of saws, circular or upright, and the sharpening of molding bits or similar tools.

The working portions are composed of a movable frame, A, which, by a ball joint, is hung on the main frame, B, so that the grinding wheel, C, has a universal movement controllable by the handle, D. Still freer motion is afforded by a second joint on the frame, A, or the latter may be so arranged that only a straight up and down or side motion can be imparted to the wheel, which is thus kept square to the work. The lever and weight shown serve to balance the frame and wheel, and so relieve the hand of the operator.

Fig. 1



FLEXIBLE SAW AND TOOTH FILING APPARATUS.

The accompanying illustrations represent the adaptations of the machine to various purposes. Fig. 1 shows it arranged for use in circular sawmills. The apparatus is placed immediately behind the saw upon a plank, on the side where the teeth turn up, the shaft of the emery wheel being in line with the blade. The countershaft is attached to the back end of the plank in a direct line with the driving pulley of the engine. The belt or cord is placed upon the small pulley of the machine, then around the pulleys on the countershaft, turning an angle thence to the driving pulley. The operator applies the wheel, which revolves at the rate of from 1,500 to 2,000 revolutions per minute, to the saw by means of the handle.

Fig. 2 represents the machine as applied to the dressing of muley, drag, or cross-cut saws, and also to circular saws when removed from their mandrels. The appliances for holding the implements are the principal features, and are clearly depicted in the illustration. Fig. 3 shows the apparatus adapted to shaping molding bits or cutters for wood working machinery. The adjustable device for holding these tools is represented at G, in Fig. 4. It can be readily removed from the bar, H, by loosening a set screw. The arrangement shown in Fig. 2, for holding saws, may then be substituted and fastened in place in a similar manner.

Patented through the Scientific American Patent Agency, December 31, 1872. For further particulars address the manufacturers, Messrs. Frey, Sheckler & Co., Eagle Machine Works, Bucyrus, Ohio.

Fig 2

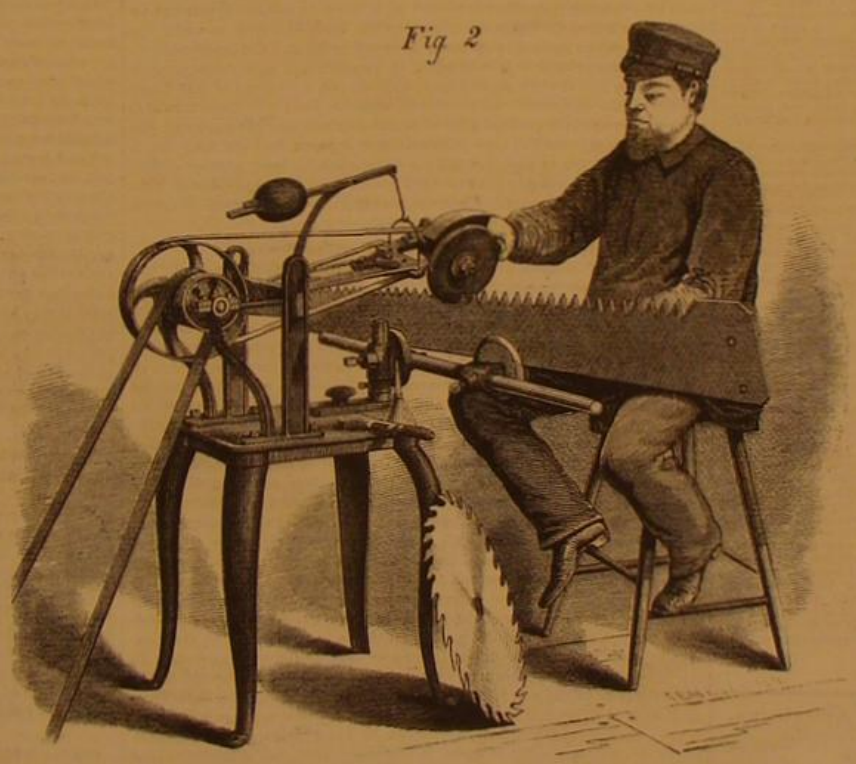


Fig. 3.

A Singular Fire.

A correspondent, A. A. F., encloses the following paragraph from the Cleveland (O.) *Leader:* A hard wood plug had been put into a hole in a gas pipe that ran along the ceiling in our job rooms, several feet from any burner, and in a position where no one could ever suppose it would catch fire. About six inches below it, passed a belt running from one pulley to another, and in operation during the day. About four days after the plug had been driven into the pipe, it was noticed to be on fire, and a bright jet of light, as if from a burner, burst forth from the side of the plug, which was already charred and being rapidly burned up. How the plug caught fire, how a steady flame of light could suddenly burst out from the side of it, was of course a subject of anxious inquiry. No one had lighted it and no fire had been used near it. The only conclusion possible was that it was caused by electricity from the belt, and a full investigation confirmed this conclusion. Had it happened in the night time, it might have enkindled an extensive conflagration, and its origin would never have been known. Many destructive fires may have started in this manner, their causes remaining for ever unknown. It is an incident worth bearing in mind, and proves that too much care cannot be taken in guarding against fire."

REMARKS:—In this case there was doubtless a slight leakage of gas at the side of the plug, and the gas was fired by electricity from the belt, just as our young folks at home ignite gas at the burner by rubbing their feet on the carpet and then approaching the escaping gas at the burner with their fingers.

Man a Republic.

Professor Haeckel, of the University of Jena, may be regarded, says *Nature*, as the most eminent living representative of the doctrine of evolution in Germany. He has won a name for himself during the last ten years as the author of several remarkable works in various sections of natural history. He has adopted out and out the system of Darwin. Indeed, on more than one point he goes much further than his master, and it may with truth be said that he is more Darwinian than Darwin himself.

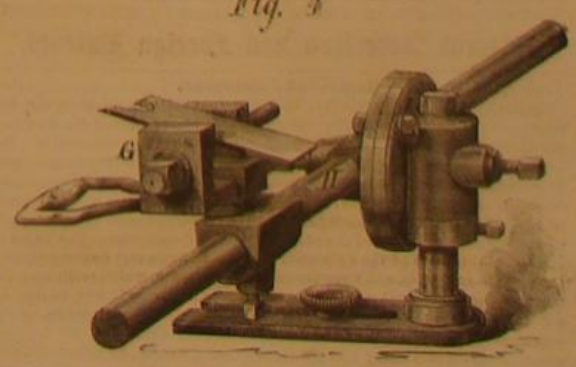
Professor Haeckel has given a *resumé* of his theories as a whole in a series of lectures at Jena, re-published under the title of "Natural History of Creation," in which he gives the following facts concerning the embryology of man:

At the outset of his existence, man, like every other animal organism, is only an egg, a simple little cell, whose diameter is only one fourth of a millimeter—the one hundredth part of an inch—at the most. It differs from the primordial cellule of the other mammalia only in its chemical constitution and the molecular composition of the albuminous matter of which the egg essentially consists. And yet these differences cannot be directly perceived by any means at our disposal; but we are *compelled* by indirect conclusions to suppose their existence as the prime cause of the *difference* in individuals. The human egg incloses all the essential elements of a simple organic cellule; a protoplasm which bears the name of *vitellus*, and a *nucleus* or germinal vesicle. This nucleus is a small sphere itself, inclosing another nucleus much smaller still, the *nucleolus;* exteriorly the protoplasm is enveloped by a membrane which is known by the name of *zona pellucida*. The eggs of many of the lower animals, as the greater part of the medusæ, are, on the contrary, naked cells which do not possess this envelope.

As soon as the egg of the mammal is completely developed, it leaves the ovary and descends, by the narrow canal of the oviduct, into the uterus, where, after fecundation, it becomes an embryo. This transformation is thus brought about: The original cellule becomes divided into two cellules: on the primitive nucleolus are formed two new specks, and the nucleus becomes separated into two vesicles, each of which takes with it half of the protoplasm. The result of this process is that, in the heart of the vitelline membrane, which alone is not divided, two cellules are found in juxtaposition, differing from the original only in being unenveloped. Each of these new cellules is in its turn divided into two others, so as to form four, which in the same way become eight, these eight, sixteen, and so on; these successive segmentations producing an agglomeration of cellules, in outward appearance resembling a mulberry. The further development consists in these cells assuming the shape of a sac (*vesicula blastodermica*), in the interior of which a liquid collects; shortly, on a point of the wall which is composed of these cells is produced a disk-like coagulation; their number rapidly increases, and this particular condensation becomes the embryo strictly so called, while the remainder of the blastoderm serves only for its nourishment. The embryo soon begins to broaden into the form of a biscuit. Three leaves or layers of cellules can be distinguished, superposed like envelopes upon each other, and each having its particular place in the construction of the living being; from the exterior leaf is formed the epidermis and the central parts of the nervous system, the spinal marrow and the brain; from the central layer is formed the interior membrane which lines the digestive canal from the mouth to the anus, with all the glands that are attached to it (the lungs, the liver, the salivary glands, etc.); the intermediate layer is the source of all the other organs.

The processes by which the three layers of cellules give birth to the most complicated organs can all be reduced: (1). To new segmentations, and consequently to an increase in the number of the cells; (2). To the divisions of labor or the differentiation of these cellules; (3). To the combination of these cellules, differently developed. The cellules which comprise a living organism may thus be compared to the citizens of a state, some of whom have one set of functions to perform, others another; the division of labor, and the organic perfection which results from it, enable the state to accomplish certain undertakings which would be impossible to isolated individuals. Every living organism composed of many cellules resembles a sort of republic, capable of accomplishing certain organic functions, which could not be discharged by a single cell, an *amœba*, or a monocellular plant. No rational mind would seek to explain by superhuman intervention the public weal which accrues to political society, from the harmony of particular actions; so also in the organism, all the adaptations to ends ought to be regarded as the natural and necessary consequence of co-operation of the differentiation and the

Fig. 4



perfection of the cellules, and not as the intentional work of a supernatural will.

Until the brain begins to show itself distinctly, it is scarcely possible to recognize any difference between the embryos of the different vertebrata, or at least of the three superior classes—reptiles, birds, and mammals. Why, then, should any one now refuse to admit the most important consequences of the theory of evolution, according to which men have descended from simious or even inferior mammals?

DECISIONS OF THE COURTS.

United States Circuit Court---District of Massachusetts.

REFRIGERATORS.—PATENT.—GEORGE C. ROBERTS *vs.* JOSEPH BLAKE, JR.

SHEPLEY, *J.*:

This is a bill in equity to recover profits and damages for alleged infringement of letters patent granted to D. W. C. Sanford, November 13, 1855, reissued April 21, 1857, and extended October 21, 1869, for an improvement in refrigerators, the interest in the letters patent being now owned by the complainant.

The principal question in the case is as to the novelty of Sanford's invention.

The claims in the Sanford patent have been fully and clearly construed by the Court in the case of Roberts *vs.* Herndon, 2 Clifford, p. 503. Upon a careful examination of the evidence in this case, I am of opinion that the conclusion of Judge Blatchford in the case of Roberts *vs.* Dodge, in the Second Circuit and Southern District of New York, is correct; that the inventions of Sanford and the claims of his patent are fully anticipated, on the point of novelty, by the refrigerators constructed under Lyman's direction, at the Novelty Works in New York, in 1854.

These refrigerators, including also Exhibit Hedden No. 1, contain the same combination of elements named in Sanford's first claim. There are some slight structural differences. The elements of the combination are somewhat modified in their form, but the combination of the same elements produces in substance all the results and the same results claimed by Sanford.

Bill dismissed without costs.

[*Thomas A. Jenckes* and *Richard Stone*, for complainant.
Cursten Browne and *Jabez S. Holmes*, for defendant.]

United States Circuit Court---Eastern District of New York.

HOSE COUPLING PATENT.—WM. H. BLISS *vs.* THE CITY OF BROOKLYN.

BENEDICT, *Judge*:

This action, which has been before me on a former occasion upon other pleadings and proofs having been reopened, now comes up for determination upon new pleadings and different proofs. It is an action to recover damages of the city of Brooklyn for using certain hose couplings, which are claimed to be an infringement upon a certain patent for hose couplings, originally issued to Robert B. Lawton and William H. Bliss, on the 23d day of February, 1859; reissued December 21, 1869; and now owned by the plaintiff.

The claim in this reissue, which is the object of this controversy, is as follows:

"The combination of the two thimbles C and D by means of a pin operating longitudinally through the outer thimble C and against the inclined side of the thimble D, so that the two thimbles will be forced together by the inward movement of the pin and be liberated by its outward movement, substantially as described."

In opposition to the patent as thus reissued, several grounds of defense have been taken. One of them is that the invention which the reissued patent describes is worthless and the patent invalid; and this defense appears to me to be supported by the proof. The law upon the subject of utility is not in doubt. No particular amount of utility is required to render an invention patentable, but there must be some. When the invention is shown to be worthless the patent must fail. Such appears to be the case in the present instance. The evidence fails to disclose an instance where the combination described in the reissued patent of 1869 has been successfully used. The plaintiff himself testifies that he does not know of any such coupling having been found to be of practical use. Although he sells couplings, he never sold any such, and only recollects three instances where their use has been attempted. His testimony satisfies me that the combination described in the patent here relied on proved inoperative and worthless.

It is true that couplings containing all the elements in combination which are described in the plaintiff's reissue of 1869 are in use, and such are those used by the defendant, but in these couplings another essential element is present in the combination, which additional element is not to be found in the plaintiff's reissue of 1869.

This additional feature is a lug, which is placed upon the inside of the outer thimble opposite to the pin in such a manner that when the pin is forced inward upon the inner thimble the inclined side of the groove of that thimble is pressed upon the lug, and the part of the inner thimble thus forced up to the shoulder of the outer thimble, at the same time that the pin itself, by pressing the inclined groove when it is touched by the pin, forces that side of the inner thimble up to the shoulder of the outer thimble, thus making a tight joint which cannot tilt, although the inner thimble be smaller than the inside of the outer thimble, and which cannot swivel or turn and be tight.

The introduction of this element makes the combination a different combination from that described in the plaintiff's patent of 1869. This combination, in which the lug enters as an element, is the subject of another patent obtained by the plaintiff in 1862, which he has not proved here, and in which he states that the lug is "very essential."

This latter patent of 1862 has been put in evidence by the defense, and it affords strong support to the position that the combination described in the reissue of 1869 proved worthless.

But it is said the introduction of the lug is simply an improvement. I cannot so consider it. The two combinations are distinct, because they have different elements and attain a different result. In the one combination no lug appears, and no practical result is attained. The introduction of the lug for the first time produced a combination which accomplished any useful result. An added element which increases the efficiency of a combination, of itself effective, is of the nature of an improvement; but when the added element is essential to the production of any useful result such an addition is not an improvement, but its use gives birth to the only patentable (because the first useful) combination. Notwithstanding, then, the conceded fact that the combination which includes the lug, with other elements, which are described in the reissue of 1869, is useful, it is nevertheless necessary, in order to sustain the reissue, that it should appear that the device there described, which does not contain the lug, is of some utility. As before stated, the contrary here appears, and for this reason the patent must be declared invalid.

[*George Gifford*, for complainant.
B. E. Valentine, for defendant.]

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From February 14 to March 5, 1873, inclusive.

BOARDING LEATHER, ETC.—W. J. Coogan, Pittsfield, Mass.
CAR VENTILATOR.—R. Hitchcock, Springfield, Mass.
FINISHING BOOT SOLES, ETC.—L. R. Mears, New York city.
FUR-COATED FABRIC.—H. Kellogg, Milford, Conn.
GAS, ETC.—J. C. Tiffany, Portsmouth, N. H.
GRAINING, ETC.—J. J. Callow, Cleveland, Ohio.
HAND STAMP.—D. W. Fish, Brooklyn, N. Y.
HOSE PIPE.—G. McKay, Boston, Mass.
LAMP.—T. H. White, E. Knight, Cleveland, Ohio.
LASTING BOOTS, ETC.—J. W. Brooks, Boston, Mass.
MAKING HATS, ETC.—A. Bogardus, Matteawan, N. Y.
MAKING NUT BLANKS.—J. Ostrander, Richmond, Va.
MULTIPLE CRANK DRILL, ETC.—C. F. Ritchell, New York city.
ORNAMENTING PAPER, ETC.—F. Beck, New York city.
PAPER PULP ENGINE.—S. L. Gould, Skowhegan, Me.
PENCIL HOLDER, ETC.—W. H. W. Campbell, Norwich, Conn.
RAILROAD CAR SPRING.—H. Gardiner, New York city.
TRIMMING BOOT SOLES, ETC.—S. H. Hodges, Lynn, Mass.

Recent American and Foreign Patents.

Improved Cultivator.

Singleton L. Young, Scottville, Ill.—The invention consists in the improvement of cultivators. To the upper side of the ends of the axle tree are pivoted axle arms upon the journals of which revolve the wheels. The latter are made with a flange upon the center of their rims to prevent them from slipping laterally upon the ground, and to cause them to operate more promptly in guiding the plow. The inner ends of the axle arms are made wide and have transverse slots formed in them curved upon the arcs of circles, having their centers at the pivoting points of said arms. The edges of the wide inner ends of the axle arms are curved upon arcs concentric with the slots in said ends, and have teeth formed in them, which mesh into the teeth of the gear wheel pivoted to the center of the axle tree, so that, by turning the said wheel in one or the other direction, the direction of the wheels and consequently of the machine will be changed. To the gear wheel is rigidly attached a rearwardly projecting handle, by means of which the plowman can readily turn the said wheel to guide the machine. The plow beams are placed end to end, and each is connected with the axle tree by two draft rods, the forward ends of which are pivoted to the axle tree, and their rear ends are pivoted to the forward side of the beams near heir lower edge. Braces are pivoted to the forward side of their beams near their upper edge. The forward ends of the braces are secured to the sides of the draft bars, several holes being formed in the said end of the braces to receive the fastening pin or bolt, so that, by adjusting the relative length of the draft rod and braces, the inclination or pitch of the plows may be adjusted at will.

Improved Fertilizer.

John W. Stubbs, Cheraw, S. C.—This invention has for its object to furnish an improved machine for distributing guano or other fine fertilizer. To the off-side of a beam, similar to a plow beam, is attached a standard, to the lower end of which is attached a plow, for opening a furrow to receive the guano. To the near side of the rear end of the beam is attached a standard, to the lower end of which is attached a plow for filling up the trench or furrow to cover the guano. To the standards and to the beam between said standards is attached a board extending nearly to the ground, to which and to the beam is attached a hopper to receive the guano to be distributed. From the bottom of the hopper the guano passes through an opening in the vertical plate into the distributing hopper, which is made in the form of the frustum of the cone, and its smaller and closed end is securely attached to a wheel, which is rigidly attached to the shaft. The side of the plate against which the mouth of the distributing hopper bears may be covered with a metallic plate to prevent wear. The mouth of the distributing hopper is supported and secured in position by radial arms attached to the shaft. To the shaft and inner part of the arms is attached a small metallic plate for the forward end of a screw to rest against to hold the mouth of the hopper at a greater or less distance from the plate, according as it is desired to distribute more or less guano.

Improved Photographic Negative.

Joseph Kirk, Newark, N. J.—This invention consists in coating a glass plate on both sides, or coating two plates and putting one at the back of the other, with collodion or any other compound used in producing negatives for photographic purposes, whereby, when the plate or plates are exposed to the subject to be photographed and developed in the usual way, a faint image is produced on the back of the plate or on the second plate in addition to the image on the front. This has the effect of blending the highest points of light gradually with the shadows of the printed photograph, giving a beautiful, soft, and porcelain-like effect, and saving a great amount of labor in retouching negatives for portraiture.

Improved Steering Apparatus.

John F. Sparr, Rochester, N. Y.—This invention consists in combining a propeller shaft and screw with a balanced rudder, and in certain operative mechanism. The invention consists, principally, in carrying the shaft which propels the screw through the tubular upper spindle or pivot of the rudder, and in hanging the propeller in the rudder. The propeller can thus be freely revolved without affecting or interfering with the motions of the rudder, and the rudder can be freely turned without interfering with the rotation of the screw; but the screw will follow the oscillations of the rudder, and apply its power in the desired direction to the vessel, thus aiding in the process of steering. Vessels provided with this apparatus can be turned on sharp curves and rapidly with safety. The invention is designed to be applicable to canal steamers and to men of war, and also to all other steamships.

Improved Propelling Mechanism for Vessels.

John Welch, New York city.—This invention is an improvement in the class of vibrating propellers provided with floats or paddles pivoted so as to swing in either direction according as the boat or vessel to which the propeller may be applied is to move forward or back. The improvement consists in the provision of bent rods, in combination with floats pivoted horizontally and at their upper edges, whereby the movement of said floats is controlled. By suitable arrangement, when the boat is to move forward, a forward crank is turned parallel with, and another at right angles to, the paddle frame, so that the said paddles, when moving forward, may take a horizontal position to pass through the water with the least possible resistance, and when moving to the rearward will be in a vertical position to bear strongly against the water. When the boat is to move backward, the positions of the rods will be exactly reversed.

Improved Machine for Cutting Stone.

Christopher E. Odgers, Bloomfield, N. J.—This invention consists in improving stone cutting machines. To the top of the frame of the machine, near one end, is pivoted a shaft to which are attached radial arms, upon the outer ends of which are formed cams to operate the hammers, said arms being so arranged that each hammer may be operated four times at each revolution of the shaft, and that no two adjacent hammers may be operated at exactly the same time. The hammers are pivoted to a shaft connected with the upper part of the frame, and their rear ends are slotted and have a friction roller pivoted at the outer end of said slot for the cam arms to operate upon. The faces of the heads of the hammers are concaved, so that they may strike fairly upon the ends of the chisels, however said cutters may be adjusted. The journals of the cutter holder are secured to the frame, so that the holder may be conveniently adjusted to hold the cutter at any desired inclination, and, when adjusted, may be held securely in place. The cutters are made with a shoulder upon their upper and upon their lower side, and are placed in slots in the holder, which recesses are made with a shoulder to receive the lower shoulder of the chisels, to prevent the possibility of the chisels descending too far. The cutters are raised to receive the blow of the hammers by springs attached to the holder, and which bear against the upper shoulders of the cutters. By this construction the work will be done in a manner very similar to hand work. To the base of the frame is secured a track, along which roll the wheels pivoted to the ends of the side bars of the carriage frame. The stone to be operated upon is secured in place upon the platform of the carriage by pointed screws which pass through nuts attached to hook plates, so that the holding device may be readily adjusted to different sized and different shaped stones. Suitable mechanism is provided so that the stone may be drawn forward beneath the cutters automatically.

Improved Wagon Body and Seat.

Peter S. Rich, Avalanche, Wis.—This invention relates to wagon bodies and wagon seats designed for light pleasure wagons, either open or covered The sides of the body are bent so as to form round corners, and are connected together at front and rear by straight pieces, the joints being securely nailed. The sills are joined together at the corners and supported by angle irons. The dashboard is supported by a bow, the ends of which are confined to the sill by angle irons. This bow is made of wood, and the dash board is attached to it. Wood ovals are connected with the upright sides of the bow and attached to the outer ends of the dash board. The seat is formed of bent sides and straight back connected together with nails, and with arm pieces extending from the back piece to the front of the seat, and supported by the stay irons which extend down on to the bottom of the seat. These arms, where they are connected with the back piece, are secured with plates of metal. It will be seen that there is no working against the grain of the wood in constructing a body and seat of a wagon in this manner, and that the full length of the timber is preserved throughout. The body and seat are consequently more durable than those made in the ordinary manner.

Improved Self Closing Hatch.

Charles H. Reynolds, Williamsburgh, N. Y., assignor to himself and Henry C. Richardson, of same place. This invention has for its object to furnish an improved device for holding the hatches of a hoistway or elevator well raised or open, and which shall be so constructed that in case of accidental fire the hatches will be closed automatically. As the hatches are raised or opened, arms attached to them strike latches, raise them, and slide along their lower edges till they enter the notches in said latches, and the hatches are thus held raised or open. The latches are so arranged with respect to the hatches that when the said latches are raised the said hatches will drop shut by their own weight. A pipe or tube passes up through the various floors of the building, except the lowest one, and through the roof. The ends of the tube are left open, and openings are formed in its side above each floor. A rope, which passes down through the tube and its upper end, is secured in the upper end of the tube. The lower end of a rope is attached to a lever. One end of the lever is pivoted to a support attached to the lowest floor, and to its other or free end is attached a weight. Upon the pivoted end of the lever is formed an upwardly projecting arm upon the end of which, when the weighted end of the lever is raised, rests the lower end of a rod, which passes up through all the floors and to which is pivoted the inner ends of the latches. By this construction, when the weighted end of the lever drops, the arm is withdrawn from beneath the lower end of the rod, allowing said rod to drop. The downward movement of the rod raises the outer ends of the latches, which recloses the hatches and allows them to drop shut. Should a fire occur near the hatchway, the tube will act as a flue to draw the flames into it so that the rope will be quickly burned off, allowing the weighted lever to drop, and thus closing the hatches. If desired, the rope may be coated with some substance that will ignite readily, so that the rope will burn off quickly and close the hatches.

Improved Seed Dropper.

Frank W. Young, Holden, Mo.—This invention has for its object to furnish an improved seed dropper for corn planters, so constructed that the size of the dropping apertures may be conveniently adjusted to any desired extent, according to the amount of seed required to be dropped at a time. Two boards form the bottom of a seed hopper, between which is placed a wheel, which is pivoted at its center to the lower board. In the upper board is formed a round hole, of such a size that the edge of said board may slightly overlap the upper edge of the wheel, so that the seed may rest upon the board and wheel but cannot get into the space between the boards. Through the wheel, near its outer edge, is formed a circle of holes, the outer parts of which are semicircular. The upper ends of the holes are open, so as to receive seed from the hopper, and their lower ends are closed by the lower board, so that the seed cannot escape from the said holes until each hole comes over a hole in the board through which it escapes to the ground. The middle part of the upper side of the wheel is recessed to receive arms pivoted to the under side of a disk, so that they may be drawn inward or pushed outward by turning the disk in one or the other direction. The dropping apertures may be enlarged or diminished by the inward and outward movement of these arms. The disk is clamped to the wheel. The wheel, at each movement of an actuating bar, is turned a distance equal to the space between two adjacent holes.

Improved Pulp Strainer.

Henry H. Olds, New Haven, Conn.—The object in this invention is to provide means for separating the pulp of apples, pumpkins, and similar articles from the cores, seeds, and skins; and it consists in a machine having a semi-cylindrical strainer provided with a rotary central shaft and cylinder with elastic wings or webs placed spirally thereon for crushing and forcing the article to be strained. The articles are boiled or steamed so as to be soft and readily crushed, and are fed into the machine through the hopper, where they come in contact with the revolving wings, which crush the pieces and force the pulp through the strainer. The cores, seeds, skins, etc., will be carried along to the other end of the strainer, and may be discharged from time to time, as may be necessary. The wings, by reason of their elasticity, will rub against the strainer and crush the fruit and force the pulp through it.

Improved Hand Corn Sheller.

James M. Hawley, Alma, Ill.—This invention consists in an improved hand corn sheller. Two disks are connected to each other and held in their proper relative positions by a band securely attached to their edges. A part of the band is cut away to form an opening, through which the shelled corn may be allowed to escape. Two parallel bars are arranged, upon the outer side of each of which is formed a hollow journal, which journals pass through holes in the centers of the disks. The bars at one end are kept at the proper distance apart by a block, to which they are attached. To and between the other ends of the bars are pivoted the outer ends of two arms, upon the inner ends of which are formed semicircular jaws. Upon the upper edge of each of the jaws are formed three teeth, the two rear ones of which upon each jaw are made smaller than the others, and are arranged upon the arc of a smaller circle so as to operate upon and remove the kernels from the point or small end of the ear. The front teeth upon each jaw is made longer and projects forward in hook form, so as to move along the cob and force the kernels off laterally and toward the shelled end of the cob, so that they may be removed with less force. The upper and lower edges of the arms are cut away so as to leave narrow bearings to rest against the inner surfaces of the bars. The arms are kept from getting out of position by a stop. The bars are held toward each other, pressing the jaws against the ear by coiled wire springs, so that the said springs may press against the outer sides of the said arms. A hollow journal is made of such a size that the unshelled ear may readily pass through it. Another hollow journal may be made smaller, as only the cob has to pass through it. To the projecting end of the second hollow journal is attached a bevel gear wheel, the teeth of which mesh into the teeth of another bevel gear wheel attached to the end of a shaft which revolves in bearings attached to the brackets, by which the machine is supported and secured to the table. To the outer end of the shaft is attached the crank by which the sheller is operated.

Improved Pruning Shears.

Thomas Borden, Squancum, N. J., assignor to himself, David P. Kisner and Thomas Hulett, of same place.—The object of this invention is to provide a convenient and improved shears for pruning shrubbery, designed more especially for pruning or cutting hedges, but applicable to other purposes. The invention consists in a new mode of making four blades work together so as to form three pairs of cutters. The two central blades work together the same as the cutting blades of ordinary shears, but these blades have two edges each. The outer edges work in connection with the branch blades In one of the levers near the fulcrum pin is a recess, and through the other lever a lug rivet, which rivet projects so as to enter the recess and form a stop to limit the action of the levers. By this construction three pairs of cutting edges are formed, and the operator has really three pairs of shears for one pair of handles; but the shears may be made with but one branch blade, and consequently there would be but two pairs of cutting edges.

Improved Vibrating Propellers.

Charles P. Macowitzky, Corpus Christi, Texas.—This invention has for its object to furnish an improved device for propelling steamers, enabling the movements of the vessel to be controlled readily and so effectually that she may be turned almost upon her axis. The device is designed to be placed upon the bottom or sides of the vessel below the surface of the water, and one or more upon each side of the keel. The inner end of the piston rod is screwed into an arm, which passes through a slot in the bottom or side of the vessel, and its outer end is connected, in the manner hereinafter described, with a block or plate which slides in a short slot in the frame. To the outer side of the block or plate is securely attached a rack bar which slides upon the outer surface of the frame, and into its teeth mesh the teeth of small pinion wheels rigidly attached to the paddles. The paddles are securely pivoted to the frame. Two stops are attached securely to the piston rod arm, and strike alternately against other stops, placed between them and secured to the frame to limit the movement of the plate. A screw is swiveled to two lugs. By turning a screw the piston rod arm, and with it the stops, may be adjusted to reverse the paddles. As the screw is turned in the arm the piston rod must also be turned in the said arm to keep the arm in proper position, so as not to interfere with the stroke of the piston. This is done by connecting the screw and piston rod with each other by equal sized and equal toothed gear wheels. The piston rod or screw may be turned from the pilot house by a screw and screw wheel or other suitable gearing. In operation, as the piston rod moves in the proper direction to drive the vessel forward, the first effect is to slide the arm and plate upon the frame, moving the rack bar and projecting the paddles to bear against the water. As the stops strike, the arm plate frame and paddles are all carried along together, the paddles acting upon the water to propel the vessel. As the piston rod begins its return movement the first effect is to move the arm and plate upon the frame. This moves the rack and turns the paddles in a horizontal position, so as to pass through the water with the least resistance. The arm plate, frame and paddles then move on together.

Improved Barrel Support.

Frederick W. Claussen, Mars Bluff, S. C.—The object of this invention is to provide a device by which barrels may easily be tipped over into an inclined position, so that not only the bottom parts of the same are easily reached but also space economized, as the barrels may be placed out of the way under the counters, shelves, or other fixtures. The invention consists of an upright piece of wood pivoted horizontally to transverse ears, and carrying under right angles a strong cross piece, supplied at one end with a vertical support to rest upon when placed in horizontal position. The pieces are so fitted that the bottom of a barrel may be placed on them and follow the motion of the same.

Improved Sink Trap.

Nicholas Wright, New York city.—This invention is an improved sink trap so constructed as to prevent the possibility of the waters being siphoned out, or the offensive gases from the waste pipe escaping through the trap into the room; which shall, at the same time, be easily opened and cleaned when required. By suitable construction, as the water flows through the inlet pipe into the trap, a float rises, raising a valve so that the water can flow out through the outlet pipe. As the water in the trap lowers, the float descends and closes the valve before the water has fallen sufficiently in the trap to uncover the lower end of the inlet pipe, so that it may be impossible for any offensive gas to escape through the trap into the room.

Improved Lock.

Elizabeth Duenz and John A. Duenz, Fayetteville, Ill., administrators of Casper Bodmer, deceased.—This invention relates to door locks having tumblers and dumb levers, and consists in a false bottom having certain slots and notches; in a tumbler having a stop and pivoted to the sliding bar; in a ward having an arm that operates against a pin to swing the sliding bar and tumbler clear of obstructions; in a pivoted tumbler combined with a sliding bar pivoted to a bolt; in a tumbler pivoted to a sliding bar and having a projection working in a notch of the false bottom; in a movable tumbler and stationary plate arranged in the same plane; and, finally, in a vibrating plate that acts at once upon a pin and bolt.

Box for Assorting Peaches.

Edward W. Lockwood, Middletown, Del.—The invention consists in a box constructed so as to separate the leaves from the peaches, and allow them to be hand picked as they are poured into the peach baskets. It consists of two sides and an open slat bottom supported by two frames at a convenient hight from the ground. The box is placed so that the bottom is inclined longitudinally, and so that the peaches will have a tendency to roll from the upper to the lower end. The bottom is made of rounded slats placed at about one inch, more or less, from each other. The peaches, consisting of good and bad together, with more or less leaves, are gathered in baskets and emptied into the upper end of the box. A person stands by the side of the box and picks out the defective peaches as they roll down the bottom, while the leaves pass through the bottom between the slats. The marketable peaches are caught in a basket at the lower end.

Machine for Corrugating Sheet Iron.

Abram Reese and Jacob Reese, Pittsburgh, Pa.—This invention consists in the novel construction and arrangement of a series of corrugating rollers, whereby a sheet of iron is corrugated by passing it once through the machine without cracking or fracturing the iron, and is thus prepared for roofing and siding buildings, and for all similar purposes. The first pair of rollers makes a single corrugation in the middle of the sheet. The next pair of rollers makes two corrugations, one on each side of the first corrugation; and the third pair of rollers makes two more corrugations, one on each side of those already made. The fourth pair of rollers is constructed and arranged to receive all the corrugations made by the three previous pairs, and they correct imperfections and straighten the sheet. The rollers of each pair are geared together at one end; and, at the other end, the pairs of rollers are geared together so as to give all the rollers the proper speed that they may revolve in unison with each other.

Improved Saw Gummer.

Henry Baughman, Dorn's Gold Mines, S. C.—This invention has for its object to furnish an improved machine for gumming saws; and it consists in a vertical frame, secured to its support by a bolt, and another frame suspended to it by suitable means. The emery wheel is attached to the end of the shaft, which revolves in bearings attached to the front bar of the suspended frame, and its rear end revolves upon the point of a center screw. To the shaft is attached a grooved pulley, around which passes the band by which the emery wheel is driven. A holder for the saws is bolted to the base bar of the upper frame. The saw plate is placed at the side of the holder with its rear edge resting upon the shoulders of small flanged eccentric wheels pivoted to the lower part of the side of the said holder, and which are provided with handles for convenience in adjusting them according to the breadth of the saw plate. The pivoted frame is operated by means of a handle or handles formed upon the projecting ends of a side bar. An adjustable guide is provided to limit the movement of the frame, and thus insure the uniformity of the teeth.

Improved Extension Table.

August Herzog, New York city.—This invention relates to a new extension table, whose middle portion is vertically adjustable and made self-elevating, so that when the sliding extension leaves, which are above it while the table is contracted, are drawn apart, such middle portion will spring up and fill the gap between the sliding leaves, thus producing a perfect extended table, and also an unobjectionable form of contracted table.

Improved Car Coupling.

John W. Gillam and John W. Gillam, Jr., Newton, N. J.—This invention relates to a new form of car coupling in which a drawhead is made with opening large enough to insure the entrance of the connecting bar. A square space is formed in the sides of the drawhead, of sufficient width and depth to admit the cross bar, which is firmly held therein by a spring fastened at the back of the drawhead. The connecting bar is a flat piece of metal, with a catch at each end and a narrow rib running across the center from catch to catch, corresponding in hight with the catch, the object of the narrow strip being to prevent the connecting bar from engaging with the rim of the drawhead after being disengaged from the cross bar. The cross bar is recessed out in the center to enable it to properly engage with the connecting bar. An upright piece is fastened to the drawhead, by means of which the catch of the connecting bar is prevented from passing too far back of the cross bar. The lifting bar is fastened to the platform, one end being attached to the cross bar, the other end being under and acted upon by the lever. The lever is attached to the end of the platform, and is so arranged that, when moved from left to right, it forces that end of the lifting bar down and raises the cross bar end up, thus disengaging the cross bar from the connecting bar. When the lever is thrown back to the left the spring forces the cross bar back to position, ready to engage with the connecting bar when the cars come together.

Improved King Bolt for Carriages.

John L. H. Mosier, New York city, assignor to Brewster & Company, of same place.—This invention has for its object to improve the construction of king bolts for platform carriages so as to give a smooth finish to the top plate of the front bed of the top carriage. The invention consists in the cross head formed upon the king bolt, and the corresponding recess formed in the top plate of the front bed of the top carriage, said crosshead and recess being so formed as to correspond and leave the upper surface of the crosshead flush with the upper surface of the said top plate, giving a smooth finish.

Novel Chair Seat.

William T. Doremus, New York city.—This invention has for its object to furnish improved seats for chairs and other articles of house and office furniture, which shall be strong, durable, very elastic, simple in construction, and inexpensive in construction, enabling the manufacturer to work up the waste pieces of lumber derived from other articles of furniture. The improvement consists in an ingenious division of the seat and the placing thereunder, below each division, of compact springs, upon which the seat divisions rest with considerable leverage, the whole forming a substantial, elastic, and superior seat. The invention may be applied in various forms, and is likely to have an extensive introduction.

Improved Seed Planter.

Reuben Friday, Crockett, Texas.—The invention consists in an improvement of seed planters. The plow is adjustably secured to the draw bar so that it may be conveniently raised and lowered. To the draw bar, directly in the rear of the opening plow, is attached an adjustable bar, the lower end of which is made V-shaped so as to press upon the furrow to receive the seed. To a shaft, which revolves in bearings on the frame near its ends, are attached two circular disks, in the outer part of the inner sides of which are formed zigzag grooves to receive the ends of the plates that form the body of the dropping cylinder, and thus make said body star-shaped in its cross section. The outer edges of each pair of plates meet at the circumferences of the disks, and are secured in the latter by metallic bands. One of the plates is made detachable, a notch being formed in the bands so that it may be slipped out to form an opening for the convenient insertion of the seed. In the center of the salient angles of the dropping cylinder are formed holes of such a size as to allow the proper amount of seed for a hill to pass out, the edges of the plates at the holes being notched to allow a cleaner to clean out any soil that might enter said holes and clog them. Two curved spring bars are adjustably attached to the frame, and to their rear ends are attached the ends of the covering bar, which is held down upon the surface of the ground with sufficient force to cover the seed. The middle part of the under side of the said coverer is concaved, to give the proper form to the top of the ridge or row.

Improved Safety Valve.

Henry Davies, Newport, Ky.—This invention has for its object to furnish a device for automatically regulating the pressure of steam, gases, fluids, etc., without regard to the pressure in the boiler, generator, or reservoir, or to the amount passing through the machine. A polygonal dish-shaped recess is formed in the upper part of the body of the device. A double beat valve closes and opens the ports leading from the valve chamber at the opposite ends of the valve. A diaphragm of sheet metal rests upon the edge of the dish and is secured. Radial or triangular plates rest upon the diaphragm, and their base ends or sides enter a rabbet in the lower inner edge of the securing ring. The small ends or apexes of the radial plates reach nearly to the center of the dish, where they are secured in place by the collar upon the collar pin, the lower end of which rests upon the center of the diaphragm. The outer ends of the plates are rounded off, and their inner ends are rounded off and grooved to enable them to move easily with the movement of the diaphragm. The pin is held down by a lever and weight and passes up between two brackets formed upon the ring. The pivot of the lever is a knife edge, and the upper end of the pin is conical or pointed, so that the lever may work upon its bearings with the least possible friction. The valve is made in two parts, connected together by a stem to which they are secured. The upper end or head of the stem passes through a guide in the valve seat, which is made in the form of a bushing to allow the upper part of the valve to be inserted. The upper end of the bolt or stem abuts against the center of the diaphragm directly beneath the lower end of the collar pin. The other or lower end of the stem, below the nut, is made smaller, and extends into and works in a guide hole in the cap that closes the opening through which the lever part of the valve is introduced. In using the device, the weight is adjusted into such a position upon the lever that it will require exactly the required amount of pressure upon the diaphragm to raise it. The upper part of the valve is made the larger, so that, were the valve left free and steam introduced, the valve would be closed by the steam pressure. The valve is pressed down and opened by the pressure of the weight pressing the diaphragm down upon the upper end of the stem. As long as the steam pressure on the dish is equal to or less than the amount determined upon, the valve will remain open and the steam will flow continuously. Should the pressure in the dish at any time exceed the amount determined upon, it will raise the diaphragm, allowing the steam pressure to close the valve until the pressure in the dish has been again reduced to the desired amount, so that the pressure in the dish, and consequently in the passage, will be kept always the same, whatever may be the pressure in the boiler.

Improved Journal Box.

Samuel Aland, Rome, N. Y.—The first part of the invention consists of a tubular box with a ball at the center for being confined in a socket; also, for having a chamber for containing oil to lubricate the journal, with passages for the oil to the journal box cast in one piece, whereby it is more durable than those composed of a tube fitted in a large hole in the shell of the box, and it can be made cheaper. The second part of the invention consists of a socket in the end of the box with a discharge passage from the bottom adapted to receive the drip escaping from the end of the box and conducting it to a receptacle, and a groove in the face of the shaft behind the shoulder of the journal, which prevents the drip from escaping along the shaft.

Improved Hand Stamp.

George H. Rountree, Milwaukee, Wis.—This invention consists of a hand stamp in which the stamp head is pivoted between two bars at one end, which at the other are pivoted to the base plate between the stamp pad and the inking pad, so that, as the stamp is raised up from one pad, it swings over to the other, and *vice versa*. One of the said bars has a pawl, which turns the inking pad to present fresh surface to the type at each operation. The object is to avoid the use of the expensive inking ribbons employed in the stamps now commonly used. It is a very simple and effective stamp, cheaply made, and neat in appearance.

Value of Patents,

AND HOW TO OBTAIN THEM.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Larger inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

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HOW TO OBTAIN *Patents*

This 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?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows and correct:

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Preliminary Examination.

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Wanted—The address of Franklin H. Brown, inventor, who in 1870 was residing in Chicago, Ill. Address P. O. Box 232, Hamilton, Canada.

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Manufacturers of Chair Stock Machinery, please send price list to F. Higel, 320 E. Cumberland Street, Philadelphia, Pa.

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Notes & Queries

O. P. S. wants to know the best process for tempering locomotive springs.

A. McG. asks how to find the bevel on the backs of the posts of an octagonal church spire.

F. A. S. asks: How can a small round hole be made through a pane of glass without the use of a diamond?

S. H. S. asks for the best and cheapest way to manufacture lime from the common limestone, and how it can be done on an extensive scale.

W. H. F. would like to enquire how to redye with cochineal. "I have some flannels dyed in this stuff, and by accident it has nearly all been taken out."

J. F. G. asks: 1. How can I bleach Mediterranean rice shells that have burned yellow or a dull color. 2. How can I plate iron wire with nickel without the use of a battery, and what is the solution?

H. N. S. asks: What is the best substance known for coating iron patterns so as to cast on a chill and obtain the best surface in hard brass or composition? We have used black lead and oil, but not with very good results.

H. H. asks: In boiling sugar to say 300° Fah., is it economical in point of fuel and time to use air tight vessels, pumping off the vapor as soon as formed? At what temperature will steam readily boil liquids to 400° Fah.?

R. P. asks: 1st. What is the best preparation of paint, for engines or other hot surfaces, that will not scale off? 2d. What is the best kind of varnish to use on an engine cylinder, enclosed in what is called a wooden jacket? 3d. What is the best mode of preparing an iron cement for joints of safety valves?

J. M. asks for a rule to calculate the proportion of suction and discharge pipes to pumps (for different sizes of cylinders.) "I have 3 or 4 five inch cylinder pumps, 15 inches stroke, under my charge, and I would like some one to give a rule to find the size of both pipes."

A. W. P. asks: Is there any process whereby an oilstone can be softened? I have in the last few years bought four or five of the most celebrated oilstones in this country, but I have been rather unfortunate in selecting. After a little use they all proved to be too hard, and rubbing a tool on them is like rubbing on glass.

J. H. W. says: Is there a probability of giving a fan mill too much speed? If so, what speed should I give a fan 30 inches long and 20 inches in diameter, so as to make it send the proper draft of air? The draft is required to be very strong. What diameter is preferable for a fan to blow a strong draft of air?

E. L. asks: What is the mode of operation of a hydraulic apparatus seen sometimes in store windows, etc., as a curiosity? It consists of a glass tube bent in elliptical form put into a grotto or fountain, with its major axis towards the zenith, and different colored fluids ascending and descending with regularity. How are the fluids put in motion, and how are the different colors kept separate in ascending and descending?

W. U. says: We have some trouble with a boiler which foams. We dug a well and got water in plenty, but when we used it the froth would discharge through the safety valve with but 60 lbs. of steam. We then built a pond in a running brook some distance off, and brought the water through pipes which gave immediate relief; but the pipes got clogged so there was no passage. We again tried the well water, but it seemed to foam worse than ever. I would like to know the cause and the best preventive.

ANSWERS TO CORRESPONDENTS

V. P. sends a mineral and asks what it is. Answer: Iron pyrites; it is of no special value.

A. A. F. says, in reference to the extinction of fires by steam, that he has known an instance of it by opening the safety valve of a boiler. This filled the building with steam and saved it from destruction.

C. H. encloses specimen of ore, of which he would like to have name and value. Answer: The specimen is too small to allow reliable tests, but it appears to be tourmaline.

E. B. G. says: Enclosed please find two specimens. What are they and of what value? Answer: The white stone is a fine grained sandstone containing some clay, and might be useful as a "fire stone." The other is zinc blende.

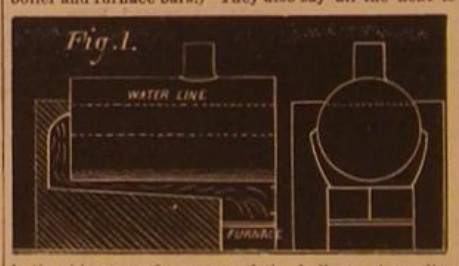
A. C. R. sends a mineral specimen and asks what it is, and if it could be polished so as to counterfeit diamond. What is the value of it? Answer: It is limpid quartz, and would not make so good a counterfeit as French paste.

A. R. G. sends a stone, found in a vein of coal, and asks what it is. Answer: It is a pebble of quartz.

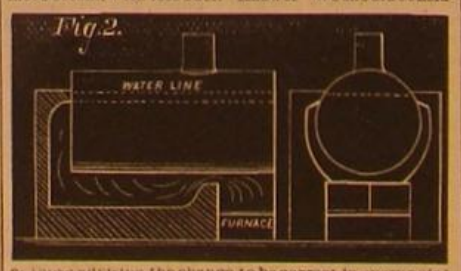
A. B. sends three specimens and asks what they are. Answer: The specimens are blue clay, graphite and brown hematite.

O. says: What will be the probable cost of a visit to the Vienna Exposition by a not wealthy young man, starting from and returning to New York, stopping in England to look at some of their shops? Please give the best route. Answer: A good route to Vienna is *via* Glasgow, Edinburgh, Manchester, Birmingham, London, Paris, Lyons, Turin, Venice, Trieste, Vienna, and back *via* Munich, Frankfort, Brussels, Rotterdam and Hamburg or Bremen. Take a map and select a route that meets the special case. There are dozens of routes, direct and indirect. As to cost, see answer to another correspondent. Go with an old traveller, if possible, and especially if not able to speak French and German fluently.

A. S. says: I send you sketches, Fig. 1, of our boilers as they now stand, and Fig. 2, as some practical builders and engineers say they ought to stand. They say the bricks are built too close to boiler after passing the bridge, (the furnace is 18 inches between boiler and furnace bars.) They also say all the heat is



in the chimney and none round the boilers. According to their recommendations, Fig. 2, (1) there ought to be a pit after passing the bridge, to allow a certain kind of gas to get down until mixed with air, then it will burn; likewise to allow a person to get under to examine the bottom of boiler. 2. The furnace should be at least 27 inches deep between bottom of boiler and bars, to allow a larger fire, to get more heat out of the same fuel. 3. The brick wall ought to be 32 inches at least, to confine the heat to the boilers. 4. The space up the sides of the boiler ought to be open nearly to water line. They say, by the above alterations, we shall have more heat and more steam, with less fuel. Answer We should consid-



er those advising the change to be correct in every point, provided it is found that the heat in the chimney is now excessive, and that the gases are not thoroughly burned. Suspend cuttings of good tin, lead and zinc separately in the middle of the chimney. If the tin remains unmelted the temperature is low enough for good draft; if the lead melts, it may be still within fair limits; if the zinc melts, it is certainly considerably too high, and money is expended in the chimney. A large combustion chamber behind the bridge wall is usually found of great value in securing perfect combustion of any carbonic oxide and smoke that might otherwise be wasted.

D. A. M. asks: What is the horse power of a cylinder boiler 24 feet long and 30 inches in diameter, and what is the rule by which you compute the same? Answer: The power of such a boiler is generally estimated at about 20 horse. The rule in use among old engineers allows a horse power for each cubic foot of water evaporated per hour, but builders are now oftener allowing but one half that quantity, as a good engine should not use more than 30 pounds of steam per horse power per hour. With well proportioned tubular boilers the total heating surface divided by 12 will give the horse power, very nearly, on the latter basis. With cylinder boilers, the heating surface is much less in area and is nearer the fire. Their performance may usually be estimated by dividing the pounds coal burned per hour by four or four and a half, for long and for short boilers respectively.

C. F. E. says: An artesian well in our neighborhood was recently put down in the following manner: A 6 inch pipe is driven down for 84 feet, or until it strikes bed rock, then a hole is drilled of the same diameter 234 feet through the rock, making a total depth of 318 feet. Here we stop in shale, with the well flowing at the rate of 11 gallons per minute, which has not increased or diminished for about two weeks, or since we stopped drilling. This well is intended to supply the steam fire engines. The engines have a capacity of 600 gallons per minute, but the well will not supply over one tenth the amount required. A neighbor says: "If you drill a hole through the top of the hydrant and then let down a tube 35 feet long, say two inches in diameter, and carefully solder it at the top so as to admit of no air passing between the joint formed by the tube and hydrant, you are enabled to raise the water to a depth of upwards of thirty feet; and as I have good reasons for believing that the well will maintain its hight at not exceeding fifteen feet from the surface, you will thus be supplied with an inexhaustible supply of water, and it will not cost to exceed ten or fifteen dollars." What I wish to know is, shall I be able to raise any more water with the pipe in as he proposes, or less? My own opinion is that air would get in. The water contains considerable salt, a little more than sea water. Is it fit to use in a boiler? The engine contains about the usual number of tubes. Answer: Our correspondent has very sensible views of the case; the writer of the slip which he encloses cannot be as highly complimented, we think. Such salt water, if used in steam engine boilers, with even careful and frequent blowing out, would be apt to destroy them.

F. R. M. says: A party claims to have made a discovery in tempering steel implements, and some millers, for whom he has sharpened and tempered picks, claim that one pick thus tempered is equal to 20 ordinarily tempered, and that, notwithstanding they are hard enough to cut glass, they do not break, but are hard and strong. I want to know what chemicals enter into steel to give it these qualities? How do manufacturers of edge tools temper them, and cutlery, etc.? I want a process of tempering steel that can be utilized in dressing mill picks, mining drills, picks, etc. Answer: We have little faith in quack medicines for steel. Look through these columns in back numbers of the SCIENTIFIC AMERICAN and select the most promising of the many recipes there published.

S. F. P. says: At what point in a perpendicular tube 38 inches in diameter and 20 feet in hight, fully supplied with water, should a turbine wheel be placed to be most efficient in driving machinery? There is a turbine wheel in this vicinity set at about the middle of such a tube, but it does not seem to give the power that the stream ought to furnish. Would there be a gain in placing it as near the bottom of the tube as practicable, and if so, what percentage? Answer: With the lower end properly sealed against the entrance of air, a wheel of the Jonval class should give equally good effect at any point of the tube. With any such wheel, there could not be expected a gain by change of position. Test the wheel with a dynamometer, or get some competent engineer to do it, and thus determine precisely the value of the wheel. If the effect is not what it should be, throw it back upon the hands of the builder, if he cannot make it efficient.

M. says: I have a small steam boiler 12 inches diameter x 30 inches long. It is horizontal, with no flues. The plates are ¼ inch thick. How many pounds steam can it stand to the square inch? What diameter of cylinder, and what length of stroke should I make to suit the size of the boiler, to run 100 revolutions per minute, and what amount of horse power would it be? Answer: If new and well made, such a boiler would either blow out the heads at some very high pressure which can best be determined by cold water pressure, or give way in the longitudinal seams at about 1,100 pounds. We should be inclined to load its safety valve to 200 pounds, and to put a stay rod through the middle of the heads to prevent their springing under pressure. It is too small to estimate power with accuracy. Perhaps a two inch cylinder, 6 inches stroke, may give, with a good fire under it, a half or three quarter horse power. Such toy boilers are not economical in fuel.

J. P. R. H. asks: I. Can water be confined in a boiler until it attains a red heat, or nearly so, without danger? What will be the pressure per square inch? 2. I have read in the SCIENTIFIC that water deprived of air will explode or all evaporate suddenly; is not that the cause of explosions, or is it untrue? 3. I would also like to know if I can make a grout or gravel wall out of sand or fine gravel, suitable for a foundation, as stone and brick are scarce and costly. What process is best? 4. What is used as a bath for tempering steel for tools and how is the steel worked before tempering? Answers: 1. The pressure of water confined at a red heat would be too great to be controlled by known materials. We cannot tell how much it would be. 2. Such an action may have caused some explosions, but we have shown in an earlier number of the SCIENTIFIC AMERICAN that it is improbable that it is a frequent cause. Look through our back numbers. 3. By working it as dry as possible and properly ramming it, grout can be made an excellent foundation, not only for an ordinary wall, but for as heavy a structure as a blast furnace. 4. Recipes and methods for tempering tools may be found described and discussed in nearly every number of this paper.

J. G. S. says: I would like to know of something, other than water, to stop the formation of electricity in leather rubbers on machine cards. 2. Are compasses which describe a circle with a pencil, instead of scratching, patentable; one arm being like ordinary compasses, and the other having a sleeve on it to hold a common carpenter's pencil, and a thumb screw to hold it tight? Answers: 1. We know of no practical device for the purpose. 2. The device is very old, and is in daily use in every drafting room.

A. H. C. asks: 1. What objection would there be, if any, to feeding a boiler through the back head, extending the feed pipe within the boiler, say ten feet, with holes drilled in pipe for feed water to escape, the end being closed, and pipe six inches above bottom of boiler? 2. What is the rate of passage from New York to the Vienna fair and back? Answers: 1. This has been done, and there is no objection, so far as we know. 2. From $200 to $300 according to route proposed. Allow $10 per day for whole time proposed to be spent on the excursion and the result will be probably satisfactory. An old traveller, and an economical one, will do it on $7. An extravagant and inexperienced excursionist will spend as much above the upper figure as his letter of credit will allow.

S. H. M. says: Will you inform me if it makes any difference in the power of a turbine wheel whether the water comes into the penstock at the bottom (breast of the wheel) or from 3 to 5 feet above the wheel? Answer: Not unless the current created by the proposed arrangement check the wheel. The head is, of course, the same in either case.

J. S. P. asks: 1. Where can an incubating machine be had? Is it patented in the United States? 2. I would like to know something more of Adamson and Simonin's process for preserving food. Can you give their address? 3. What kind of cane is used for making paper, and how is it prepared for market? 4. Is there such a thing as a practical drag saw, worked by power, horse or steam, for cutting up trees in the woods where they fall? 5. I have a plain cylindrical boiler 28 feet long by 30 inches diameter; it takes too much wood to keep up steam to 60 lbs. Will it be right to run a small flue of brick on top of the boiler back to the end over the fire-place, and discharge the smoke and heated air through an 8 inch pipe? Will it not make drier steam? Will it injure the boiler in any way, and will it be safe? Is superheated steam any advantage where the engine has only a plain slide valve? Answers: 1. Yes, but we do not know the address of any professional incubator. 2. Address W. Adamson, or C. F. A. Simonson, Philadelphia, Pa. 3. Attempts have been made to utilize nearly every kind of vegetable material, the bagasse from sugar cane included. We do not know of a successful process of manufacture from the latter, however. 4. We do not know of one, but believe that such a machine is used. 5. Carrying a flue over the top of a cylindrical boiler as proposed would probably accomplish the result desired. It would utilize the heat of the gases of combustion more thoroughly, and would make dry steam. We have seen this arrangement used for years with shavings as fuel, with success and without apparent injury to the boiler. We should feel unsafe, and should not advise it, as we should fear that the upper portion of the boiler, unprotected by water, might become overheated and weakened. Dry steam is economical with every form of steam engine.

J. V. H. N. says, in connection with his query as to the working of a turbine wheel, which we answered on page 90 of our current volume: Another question arises: My turbine is a 3½ inch wheel of perfect construction, located 15 feet above the main street, and fed by a three inch pipe. The discharge pipe is, according to your conditions, a perfect draft tube, and is three inches in diameter. The head of water is over 90 feet. The discharge opening in wheel is much less than 3 inches. How can I prove that the tube is full of water? Again, if my theory that the tube must be full of water is incorrect, will not placing the stop valve at the lower end of the discharge pipe keep the pipe full of water when it is opened only so far as to give the entire power of the wheel? Answer: Tap the tube at the lower end and insert a small pipe, bending its inner end upward, and attaching to it, outside, a pressure gage. It will indicate a pressure due to the equivalent hight of water in the pipe. The stop valves must check the flow of water seriously. We should set the wheel as low as we could conveniently, in any case, and, where velocities are as great as they must be in this case, should use either plug cocks or gates to give a straight course for the water.

J. C. W. says: I wish to know the striking force with which a string of tubing suspended in an oil well would strike the bottom, if let fall. Suppose the well is 1,400 feet deep; we have 900 feet of 2 inch tubing, weighing 4 lbs. to the foot, suspended from the top of the well; the tubing has consequently 500 feet to fall, with no appreciable resistance from the atmosphere, as the tubing is open at both ends, and we suppose a case where there is no liquid in the well. To illustrate the principle, can you inform me what is the striking force of a body weighing one pound, falling or moving at the rate of ten feet per second? Answer: Read our article on pile driving on page 208 of the current volume. The tube is a pile and its ram combined. The striking force may be any figure. It will depend upon the nature of the resistance. The work done in stopping it must be its weight, 3,600 pounds, multiplied by the distance fallen through, 500 feet, equal to 180,000 foot pounds. If, by crushing itself and by cutting into the bottom, it is checked in one foot, it will exert an average force of 180,000 pounds. A body weighing one pound, moving 10 feet per second, will do $1\times10\times10\div64\frac{1}{2}=1{\cdot}55$ foot-pounds of work before it will stop. If stopped in one foot, it will exert an average force of 1·55 pounds, if if stopped in one inch the pressure will be $1{\cdot}55\div\frac{1}{12}=18{\cdot}60$ pounds.

W. H. W. says: "On page 145 of your current volume, there is an article headed collapse from low water in steam boilers, which is so much at variance with what engineers have been taught that it at first created surprise. I have thought that the majority of explosions occurred from the want of water, and I know that a great many more are of the same opinion; but coming as it does from such authority as the SCIENTIFIC AMERICAN, it can scarcely be doubted. In a pamphlet sent out by H. & F. Blandy, of Newark, Ohio, it is said that water coming in contact with red hot iron creates a gas ten times as explosive as the best gunpowder. How are we to reconcile the two statements? If your statement is correct, how are we to account for the terrible damage and total destruction done to some boilers that have exploded during the past year? I have long been of the opinion that the pressure generally carried by boilers is not sufficient to tear the plates apart." Answer: As was remarked in the article referred to, our correspondent is one of many who have held similar views. We hope that we have been of some assistance in the good work of presenting correct views on so important a subject. Our article on "Explosions Produced by Low Water," page 121 of this volume, will show how far the circular referred to is founded upon fact. Look up a copy of the *Journal of the Franklin Institute* for March, 1872, and read the paper quoted in our article of March 15 on the "Colburn Theory." It exhibits very distinctly the fact that few can conceive the fearful amount of destructive force pent up in a steam boiler, under even *low* pressures.

R. L. D. says: We have had considerable bother in an old flouring mill, by a heavy jar and backlash on the machinery, the engine seeming to backlash and bind on one half of her stroke, travelling south to north. The timber which carried the plummer block and journal was badly held, shifting ¼ of an inch. This journal and timber is situated in the mill, and of course too close to the driving wheels and upright shaft. On lining up the engine, she proved to be five sixteenths out of line from cylinder to wrist. I claim that the jar and backlash is caused by the engine being out of line and binding from the wrist to the cylinder, and that the movement of timber and journal in mill is only the effect, the cause being in the engine. Another mechanic holds the view that the backlash is caused solely by the moving of the timber binding the cogs, said cogs having a clearance of ¼ an inch. Which is right? Answer: Such an action might be due to the engine being out of line, or it might result from the closing of the port too early at one end of the stroke, thus confining a little water upon which the piston may strike. We know of one case in our experience in which the trouble was found to be produced by the piston running by the port, closing it up, and then striking on the confined water. Had we charge of the engine, we should take off both cylinder head and valve chest bonnet, expecting to find something wrong in one or the other place. Failing these, we should certainly "line up."

C. C. says: I have been using coal for an engine but am now using coke, and find it much cheaper, and can get up steam a great deal sooner. Is the coke more injurious to the boiler or grate than the coal? Answer: Coke is prepared by submitting bituminous coal to the action of high temperature until all volatile matter is expelled. Sulphur is driven off among other elements, and as this is the only constituent of bituminous coal which injuriously affects iron, the coke is a better fuel than the coal. Coke makes an intense, clear fire, and it should not be forced so as to injure either boiler or grate by burning the iron.

R. S. asks: What are meant by the lead and lap of an engine, and do all engines require the lead and lap? Answer: The lead of an engine is the amount of opening of the port when the engine is on the center. It is greatest in highspeed engines and is given for the purpose of securing full pressure in the cylinder at the beginning of stroke. Some engineers of high reputation doubt the expediency of giving lead in any case. Lap is the amount by which a slide valve extends beyond the port when it stands at the middle of its throw. It enables expansion to be obtained to the extent of from one fourth to one half stroke. The valve of nearly all engines fitted with the common three ported slide have both lap and lead.

A. A. R. says: Is there any way of preventing the action of iron upon copper, and *vice versa*? I have noticed that where there were small copper pipes in contact with iron, they would be eaten out in two or three years; and if large the action would be more on the iron. If there were some way of stopping this action it would be a great benefit to steamboat men. Answer: The action described has annoyed engineers for many years. We know of no way to avoid it, where both metals must necessarily be used. There are few cases, however, in which one metal cannot be used alone.

E. W. asks: 1. Please inform me where I can get a piece of lodestone the size of a hickory nut. 2. Suppose a boiler contains 60 pounds of steam to the square inch. Now attach to the boiler a one quarter inch pipe and connect it to a steam tight cylinder 12 inches in diameter and 24 inches long, made of No. 18 iron. Will the pressure through such a small tube be sufficient to explode the cylinder, or, in other words, if it would bear the pressure, would the cylinder contain the same as in the boiler, 60 pounds to the inch? Answers: 1. Of any dealer in philosophical apparatus. 2. The pressure would be equal in both.

R. F. J. says: How much does clothes line wire (No. 9) and telegraph wire (No. 9), the first annealed and galvanized, expand or contract by heat and cold at ordinary atmospheric temperatures, per foot, yard, or rod? How heavy a weight, hung at one end of a line of such wire, 40 rods in length, would be required to keep it reasonably taut, provided the wire passed through enlarged holes in iron supports placed about 10 feet apart? Answer: The amount of expansion would depend upon the quality of the wire. No two wires expand precisely alike. The average coefficient of expansion for the range of temperature from the freezing to the boiling point is given by different authorities as follows: Lavoisier and Laplace, 0·00122; Dulong and Petit, 0·00118; Borda, 0·00116; Muller, 0·00122; U. S. Ordnance Manual, 0·00126; Tyndall, 0·00123; Boutan, 0·00122; Ganot, 0·00122. For practical purposes, take it at seven millionths (0·000007) of the length for each degree Fahr.

G. W. L. asks: What percentage of power is lost in a steam engine by the use of the crank? 2. Has the crank the same power at all points of the stroke? 3. Do you know of any rule or formula for determining the position of the piston when the center of crank is plumb with center of shaft? Answer: 1. None. 2. No. 3. When the crank stands on the half center in a direct acting engine, the distance of the piston upon the back end of its path is obtained by adding, to the half stroke, the product of the length of the connecting rod into the versed sine of the angle which it then makes with the center line of the cylinder.

J. M. D. says: 1. How is it that, in pressing car wheels on to axles, if the shaft be pressed into a wheel and the gage indicates 1,500 pounds pressure, and if two wheels are pressed on at once (the sizes and bores being practically uniform) the gage will indicate the same pressure? In other words, why does it not take double the pressure to press on two wheels that it does one? 2. What causes the colors on steel when tempered? Answers: 1. For the same reason that, if a spring balance were attached to each end of a line, and if a man at each end were to pull with a force of 100 pounds, each balance would indicate that pressure. The same pressure of 1,500 pounds acts on both wheels, and each yields at precisely that pressure. 2. The surface oxidizes and the rapidly changing film of oxide gives the colors noted.

C. M. asks: Does a locomotive standing still on the track require more steam pressure to start while the wrist pin is at the lower point between the rail and the axle of the wheel than when it is at the top of the driving wheel? Answer: Were the steam cylinder secured to the earth, it would start the engine with lower steam if its crank pin were above the axle. In actual practice, however, the two positions are equally favorable, since in each case the work of moving the engine is the same, and the product of the steam pressure into the distance moved by the piston will also be the same for, say, an inch of movement of the locomotive. The fact that the cylinder is carried upon the locomotive, moving with it, is sometimes overlooked in considering the problem. The pressure on the crank shaft bearings is, however, greatest where the crank pin is above the axle, and least when the pin is beneath. In the first case it is made up of the sum, and in the second of the difference, of the two forces, the one being the effort of the engine and the other the resistance of the track.

F. H. P says (1) that an engine, with a plain centrifugal governor, without cut off, now running at 60 revolutions per minute, with a pressure in the boiler of 60 pounds, will continue to run at exactly the same speed, doing the same work, if the pressure is increased to 120 pounds. 2. He also says that, if the speed is changed to 120 revolutions, the governor will continue running at the same speed (58) to govern the engine. L. G. S. says it will not. Who is right? Answer: 1. The ordinary centrifugal governor, or fly ball regulator, will not keep the engine precisely at speed with varying steam pressures. It is because of this fact that there have been many regulators of other forms invented, as those of Babcock and Wilcox, Huntoon and others, in this country, and that of Farcot and others in France, of Rankine in England, etc., all with a view to the avoidance of this objection to the ordinary governor. They usually have been of the class known as parabolic governors. Our Patent Office contains many models and drawings of such devices. 2. A governor may be made to regulate at any desired speed.

L. A. G. says, in answer to J. E. G., who asked about power in drawing a dray with a long rope: The experiment should be made on a level plane, and the rope should be fastened to the weight at a point exactly level with the hame rings, otherwise the weight will be partially lifted, thus reducing the friction between it and the ground, especially when a "close hitch" is taken. When in this position, the horse sustains half the weight of the rope; the other half helps to increase the weight to be overcome; this is rendered plain by supposing the rope to be stiff enough to prevent sagging. The weight of rope which the horse sustains does not act in opposition to the power he is applying, so that it is only that half of the rope nearest the weight which opposes the draft; and were it not for this one obstacle, it is impossible that the distance can make any appreciable difference.

S. P. S. says to E. B., who asks if an achromatic telescope will answer for the telescopic portion of a spectroscope: Perfectly well, but I should prefer to remove the erecting lenses and thus most likely shorten the instrument considerably. The best cheap spectroscope that I have ever seen was constructed by Professor Wing, of Cornell University, with the lenses taken from an old opera glass; one of these was used for the collimator and the other for the telescope, a bisulphide of carbon prism being employed.

S. P. S. says to S., who wants a good white preservative for wood work on buildings which are exposed to sulphuretted hydrogen: Zinc white, if pure, will answer the purpose. Much of that which is sold as zinc white contains lead. A mixture of zinc white and baryta, without any lead, is extensively used for shipping and does not change by contact with sulphuretted hydrogen.

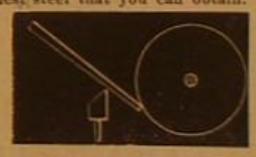
D. M. D. & Co. send a piece of boiler scale, and ask what it is. Answer: The incrustation is sulphate of lime.

J. H. M. says that W. H. F. can cleanse his hands by taking a piece of curled hair the size of a fist; run a needle and thread through to hold it together. Flatten it and rub soap in; and with a little experience, W. H. F. will have as clean hands as any one needs.

T. K. B. says, in answer to W. H. F., who wants something to take the grime off his hands: Wash your hands right in lubricating oil, next in water (letting the oil remain on your hands). After rubbing well, you will find your hands become soft; then wipe with waste. Then use the other recipe, soap, water, and elbow grease.

W. L. T. says, in reply to H., who asked for a remedy for corns on horses' feet: Put on a bar shoe and cut down the bar and crust so as to throw all the pressure off them on to the frog; you will find first that the sensible sole is relieved of the constant pressure which the crust bears upon it laterally, and second, that the jar on the frog, communicated through the shoe from the ground, has a great tendency to secrete healthy horn. The smith should therefore pare down the heel crust, so that, when the bar shoe is applied, it will allow a penny piece to be insinuated between the two surfaces; and in about three months, the heel will grow up and take its own share of pressure. In the mean time a little of the following lotion may be applied daily to the corn by means of a feather: Chloride of zinc, 1 dram, water, 6 ozs., glycerin, 2 ozs., mixed. The cause was, as is usually the case, defective shoeing.

S. P. S. says, in answer to F. H. Q., who asked how to harden steel for turning solid emery wheels: You will most likely find that you can cut your emery wheels much faster with a bar of soft iron than with the hardest steel that you can obtain. The rest



should be placed a little below the center of the wheel, and the iron held as in the figure. The wheel of course runs towards the operator. The theory of the operation seems to be that the particles of emery become imbedded in the iron and then react on those still remaining in the wheel, on the same principle that diamond dust on a soft wheel is employed in cutting diamonds.

J. B. J. replies to W. H. who asked about a coöperative society, that Fall River Workingmen's Coöperative Association, Mass., is in operation.

S. P. S. says that J. L. S, who asks how to make soft water hard, should dissolve some lime salt in it, the chloride for instance.

[OFFICIAL.]

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WERE GRANTED FOR THE WEEK ENDING

March 11, 1873,

AND EACH BEARING THAT DATE.

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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:

24,867.—ORE SEPARATOR.—W. O. Bourne. May 28.
24,493.—FUENACE DOOR FRAME.—P. A. Sabbaton. June 4.
25,153.—CARDING ENGINE.—S. Wetherhed. July 30.

EXTENSIONS GRANTED.

8,589.—MACHINE FOR MAKING KETTLES.—H. W. Hayden.
8,589.—BRASS KETTLE.—H. W. Hayden.
23,320.—BOILER WATER SKIMMER.—A. M. Sprague.

DESIGNS PATENTED.

6,490.—LAMP STAND.—D. Mosman, West Meriden, Conn.
6,491.—WORK HOLDER.—R.W. Perkins, W.Meriden, Conn.
6,492.—LOUNGE.—J. B. Rohrer, Philadelphia, Pa.

TRADE MARKS REGISTERED.

1,160.—SOAP.—J. S. & T. Elkinton, Philadelphia, Pa.
1,161.—SHIRTS.—T. J. Irving & Co., Baltimore, Md.
1,162.—RUBBER HOSE AND BELTS.—National Rubber Co., Bristol, R. I.
1,163.—PUBLICATIONS.—F. & J. Rives, A. Bailey, Washington, D. C.
1,164.—BOOTS AND SHOES.—T. W. Seaverns, Jr., West Roxbury, Mass.
1,165.—MAIZOLA.—Warder & Cooper, Valley Junction, O.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
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TAKE NOTICE.

BOSTON, MASS., March 15, 1873.

The Suit in Equity in the United States Circuit Court of Massachusetts—ALONZO GEAR *et al.* of Boston, Mass., *vs.* JONATHAN P. GROSVENOR *et al.*, of Lowell, Mass—after a long and thorough investigation, has been decided in FAVOR OF THE PLAINTIFFS, and a Decree for a Perpetual Injunction, establishing the validity and ownership of the Patent, has been accordingly entered. All persons who have built, used, and sold Variety Moulding or Upright Shaping Machine, are hereby notified that amicable settlement can be made by promptly addressing
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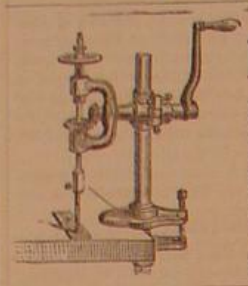
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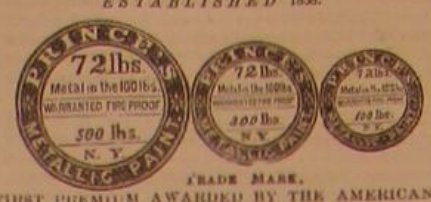

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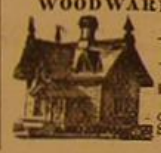

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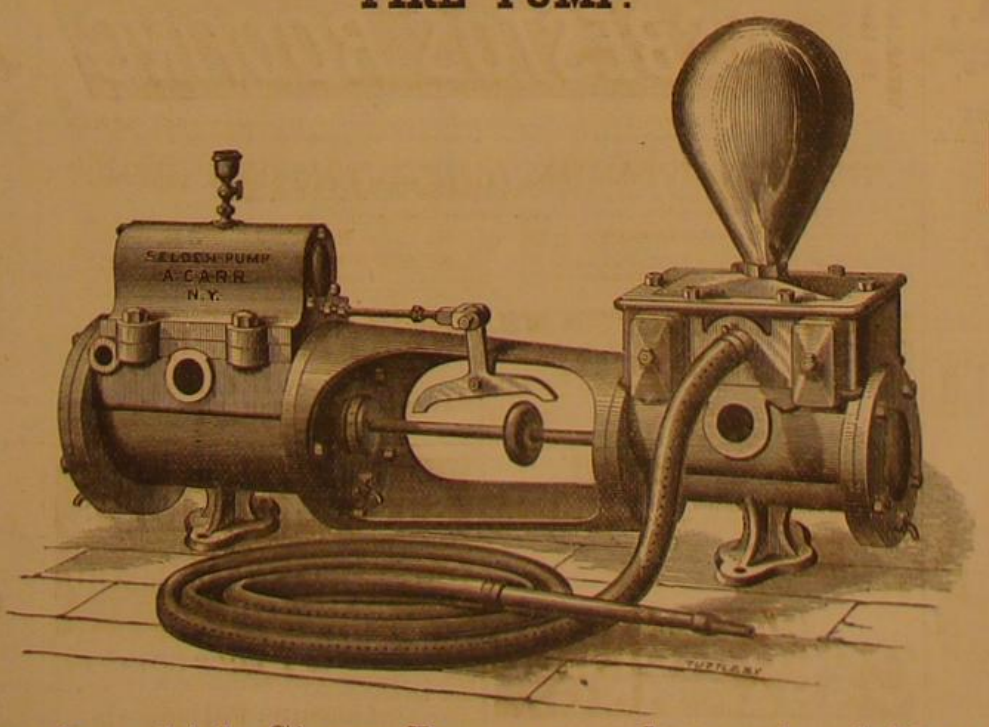

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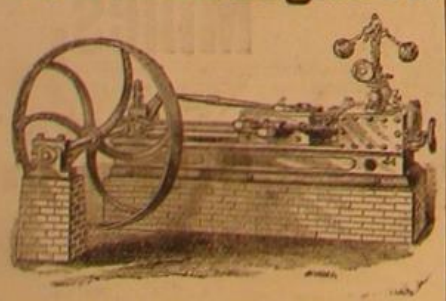

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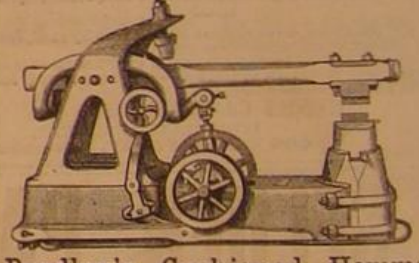

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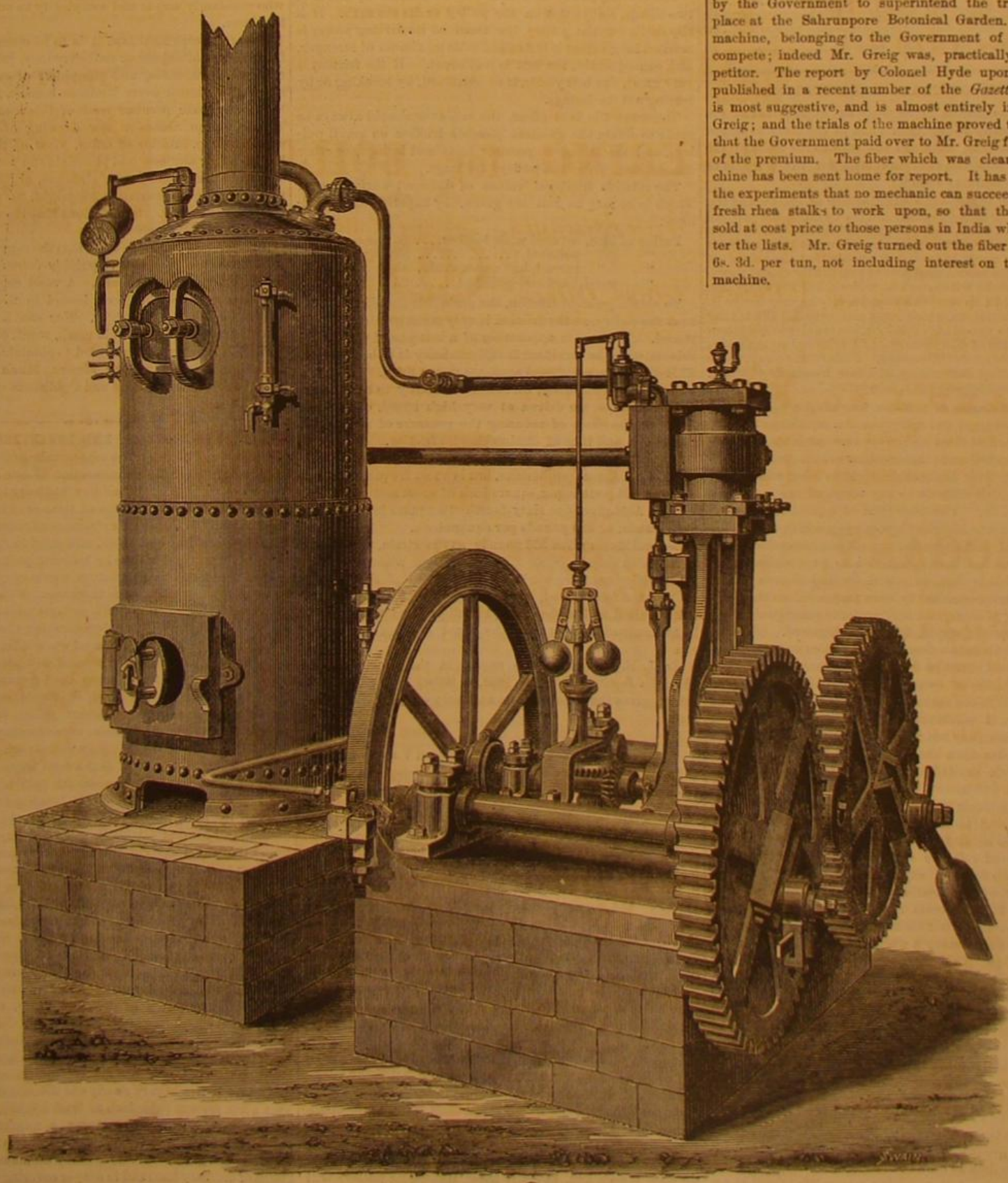
Vol. XXVIII.--No. 16. [NEW SERIES.] NEW YORK, APRIL 19, 1873. [$3 per Annum, IN ADVANCE.

STEAM PUMPING ENGINES FOR INDIA STATE RAILWAYS.

We herewith illustrate one of the pumping engines just completed by Messrs. Hathorn, Davis & Campbell, of the Sun foundery, Leeds, England, for India State railways. These engines, says the *Engineer*, from which our engraving is taken, are of the vertical type, with six inch cylinders and eight inch stroke; the pumps are worked by means of a spur pinion on the crank shaft, and spur wheels on the countershafts; the pump rods are fixed to the spur wheels in such a way that the stroke of the pumps can be lengthened or shortened at pleasure. The engines run at 165 revolutions per minute, and the pumps at thirty revolutions. The pumps, two in number, are double acting, five and one quarter inches diameter by ten inches stroke, lined with brass, and are capable of delivering collectively, eighty gallons of water per minute, thirty feet high. The valves are arranged so that they can be got at without disturbing either suction or delivery pipes.

The engine and boiler are fixed upon a stone foundation at the top of the well, and the pump on a wood beam fixed a little above the water level. The boiler is of the vertical type, five feet eleven inches high by two feet six inches diameter, with internal fire box, having two cross tubes. All the plates are three eighths inch thick, of best Staffordshire iron, except the fire box, which is of Farnley iron. The workmanship and material are alike excellent, and well maintain the reputation of the firm.



STEAM PUMPING ENGINE FOR INDIA STATE RAILWAYS.

Paint on Wrought Iron Plates.

This matter has been carefully investigated under the auspices of the Dutch State Railways, and the result was brought before the Society of Dutch Engineers by Van Diesen. Of thirty-two plates, half the number were plunged in diluted hydrochloric acid for twenty-four hours, then neutralized with lime (slaked), rinsed in hot water and, while warm, rubbed with oil; the other half were mechanically cleaned by means of scraping and brushing. Four plates of each kind were then prepared with one coat of red lead, two sorts of oxide of iron, and coal tar. This was done at Harkort's works in July, 1867. The plates were then exposed to the influence of the weather for a period of three years and re-examined, when it was found: 1. That the coating of red lead had stood well on plates of either method of preparation, therefore in this case no preference could be assigned. 2. That oxide of iron, by Kampand Soeten, gave better results on plates cleaned chemically than on those cleaned mechanically, the coat on the former being in as good a state of preservation as the red lead. 3. That oxide of iron by Anderghem gives as good results on plates cleaned chemically as the two previous materials, but is inferior to them if applied to scrubbed surfaces. 4. That coal tar is much inferior to any of the preceding; from scrubbed surfaces it had almost entirely disappeared.—*Iron.*

Award to an Edinburgh Engineer.

The late Lord Mayo, while Governor General of India, offered a reward of £10,000 for a machine to clean and prepare the valuable rhea fiber for the market. Mr. Greig, engineer, Edinburgh, invented and patented an ingenious machine for that purpose, and about a year ago he proceeded to India in order to compete for the valuable prize. No other competitors worthy of the name appeared at the trials. Colonel Hyde, the Master of the Mint of India, was appointed by the Government to superintend the trials which took place at the Sahrunpore Botonical Garden. An American machine, belonging to the Government of India, did not compete; indeed Mr. Greig was, practically, the only competitor. The report by Colonel Hyde upon the trial was published in a recent number of the *Gazette of India*. It is most suggestive, and is almost entirely in favor of Mr. Greig; and the trials of the machine proved to be so hopeful that the Government paid over to Mr. Greig forthwith £1,500 of the premium. The fiber which was cleaned by the machine has been sent home for report. It has been proved by the experiments that no mechanic can succeed unless he has fresh rhea stalks to work upon, so that the fiber is to be sold at cost price to those persons in India who desire to enter the lists. Mr. Greig turned out the fiber at a cost of £13 6s. 3d. per tun, not including interest on the cost of the machine.

Scientific American.

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NEW YORK, SATURDAY, APRIL 19, 1873.

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THE EVIL OF TRADE ORGANIZATIONS.

We find in the Boston *Daily Globe* an explanation of the reason why so many young men rush to the cities to accept the position of clerks, while so few take to the trade of the mechanic; and we quote the paragraph for the purpose of founding a few remarks upon it:

"ONE REASON WHY.—The multiplicity of clerks and the scarcity of young men following trades in cities are matters often commented upon, and the expressions of opinion in regard to it are almost universally derogatory to the first class named. It may never have struck people that the school of instruction in the mechanical arts is practically closed nowadays. Any one who wishes can be a clerk, but not every one can be a mechanic, no matter how earnestly he may desire it. The trade organizations, which limit and prohibit the taking of apprentices to various occupations, are cruel combinations against the youths of the country, and criminal conspiracies against the best interests of society. Under their sway, there is growing up a vast community of idlers, hundreds of whom are driven, almost by necessity, into crime."

There are two classes of persons who exert a very baleful influence upon society; one comprises the capitalists who by combinations seek to close up the avenues of labor, and the other is made up of trade associations which prevent men from exercising their inalienable right to labor where they can find work. It is difficult to say which of the two is the more reprehensible. The despotism of capital and the tyranny of the rich are favorite themes upon which to ring the changes upon all public occasions; but the greater despotism of trades' unions has been permitted to pass without comment. The result is that, as stated by the Boston *Globe*, many men are not permitted to learn trades unless they will make degrading pledges, and they prefer to enter professions where such distasteful conditions are not imposed. The consequence is that there is a dearth of mechanics and a *plethora* of clerks. Would it not be well for mechanics to reflect upon the great injustice of compelling everybody to submit to their dictation as to the manner of learning a trade and the right to practice it wherever and whenever the apprentice may please? Are they not really exerting a greater despotism and oppression than they ever have to endure at the hands of the rich capitalists of whom they so frequently complain? It is well known that in the United States, which boasts of its republican institutions, there are certain trades which no negro and no woman would be permitted to learn. It is true there is no statute law prohibiting any person of whatever shade of color or sex from taking out indentures of apprenticeship to learn anything they please; but there is a higher law of combinations, which is enforced with cruel certainty, that prevents not only the blacks and the women from having a fair chance in the struggle for existence, but also cuts off many a white man from following the bent of his genius. This goes to prove that it is always dangerous to play the part of an oppressor. The moment we become despotic in one thing we acquire a dangerous love of power and soon carry the thing to excess. The right of everybody to strive to become rich by honest, intelligent and patient labor is wholly inalienable, and it was to establish this right and the freedom to worship God according to the dictates of his own conscience that the Puritan first planted his foot upon American soil and laid the foundation of a future empire. We recall a few eloquent words spoken by Mr. Peter Cooper on the occasion of the presentation of an address from the graduates and pupils of the Union, and we cannot do better than to quote them here:

"Let me then record that, during a long life passed in active business, I have never known any but evil consequences to all classes, and especially to the innocent, to result from strikes, lock outs, or other forcible measures designed to interfere with the steady and regular march of productive industry; and I feel justified in an earnest appeal to both workmen and capitalists henceforth to regard each other as equals and friends; and to imitate the great example so recently set by the enlightened governments of Great Britain and the United States, in the submission of their differences to arbitration, and not to expect to reform social evils by combinations designed to force either side into the acceptance of unpalatable terms, by the stern logic of starvation and indiscriminate ruin. Reform, to be of any permanent value, must be based upon personal virtue, not force; and it seems to me that the millennium will not be far off when each individual shall set about reforming himself rather than society, and conforming his life to the great law of loving God and his fellow men."

These are words worthy to be engraved upon the lintels of every workshop in the country; and if the precepts so eloquently presented by Mr. Cooper could be practiced by all classes of the community, we should hear fewer complaints of tyranny and oppression, and the mechanic would find his profession enriched by the presence of young men who are now driven to seek other avocations by the despotism of trade organizations.

DRIVING POWER OF LEATHER BELTS.

We have received many applications for information about belting, and our columns have become encyclopedic on the subject; and our subscribers are now beginning to call for precise statements and for definite rules for proportioning belts to the work required to be done by them. We therefore present the following as a brief summary of some of the more important and most fully determined facts bearing upon the subject.

The driving power of a belt may be limited by either of two things, its friction on the pulley or its strength. If it slip easily on the pulley, the limit of its driving power is reached long before it is strained to its maximum of strength, and, consequently, the belt is inefficient. If the friction is very great, the belt yields, if overstrained, by breaking or by tearing out the lacings.

To secure the best effect, the endeavor should always be made to obtain the greatest possible friction on small pulleys, and the strongest possible belts and lacings, or other connections, where the pulleys are large.

The relative frictional values of different surfaces over which belts may be run are given, by experiment, as follows:

Pulley of iron, covered with leather....	35 per centum.
" " polished.....	30 "
" " turned, but unpolished..	15 "
" wood, hard and polished.....	25 "

To obtain greatest friction, the grain side should be placed next the pulley, as the friction is very much greater when so placed. The neater appearance of a belt placed with grain side out must be sacrificed if full efficiency is to be attained. This difference sometimes amounts to one third. With the grain side to the pulley, there is less liability to crack also. Where pulleys are driven at very high speed, centrifugal force has the effect of reducing the pressure of the belt on the pulley, and thus of diminishing its friction.

The strain which is allowable upon a belt is variously estimated by different authorities, but is most frequently given at about 300 pounds per square inch of cross sectional area.

C. D. Abel gives one sixty-fourth of a square inch for each five pounds, or 320 pounds per square inch.

General Morin gives 355 pounds as the strain, per square inch, which may be borne for a long time without injury.

Haswell gives 350 pounds.

From the facts stated, it will be seen that the width of belt required will be determined readily, when the power to be transmitted is known and the speed at which the belt is run.

Mr. J. H. Cooper, whose papers in the *Journal of the Franklin Institute* (January, 1869, p. 42) we have referred to before, gives the following, on authority of Professor Thurston:

$$W = \frac{7{,}000 \times HP}{S\ V}; \qquad W = \frac{700{,}000\ HP}{S\ V\ t}.$$

The circular of Hoyt Bros. gives $W = \frac{5{,}334\ HP}{S\ V}$.

W = width in inches; HP = horse power transmitted; V = velocity of belt in feet per minute; S = length in feet of that portion of the circumference which is covered by the belt; t = tension.

That is, by the first rule, divide 7,000 times the horse power by the product of the velocity of the belt and the length of that portion of the smaller pulley which the belt touches; the quotient is the width required in inches.

An old rule among millwrights allows a belt one inch wide, running 1,100 feet per minute, for a horse power.

Care should be taken in putting up belts to lace or otherwise unite them so as to obtain a uniform strain across the whole width of the belts. Long belts should be used where possible.

Properly proportioned for its work, well made, well placed and properly cared for, a good belt should last many years, and then, if wide, may be cut into narrower belts for lighter work, and good service be obtained from it in its new application.

The pulleys should be turned and polished, or, when small, covered with leather. They should be carefully balanced for high speeds and, in many cases, tightening pulleys will be found convenient, and sometimes indispensable, for adjusting tension.

COPYRIGHTS.

The copyright law of the United States offers a variety of privileges of considerable value for business purposes, and we often wonder why they are not more extensively taken advantage of by enterprising individuals. One reason, doubtless, is because the scope of the law is not generally understood. We will therefore offer a few remarks upon the subject.

The 86th section of the patent laws of 1870 provides that any citizen of the United States, or any person resident therein, who may be the author, inventor, designer, or proprietor of any book, map, chart, dramatic or musical composition, engraving, cut, print, photograph, or negative thereof, or of a painting, drawing, chromo, statue, statuary, or of models and designs intended to be perfected as works of the fine arts, may obtain copyrights, which shall secure the exclusive privilege of printing, reprinting, publishing, completing, copying, executing, finishing and vending the same.

The copyright is in fact a patent, although not applicable to machinery. A copyright lasts for 28 years, at the end of which time it may be renewed for 14 years longer, by the author, inventor or designer, or, if deceased, by his wife or children. In applying for a copyright, no sworn papers are required, and no signatures; in fact, no forms or ceremonies are involved, nor tedious official delays. Parties who do not wish to attend to the matter themselves may for five or ten dollars have the copyright promptly procured for them by almost any respectable agent, the whole time required being only from two to four days.

There is no form of protection that is more easily obtained, or which gives better satisfaction so far as it extends than the copyright, and the simplicity and excellent practical working of the law ought to afford useful instruction to those who constantly aim to add complexity to our mechanical patent laws.

Under the copyright law, it is to be observed that designs for ornamental objects or configurations, prints, engravings, cuts, pictures, cards, and pamphlets of every kind may be secured. Almost every business concern finds it necessary to produce same peculiar work of this kind, large or small. Thus if a man makes a new drawing of his building, his machine shop, interior of office, view of the town showing his works, or any new and pictorial form for a border, or design to be used upon goods, circulars, or other purposes, he may, by simply securing a copyright, prevent others from imitating the same. It is obvious that the uses of the copyright are very extensive.

But it should be remembered that the copyright must be applied for *before the work is publicly introduced*, or, in other words, before it is published. A valid copyright cannot be had for a work that has been issued to the public prior to application for the copyright. Nor can a valid copyright be obtained for a mere trade mark, word, or name.

Further information in regard to obtaining copyrights may be had gratis by addressing Messrs. Munn & Co., 37 Park Row, Solicitors of Patents and Publishers of the SCIENTIFIC AMERICAN.

THE SCOPE OF THE INFINITESIMAL.

In a recent article on the astronomical effects of the ocean tides, we gave for the consideration of our readers some figures so large as to exceed all our ordinary notions of magnitude in regard to observation of time or extent of space; we will now pass to the other extreme, and contemplate some infinitesimally small quantities, measured in space by millionth parts of inches and in time by billionth parts of seconds.

The first step in this direction was made by Isaac Newton when he calculated that the thickness of the film forming a soap bubble varied from 3 to 6 or 8 one millionths of an inch; he accomplished this feat by observing the colors and comparing them with those produced when a lens with a convexity of long radius is closely pressed on a piece of plane plate glass, those colored rings being then formed which are still named after him, and in which the determination of the distances of the surface, at different points corresponding to each other, is a simple problem of elementary geometry.

The first steps in determining short periods of time were made when it was proved that sound travels the distance of one foot in less than one thousandth part of a second, while light requires only the 1,000,000,000th part of a second to traverse the same distance. When, later, the undulatory theory of light became established beyond any doubt, it was found that the length of the luminous waves varied from a fourteen millionth part of an inch to a twenty-seven millionth; while in regard to their duration, it was proved that a wave of red light lasts the 450,000,000,000,000th part of a second, while a violet wave lasts only about half as long.

Recently another step has been made in the research after the infinitesimally small dimensions of space. Whatever the nature of the ultimate constituents of matter, which we call atoms, may be, whether they have any material extent or are mere centers of forces of different kinds, one thing is certain, that their centers must be at certain distances; and investigations combined with legitimate deductions from the same have brought the investigators to agree that the distance of the centers of the atoms constituting ordinary solid and liquid bodies is very nearly one 250,000,000th of an inch. This gives for one cubic inch at least $250{,}000{,}000^3$ or 15,625,000,000,000,000,000,000,000 atoms, a number most prodigious, as it is easy to calculate that a single drop of water, weighing one grain, contains as many atoms as there would be grains of ordinary fine sand in a layer covering our whole earth

to a depth of 1,000 feet. Those atoms are kept in place by the coöperation of attractive and repulsive forces balancing each other: they are connected in piles and groups, or molecules, each group containing definite numbers; and the agglomeration of these groups forms a regular atometic or molecular network, out of which the well known chemical formulas may be easily explained in a graphic way.

In the act of crystalization, these groups arrange themselves in a symmetrical manner, according to the attractions and repulsions which place the molecules in position, wherefore we may consider the form of a crystalized substance as an exterior expression of interior hidden forces. This symmetric and uniform manner of arrangement explains at once why most crystals will, by heat, expand more in one direction than in another, why the light waves are transmitted in one plane or direction more rapidly than in another, and why this inequality in the distance of the atoms and groups of atoms or molecules will produce the phenomena of polarization and double refraction.

The hypothesis of certain speculative philosophers that the ultimate limits of the investigations in matters of small dimensions is infinitely beyond human computations, as we know to be the case with the mattersof large dimensions, the distant recesses of the universe, and the infinity of space, as revealed by astronomy, is thus set at rest. We know the limit of the atomic distances, but also that, when we have improved our microscopes till we may magnify objects thousands of times as much in their linear dimensions as we can do now, we will still be utterly unable to see the space between the atoms.

THE WRECK OF THE ATLANTIC.

One of the most dreadful marine disasters that it has ever been our province to chronicle has recently taken place on the coast of Nova Scotia. The White Star line steamship Atlantic, one of the largest of the fleet of ocean steamers plying between New York and Liverpool, on the morning of April 1st ran ashore and soon afterwards sank. The captain appears to have miscalculated in his reckoning.

When the ship struck, nearly all the boats were instantly swept away by the heavy sea, and in about ten minutes, according to the captain's statement, the ship keeled over on her beam ends, so that, with the exception of her bow and rail, her hull became submerged and large numbers of passengers were drowned. Out of 976 persons on board, 546 were lost, most of whom were steerage passengers.

The experience of countless wrecks has established beyond peradventure that boats, however well constructed, are not to be depended upon; and each succeeding casualty, with its scores of victims, renders more apparent the urgent need for some method which will serve to lessen the dangers of the sea. We have, repeatedly, brought up the subject, and at the time of the Metis and Bienville disasters of last year, we especially asked for it the earnest attention of inventors. We now do so again, and we would more especially advise those who are now wasting their time and genius upon flying machines, perpetual motions, and other impracticable and useless schemes, to devote their full energies to this over-pressing need. We want an effective and reliable life-preserving device. Let it at once be invented and proved capable, and the law is strong enough to compel its introduction and use.

THE PRESENT CONDITION OF ARCTIC EXPLORATIONS.

At the present time three great scientific expeditions are exploring the arctic regions. The Austrian party, under Payer and Weyprecht, are near Nova Zembla and to the north of Siberia; the Swedish expedition under Professor Nordenskjöld is cruising north of Spitzbergen,and the Polaris, fitted out by our own government and commanded by Captain Hall, is still in the regions north of the American continent. Owing to the prevailing bad state of the ice in the Arctic Ocean during the past winter, the crews of several whalers have been shut in on the coasts of Spitzbergen; several smaller expeditions have been despatched to their relief. The steamer Albert, equipped by the Norwegian government and commanded by Captain Otto, sailed for Tromsoe on the 20th of November, but,on account of the tempestuous weather, was compelled to return soon afterwards, after having reached lat. 77° N. The voyage was not without scientific result, as the temperature of the sea at the surface was carefully taken and found to be, even in the coldest weather, above the freezing point. At 230 miles northeast of the Isle of Baren, in lat. 75° 45', the temperature was found to be as high as 40° Fah.

In spite of the ill success of the Albert, the sailors of Tromsoe believed that the western coast of Spitzbergen was open, and that the Gulf des Glaces, the place where the shipwrecked whalers were supposed to be, was accessible. The bark Isbjärn was therefore dispatched and reached Baren on the 7th of January, only to return however, the captain reporting that to the north and east the sea was ice as far as the eye could reach. The weather was intensely cold,—50° Fah., and very stormy, while the season of perpetual night was at hand. From this report, as compared with that of the Albert, it may be noted that there is no ice from the coast of Norway up to the Isle of Baren; but in the latter locality, large quantities exist even in summer, being evidently transported thither by a cold current. A third expedition was fitted out for Bremen by M. Rosenthal, and consists of the steamer Groenland with 70 men. The vessel left on the 28th of January last, and although she has not been heard from, it is hoped that she has succeeded in penetrating the ice and relieving the survivors of the Norwegian whalers.

Dr. Petermann has recently published a map of the northern coast of Siberia between the mouth of the Yenessei river and that of the Lena. This region will serve as a base for the operations of the Austrian expedition. Recent advices from Russia state that the President of the Geographical Society of St. Petersburg has introduced a plan of a new scientific exploration of the northern part of Siberia, which will be carried as far as the Archipelago of New Siberia. Without doubt, this expedition will be productive of valuable results. Already, on the banks of the Lena, rich mines of graphite have been found and worked, while the surrounding regions contain numerous remains of mammoths and other great mammifers of extinct species. The exploration of this zone is confided to M. Tchekanowski, who with his party left Irkoutsk during March last.

France is taking but slight part in arctic investigation. Some time since we mentioned that a M. Pavy was about to sail from San Francisco, California, but it appears that an *affaire du cœur* not only prevented his sailing but brought him to pecuniary ruin; consequently the expedition was abandoned. In England it is stated that Mr. Leigh Smith, who, with Captain Ulve, discovered the extension of North East Land (one of the great islands of the Spitzbergen group), three degrees of longitude further east than previous observations had indicated, proposes to revisit that region with a screw steamer of 250 tuns.

SWINDLING OPERATIONS.

Some weeks since, we published an account of the nefarious transactions of an individual in the neighborhood of Galesburg, Illinois, who carried on quite an extensive business in swindling inventors. Representing himself as a patent agent and as having facilities for the sale of rights, his plan consisted in inducing the patentee to forward his model and five dollars to pay for advertising, and then leaving the package in the express office and pocketing the money. More recently, it seems, the scamp has played a bolder game, and by a series of artfully worded letters, holding out tempting offers for state rights in inventions, has endeavored to persuade owners of the same to forward to him, as agent, deeds thereof, fully executed and transferring title in the property to a hypothetical person no other than himself. How many he has victimized, we are not aware; but his career as W. A. Morrison & Co. *alias* W. J. Reed & Co. is happily ended, as he has been arrested, convicted and safely lodged in the penitentiary.

We confess to but little sympathy for those who are foolish enough to forward the deeds of their patent rights to any person regarding whose honesty and responsibility they have not the fullest knowledge and confidence. An executed document of this description represents value exactly as much as title deeds to a house or bank notes, and like safeguards should be placed around all. There are plenty of adventurers in the country who stand ready to prey upon inventors—men who by offering dazzling bait too often succeed in swindling their victims out of the fruits of years of labor—and this reprobate who is now in the clutches of the law is but a fair specimen of the class. There is only one word of advice to be added, and that is to look well to the standing and character of all with whom you deal, and trust no offers which are not verified by your personal examination.

RESISTANCE OF WOODS TO TORSIONAL STRAIN.

Professor R. H. Thurston, of the Stevens Institute of Technology, communicates to the *Journal of the Franklin Institute* a description of an apparatus devised by him for determining the torsional resistance of materials, and also the results obtained by submitting specimens of different woods to experiment. By suitable mechanism, the force producing torsion is transmitted through the test piece and moves a pencil which traces upon paper a curve, the ordinates of which are proportional to the torsional moment while its abscissus represents the amount of torsion to which the specimen has been subjected, thus indicating the relative stiffness, strength and resilience, of the material experimented upon, very perfectly. The test pieces were seven eighths of an inch in thickness at the middle or smallest part, and were made from the following woods: White pine, S. yellow pine (sap wood), S. yellow pine (heart wood), black spruce, ash, black walnut, red cedar, spanish mahogany, white oak, hickory, locust and chestnut. The conclusions drawn from the results are as follows:

White pine yields quite rapidly as the torsional moment increases. The maximum strength of the test piece was 15½ foot pounds, and it was twisted completely off at a total angle of torsion of 130°. The substance is thus shown to have little resilience. Yellow pine has much greater strength, stiffness and resilience. The sap wood is equally stiff with the heart wood, but sooner passes its limit of elasticity. Spruce is less stiff than white pine even, but possesses greater strength and resilience, its moment of resistance reaching 18 foot pounds and twisting through a total angle of torsion of 200°. Ash seems to be weaker and less tough than is generally supposed. Its most striking peculiarity is its very rapid loss of strength after passing its limit of elasticity. Black walnut is very stiff, strong and resilient, and is but little inferior to oak. Its resisting moment reaches 35 foot pounds, and one specimen attained a total angle of torsion of 220°. Red cedar is stiff but brittle, and loses all power of resistance after twisting through an angle of 92°. A torsional moment of 20 foot pounds only produced a total angle of torsion of 50°. Spanish mahogany is very stiff and strong. It is deficient in toughness and resilience, losing its power of resistance very rapidly after passing the limit of elasticity. White oak has less torsional strength than either good mahogany, locust or hickory, but is remarkable for its wonderful toughness. It passes its limit of elasticity at 15°, but loses its resisting power very slowly. The latter remains unimpaired to a torsion of 70° and yields completely at 253°. Millwrights are evidently correct in holding this wood in high esteem for strength, toughness and power of resisting heavy shocks and strains. Hickory has apparently the highest ultimate torsional strength combined with unusual stiffness and considerable resilience. Its moment of resistance to torsion reaches a maximum of 58 foot pounds. Locust has greater stiffness than any other wood on the list, and stands next to hickory in strength; it is also very resilient.

DIAMONDS APPLIED TO DRESSING AND WORKING MOLDINGS IN STONE.

The Gear Stone Machine Company, of Boston, have recently exhibited in this city, a newly invented machine for working stone, which surfaces, makes straight and irregular moldings panels, letters, upon edges and faces, carves, and in fact operates upon the hardest rock with as much facility and with nearly the same degree of rapidity, that a steel cutter penetrates a wooden board. The apparatus consists in simply a horizontal arm working freely from a standard and jointed at the middle. Rotary motion is transmitted by belting to a vertical shaft at the outer extremity, to which the cutting instrument is attached. Suitable appliances are provided for regulating pressure, vertical movements, etc., of the tool, and the table is made capable of adjustment to any desired hight. The chief merit and efficiency of the machine lie in the use of carbons or black diamonds and their arrangements in the cutting tools. The latter are made of steel, and the diamonds are so secured in them as to conform to the shape of the style of molding required. The operation consists in placing a wooden pattern upon the stone and clamping both firmly to the table. The workman then grasps handles above the cutter, and thus causes the latter, while swiftly revolving, to follow the lines of the model.

Trials conducted in our presence fully satisfied us as to the practical success and utility of the invention, as we saw the instrument cut moldings in stone, in a few seconds, which would take a man some hours to complete. The most refractory substances, such as hard granite, seem to present no more obstacle to the passage of the tool than the softest limestone, and the work is turned out finished with even more smoothness than would be possible by hand labor. For raised moldings, edge cuttings, and surfacing, the machine developes equal efficiency. There can be no question but that this is one of the most important applications of the diamond yet discovered, and its general introduction must tend to largely diminish the now great cost of preparing and dressing stone for building purposes.

The Canadian Patent Office Record and Mechanics' Magazine.

A new publication under the above title has been recently commenced at Montreal, Canada, by the well-known publisher, Mr. George E. Desbarats. It is issued monthly at $1.50 per annum, and embraces an official list of all patents granted in Canada, with the claims and reduced diagrams of the patent drawings. Added to this is a department of miscellaneous information, containing illustrations of recent interesting discoveries, general scientific news, etc. The whole forms a valuable publication, which reflects the highest credit upon its enterprising publisher, and deserves success.

Tracing Paper.

A convenient method for rendering ordinary drawing paper transparent for the purpose of making tracings, and of removing its transparency so as to restore its former appearance when the drawing is completed, has been invented by C. Puscher. It consists in dissolving a given quantity of castor oil, in one, two, or three volumes of absolute alcohol, according to the thickness of the paper, and applying it by means of a sponge. The alcohol evaporates in a few minutes and the tracing paper is dry and ready for immediate use. The drawing or tracing can be made either with lead pencil or india ink, and the oil removed from the paper by immersing it in absolute alcohol, thus restoring its original opacity. The alcohol employed in removing the oil is, of course, preserved for diluting the oil used in preparing the next sheet.

ARTIST'S RUBBER AND INK ERASER.—Quite a useful article of the above description has recently come under our notice. It is made of a patented composition and rubs out pencil marks with great celerity. As an ink eraser it is much superior to any of the compounds known to us now sold under the name, as it actually removes the ink, while it excels the ordinary scraper by leaving the paper with a surface that can be immediately written upon. It is supplied in a variety of convenient forms, at very reasonable prices, by Mr. J. H. Green, of No. 26 Beekman street in this city. Dealers in stationery and artist's materials will find this a profitable article to keep in stock.

PROGRESS OF THE HOOSAC TUNNEL IN MARCH, 1873.—Heading advanced from east end westward, 155 feet; from west, eastward, 162 feet; total extension of headings during March, 317 feet. Total lengths opened to April 1st, 22,793 feet; remaining to be opened, 2,238 feet, being 402 feet less than half a mile.

A LARGE DIAMOND.—The finding of a 288¼ carat diamond, at the diggings at Vaal river, South Africa, is announced. It is alleged to measure 1¼ inches in diameter, and is therefore one of the largest diamonds in the world.

New Jewelers' Tools.

M. Capitaine has devised several new tools for jewelers' use. His *boulet coussin* comprises in one instrument more than 300 matrices or forms of the usual descriptions mostly employed for shaping plates of gold and silver. It replaces the above number of dies in the workshop. The *chasse pierre* is a portable pincers, having on one part a steel tooth and in the other a cavity of variable dimensions. Its object is to remove delicate gems from their settings without endangering their being accidentally dropped. The same inventor has devised a way of setting precious stones upon concealed springs which allow them to move and appear more sparkling, and has also introduced bronze forms in the shape of truncated busts marked with radiating lines on which necklaces of jewelers can be fitted and the position of the stones or divisions of the work adjusted.

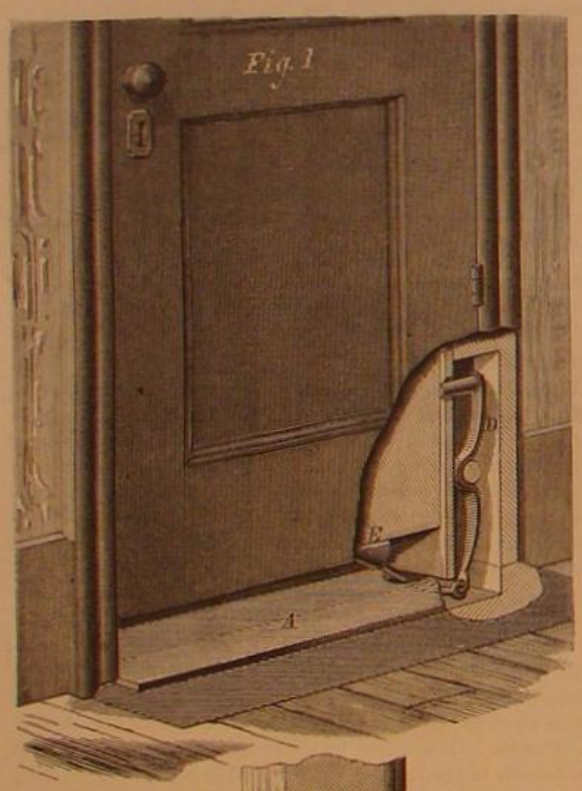
An Egg Within an Egg.

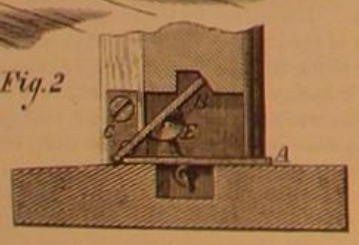
D. L. M. says that a resident near Grater's Ford, Pa., found, on March 4, a hen's egg as large as a goose egg. It weighed four ounces, and was three and a half inches long and seven inches around the middle or shorter diameter. The shell is very thin, hard and a little cracked. The egg, on being opened, was found to contain a yolk and albumen or white, and another perfect egg. The inner egg is two inches long, five inches around the middle, and weighs one and a half ounces.

WEATHER THRESHOLD.

Our engraving illustrates the application of an improved self-adjusting weather threshold to an ordinary door, the object being to prevent the entrance of drafts of cold air and dust, by closing the space between the bottom of the door and the floor. A portion of Fig. 1 is broken away in order to show the working parts, which are represented in section in Fig. 2.

A is a metal plate secured by screws to the sill, and, beside protecting the latter from water, may serve to hold down an end of the oil cloth or carpet. B is the movable door strip, provided with lugs at either extremity, which enter sockets in small metal plates fastened against the door frame





at C. D is a spring lever pivoted in a recess, as shown, and connecting at its lower end with a rod which enters a pocket, E, formed in the door strip, B. When the strip lies flat upon the plate, A, which is the case when the door is open, it swings the lever, D, so that its upper end projects inward from the door frame. As the door is shut, its jamb strikes against this projecting extremity, forces it in, and so moves the lever, causing the latter to swing the strip, B, into an inclined position. The strip then fits closely against or, as indicated in Fig. 2, into a rabbet in the bottom of the door, thus completely closing the aperture underneath.

The mechanism of this invention is simple and easily reached for repair, while it is probably of a more durable nature than the ordinary weather strip.

Patented through the Scientific American Patent Agency, January 21, 1873. For further information, address the inventor, John W. Kramer, Bloomsburg, Columbia county, Pa.

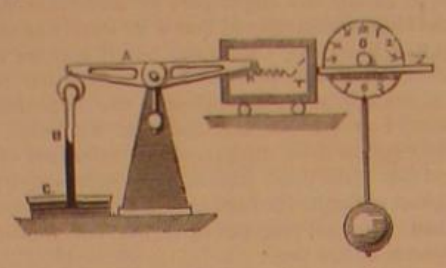
M. SORTAIS, in France, has invented an electrical device which is placed in the holds of vessels. In case of a leak or the entrance of too much water into the bilge, a current is established and a communicator is set in operation, signifying the fact to the commander and the officer of the deck.

THE velocity of circular saws at the periphery is from 6,000 to 7,000 feet per minute, or from 70 to 80 miles per hour.

RECORDING BAROMETER.

A is a fine balance lever with unequal arms and a regulating weight. B is a barometer tube, which is connected with one end of the lever, and the lower end of which dips in a trough of mercury, C. To the other extremity, K, of the beam, a pencil is attached. U is a clock, which, when in action, moves the rack, Z. This rack is connected with a vertical paper covered board, T, which is in contact with the pencil of the lever, and rests on rollers.

The action of the instrument is thus evident. The motion of the mercury in the barometer causes the lever to move up and down, and the pencil at the end of the longer arm makes a trace on the paper, which is gradually being pushed along according to the rate of the clock.

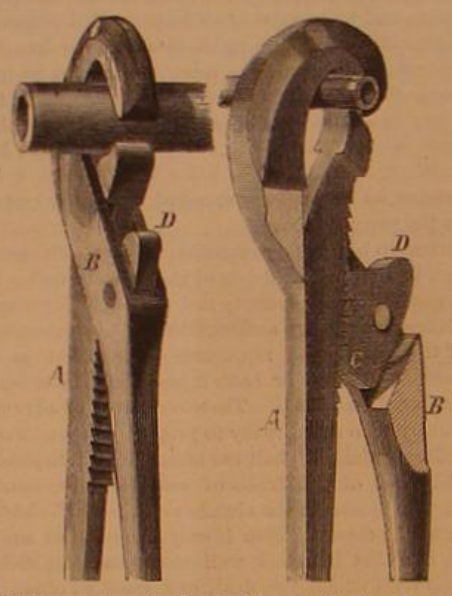


Time divisions are indicated on the paper, and it is recommended that a small hammer be made to tap the barometer tube occasionally, in order to prevent adhesion of mercury.

A recent number of the *English Mechanic* describes the above, and states that it is the invention of Professor Brahns, of Leipsic.

PIPE TONGS.

This invention is an ingenious form of pipe tongs adapted to fit any size of pipe. It is made in two portions—a



straight lever, A, and a hooked lever, B—the former passing through a slot in the latter. The back of the straight lever is notched and a serrated fulcrum piece, C, is pivoted in the slotted lever by a pin upon which the lever, B, receives its support when the tongs are in operation. The fulcrum piece is provided with a spring which retains its serrated edge in proper position to engage the notches in the lever, A. By means of the thumb piece, D, the piece, C, can be moved in either desired direction. When the tongs are open, the lever, A, can be moved within the slot and adjusted so that the instrument will fit on any size of pipe. The fulcrum piece, C, being pivoted, allows the full length of its serrated surface to come in contact with the similar portion of the lever, A, so that the parts always have a firm bearing upon each other and be subjected to an equal strain and wear.

To Mr. Andrew B. Lipsey, of West Hoboken, N. J., is due the credit of this device. Patented September 17, 1873.

A Photo-Improvement.

An improvement in photographic printing, by W. H. Jacoby, Minneapolis, Minn., is as follows: If the printing is to occupy one minute, the sensitive paper is exposed in contact with the negative for forty-five seconds, and the paper is then separated from the negative to a distance of, say, one eighth of an inch, and the exposure continued for fifteen seconds. This produces a sort of double printing, and imparts a soft mezzotint effect to the picture which is very pleasing. The separation of the paper from the negative is done by means of a peculiar construction of the printing frame.

A WINKING SITTER.—At a recent meeting of the Boston Photographic Society, Mr. Burnham explained some experiments he had made for the purpose of getting the eyes of at man who winked 364 times in one minute. The feat was accomplished by placing in front of the subject a black screen, with a hole large enough for the tube, and at the same time shutting off almost all of the light, giving (say) thirty seconds' exposure to the subject, and then holding before the lens a black velvet cloth for some thirty seconds. The eyes were perfect, and the experiment was successful.

By means of the spectroscope, astronomers have found tha the atmosphere of Uranus is almost entirely composed of hydrogen gas. M. Protier remarks that if a very small proportion of oxygen also existed there, an electric spark would cause tremendous convulsions by combining the two gases.

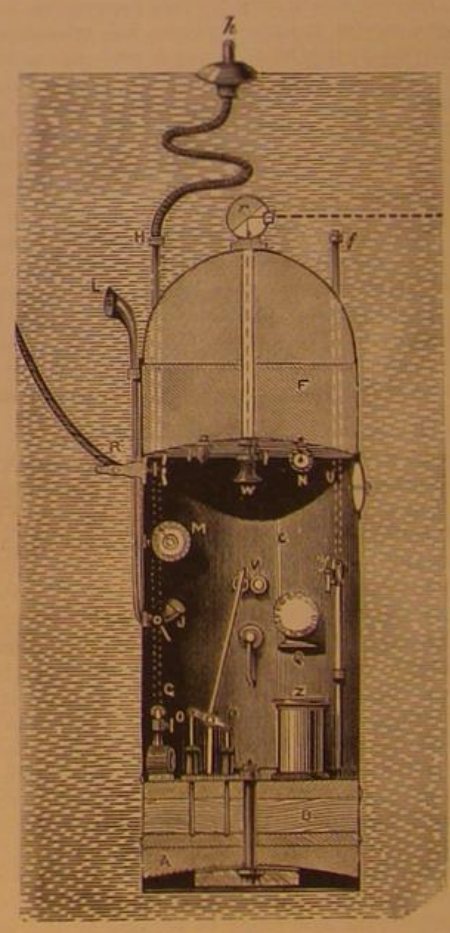
A SUBMARINE OBSERVATORY AND PHOTOGRAPHIC GALLERY.

M. de Toselli has recently invented an apparatus which allows of descent to considerable depths in the sea, in order to examine the natural productions and to take photographs of them, without inconvenience to the observer from pressure of air or of water, or other causes. He calls his machine a *taupe marine*, or marine mole. It consists of a long case, as shown in the annexed figures, taken from the *English Mechanic*, and is divided into four compartments. The chamber, A, is filled with lead to keep the machine vertical. Into chamber, B, water may be admitted by a stopcock, and can be expelled by means of the hydraulic pump, P. The chamber thus serves to increase or diminish the weight of the machine, so that it may sink or rise in the water as wished. The operator occupies the large chamber, C. The top chamber, F, contains respirable air, and is charged according to the time to be spent in the water. I is a cock by which the air is admitted into the principal chamber. G A is a metallic abductor tube, with stopcock, O, meant for expulsion of vitiated air. A caoutchouc tube from the upper extremity leads to a float, *h*, which has a valve allowing the egress of air, and preventing entrance of water.

The mole has a rudder and a screw (wrought by hand), which allow of its being slowly propelled in the required direction. M is a manometer, showing the pressure of the water, and thus the depth reached. N is a manometer, indicating pressure of condensed air at disposal in chamber, F. R is a rope connecting the mole with a vessel. It contains a metallic wire, by which and the telegraphic apparatus, Q, communication may be held with the captain of the ship. U is a manhole by which the observer enters. It has a double lid, and can be opened from without or from within. V are small glass windows of observation. Z is a seat, which may also serve for wardrobe.

The following difficulties are discussed by M. Toselli:—1. Suppose the abduction tube for vitiated air to be injured, so that it were necessary to close the cock, O. In this case the apparatus would immediately be raised for repairs, and, if necessary, the stopcock, Y, of the second abductor tube might be opened; this tube having also a valve at its upper end.

2. Suppose the electric wire broken, and it were necessary to communicate with the ship. The mole would be raised till the upper mouth of the speaking tube, I J, was above water, so that the observer might speak through it.



3. Suppose the hydraulic pump deranged so that the mole would not rise. Telegraph orders to draw up.

4. Suppose the pump, the wire, and the rope, to be all injured. The operator might then set free the weight, S, placed under the mole, and connected with it by a screw above.

5. Suppose, as an extraordinary case, that the ship were wrecked. The operator would first detach the rope at B, then rise to the surface, and having ascertained the right direction, proceed thither. For this purpose the mole is furnished with an artificial eye, *r*. This is a camera obscura, which, with the tube, W, enables the observer in the machine to see external objects as ships, rocks, etc. He can turn the tube in any desired direction.

COSTUS ROOT.—Dr. John R. Jackson, Curator of the Museums, Kew, states that: Its chief use is by the Mahommedans for burning as incense, but the Chinese also use it as an aphrodisiac. In Cashmere its only use is for preserving the celebrated cashmere shawls from the attacks of moths, pieces of the root being put into the bales in course of packing. When dry the root is of a dark brown color, very brittle and apparently full of resin, but it does not burn freely. It has a strong but agreeable odor, similar to that of orris root.

[For the Scientific American.]

MANUFACTURE OF COMBS.

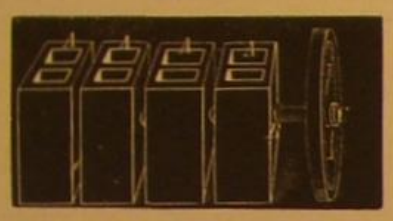
Very few persons understand how the combs, which we have in such daily use, are made. As we have recently had an opportunity of visiting a comb factory, we propose to give a slight sketch of the work.

The processes which each comb undergoes are many, though simple. In the first place, the rough horns of cows and oxen are brought in immense quantities to the factory. Each one is then marked for cutting. Some are marked in a circle,

FIG. 1.

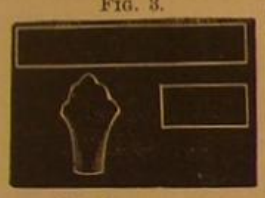
others in spirals (Fig. 1), so as to give a long strip, from which the round combs are made. After the marking, a rotating saw cuts them into these shapes, and also longitudinally, in order that they may be opened. The tips of the horns are of no use in making the combs, but they are by no means wasted; all are carefully preserved for making umbrella and knife handles. The horns are now boiled for four or five minutes in oil; whale oil is most common for this purpose. This softens the horn, renders it tough and somewhat flexible. A workman stands ready to take them from the oil, and places them, open, between flat bars. These bars are so arranged that a slight fire of charcoal in the center,

FIG. 2.



A, Fig. 2, keeps the horns warm enough to work with. By means of a wheel connected with the bars by the axis, B C, a very great pressure (of 400 tuns) is applied which, in three or four minutes, makes them perfectly flat. All the oil has been squeezed out, and the color changed from an opaque white to the translucent amber of the tortoise combs. As soon as they are taken from this pressure, they are cut into shape. This is easily done. The workman is provided with a variety of iron forms (Fig. 3), and uses the one most in demand and that will cut to the best advantage. He places the form on the horn, and with a single blow cuts it out. Of all kinds, except the fine combs, two are cut at the same time, their teeth interlacing.

FIG. 3.



The material is sometimes of unequal thickness, and in order to remove this difficulty they are passed under a great pressure.

The next process is that of cutting the teeth. This is one of the most curious and ingenious parts of the work. The ordinary dressing combs are heated so as to soften and make them malleable Then they are placed on an iron, E, Fig. 4, the size and shape of the comb, having ridges, both fine and coarse, for the teeth. This is under a machine with a sharp knife, D, attached, which, on being started, moves up and down, cutting the fine teeth. It stops of itself, requires to be slightly re-adjusted, and then cuts the coarse teeth. The two combs are then torn apart.

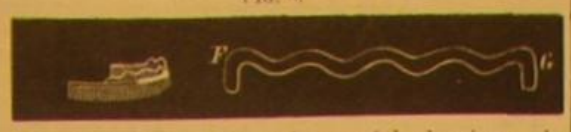
FIG. 4.

Next they are rubbed on a wheel covered with emery or some other rough substance, which takes off some of the superfluous material, but adds no polish, After this they are washed to cleanse them from the dust. On another wheel they are pointed. They are then placed in hot sand in order more effectually to soften them, and any little irregularities, such as the projection of the teeth too far at the end, are easily remedied by pressing the pliant horn.

The next process is polishing. This is done by rubbing them on wheels covered with emery. In fact the combs are continually going through the hands of workmen who, rubbing them a few times on the emery, add a little each time to the polish, until the last one puts the finishing touch to the whole work. This completes the dressing combs. The fine combs have the teeth cut in a different manner from the others. Each comb is fastened on a machine which moves back and forth against a saw. The machine is so arranged that as each tooth is cut the comb is moved slightly to the left to present a place for the next tooth. When the teeth are all cut, the machine stops and the comb is reversed. The grooves are made by passing the combs under a machine which scoops them out. After all the teeth are cut, the combs are picked out with a pin or needle, and brushed to get rid of any of the horn which still remains between the teeth. A polish is put on, and they are ready for packing.

After the long round combs, which are worn by children, are polished, they are laid on a hot iron. When heated, they are flexible and easily bound around a smooth cylindrical beam, where they remain until cold. When taken from this, they are in shape and ready for market. To some of them, however, a small piece is added, which stands up on the top. The ends, F G, Fig. 5, are bent over and fastened to the comb by small rivets. Colored ribbon is wound around the other parts. This is a new style and, to us, not very pretty. But it affords variety, and will undoubtedly find ready sale among children.

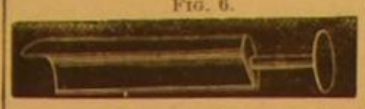
FIG. 5.



Most of the round combs, and some of the dressing combs are made of rubber instead of horn. This is prepared in Edinburgh, Scotland, and imported.

The high back combs which are very much worn as ornaments, after having the teeth cut, are each shaved by hand a little, and also by a machine. Then they are pointed, washed, polished a little, and carried to the engraver, who carves from a pattern. His only tool is hollow, much like a chisel (Fig. 6); with this he scoops out the various figures and curves. The combs are colored black, with acetate or sugar of lead, and, in imitation of tortoise, with lime, litharge, and potash They are then heated and placed on molds to give them the requisite form. The difference between the real and imitation tortoiseshell is that the real has a much richer, more reddish color.

FIG. 6.



In this work nothing is wasted. The horn dust is of especial value as a fertilizer, and is carefully saved for that purpose.

One of the largest comb factories in this country is at Wappinger's Falls, N. Y., Elias Brown & Co., proprietors. Their product exceeds a hundred dozen in a day.

A Cure for Girdled Trees.

Since the winter of 1867 and 1868, there have been none more favorable for field mice, says the *New York Tribune*, than the one just ended. Over a wide range of country the ground was covered with a heavy body of snow in December. This was added to by frequent storms, and it remained during the entire season. In closely planted orchards, the snow was piled in places several feet in thickness for eight or nine weeks, and afforded just the conditions most propitious for these active pests.

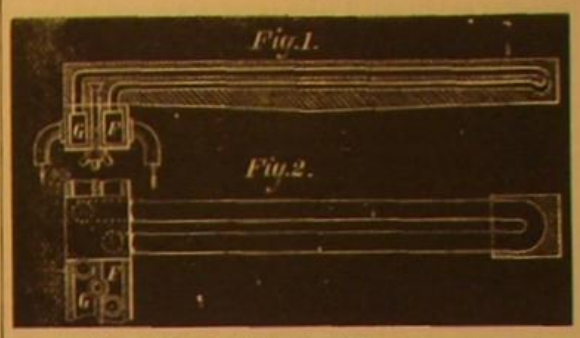
Under such circumstances it will be strange if, on disappearance of nature's blanket, thousands of fruit trees are not found girdled, especially those standing in or near grass land. Trees from which the bark has been gnawed all around and six to twelve inches in width, are sure to die within a year unless prompt measures are taken to make connection between the bark above and that below the wound. The prescriptions which have been published from time to time are as numerous as flies in midsummer, and most of them as unsatisfactory. Where only a third or a half of the circle has been made, leaving a connecting strip, then, by covering the bare part with a coating of cow droppings and yellow clay, the young bark will grow over the mound much sooner than if left exposed. Where there is no such connection, however, the best and most simple method of forming one—and the method that never fails—is to insert scions (one, two, or three, as the case may require), bridging over the barked part as in the foregoing picture, which is an exact drawing of a pear tree that four years ago was girdled, and (with many others similarly treated) is now in prime condition. The method is simple and rapid, and most any one can do the job without difficulty. Take the scions of last year's growth of wood, from young healthy trees, cut them the right length, bevel each on the same side at both ends. Then, with a budding knife, make an incision in the bark of the tree above and below the injured part, and carefully press the scion in place. Cover over where the incision was made with grafting wax, and then wind around the stem of the tree, at both ends of the scions, some narrow strips of bass matting, which will keep them firmly in place. For trees from which the bark has only been gnawed half or two thirds the way round, one or two scions will be sufficient; but when there is no connection left, it will be found advisable, particularly on a large sized tree, to put in three scions. The work may be done at any time between the 1st and 10th of April. The figure at the left represents a scion prepared for setting in the way suggested. When we consider the ease with which damage by mice may be remedied in this simple manner, the person who permits his girdled trees to be destroyed will deserve little sympathy for his loss

THE locomotive returns from fifty-one railways, for November, 1872, published in the *Railroad Gazette*, show an average expense of 22·13 cents per mile for each locomotive. 2,682 locomotives were employed, and they traveled a total distance of 6,958,616 miles.

IMPROVED WATER FIRE-GRATE.

This is an improvement by R. J. Ellis, Liverpool, England, and recently published in the *Engineer*. Our engraving shows two methods of construction, one showing cast iron bars having the water channels formed in them, the other a bent wrought iron tube.

It will be noticed that in each of these arrangements the bars are fixed at one end only, the other end merely resting on a bearer, so that the bars are quite free to expand or contract. The bearer to which the bars are bolted contains two channels, F G, communicating with the passages through the bars, as shown. The feed water for the boiler is pumped into the channel, F, in the bearer, whence it circulates through the bars, returning to the channel, G, from which it passes off to the boiler in a highly heated state. The joints between the bars and bearer are made tight by suitable packing rings.



It is claimed by Mr. Ellis that this arrangement of bars not only forms an efficient feed water heater, and adds materially to the heating surface of the boiler, but that from the bars being kept comparatively cool, trouble from clinkering is avoided. The plan of pumping through the bars insures a good circulation through the latter, and the system of construction admits of the bars being readily removed from the bearer for the purposes of cleaning or renewal if necessary.

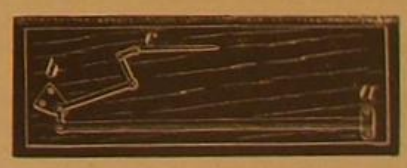
Correspondence.

Fire Alarms.

To the Editor of the Scientific American:

Some time ago you published an article in which I described a fire alarm, made with strips of sheet zinc and iron soldered together, there being the metals which differ most in expansibility. Wood is so little lengthened by heat that it is used for pendulums of clocks; and I have tried a piece of a tube of zinc (the most expansible of metals) such as is used to conduct bell wires, 18 inches long, laid on a piece of wood with one end of the tube fastened to it. At the other end of the tube is a small hole made in the side, into which is inserted a pin or point of the short end of a 6 inch lever, moving on a pivot ¼ of an inch from the tube, giving the long end fifteen times the motion; this can be moved sufficiently for a fire alarm by the heat of the breath blown through the tube, thus:

I made another by adding an additonal lever the tube, with levers fastened to the board at a, b and c, thus:



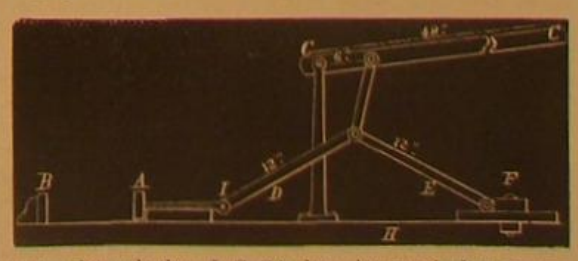
This latter will increase the motion 150 times; and in a room at a temperature of 65°, the heat of the hands will move the end of the second lever an inch and a half. S.

The Power of Compound Levers.

To the Editor of the Scientific American:

Having noticed, on page 195 of your current volume, a communication from J. C. C. as to the power of compound levers, I herewith give the equation for the same, together with a solution of his problem.

The form of compound lever known in mechanics as a "knee joint" has for its proportion P : W :: 2 R : tan ½ a; a being the angle between the bars. Now J. C. C. desires to know what power would be exerted on the head, A, when the joint is acting at its fullest efficiency, the power arm of the lever, C, being to the weight arm as 8 to 1. A glance at the proportion for the "knee joint" shows that it matters



not one iota whether J. C. C.'s bars be two inches or two feet long, or whether the value of his lever be 8 or equal to that of Archimedes. The power of the knee joint, when the angle between the bars approximates to 180°, is approximately infinite; for, just in the same ratio that the extreme

tan ½a increases, the other extreme, P, diminishes, and when ½a = 90°, its tangent = ∞, hence P is then infinitely small. Conversely, when the bars are together, P must become ∞ The following equation gives the value of the lever or joint for all angles: W = P½d ÷ 2h, or P : W. :: 2h : ½d; h being the hight of the joint from the plane on which it slides, and d the distance from F to I. R. D. WILLIAMS, Ph. D.

Baltimore, Md.

Construction of Dwellings.

To the Editor of the Scientific American:

In J. H. L.'s communication, printed on page 180 of your current volume, there are a few improvements required to make just such a house as I think he wants. He proposes filling in between the studding flush with the inside and outside, then plastering upon the filling without furring off, as is usual. His house, if so constructed, will be damp upon the inside; and by this, I mean to say that almost all damp walls are so, not from passage of damp through them, but by condensation of inside moisture; if there be an air space between the plaster and the wall, his house will be warmer, because such space is a nonconductor. Therefore, to follow out his plan in part, I will commence with drain tile, as recommended in an excellent article in the SCIENTIFIC AMERICAN of March 22, entitled "Complete Drainage of Dwelling Houses." After getting the drain in place, I should run up a foundation of stone or well burned brick; on top of foundation I would lay 2 × 8 plank all around for sills; place the joist, and secure it from toppling over with strips. Then nail the joist into the sills, and erect the rest of frame, resting the foot of the studding upon the sills and against the joist, to which nail securely. Carry foundation to top of first floor joist. I find that more cold comes in through floors than warm air escapes by absorption or bad joints in walls; therefore I should nail strips, three or four inches from top of joist on each side, and cut in any waste lumber upon which I should spread mortar (concrete would be better) to within an inch of the top of joist; and I would serve the upper floors the same. In laying floors, run the flooring back again, filling in walls; this will form a preventive against fire. Now when the four inches of filling is in place, I would fur off with inch strips and lath before plastering; or I would start in the beginning with six inch studding, making a two inch space of air in place of one, as in the furring mentioned. As for fire, if the brick or stone foundation is carried to top of joist, the flue J. H. L. speaks of is closed at bottom; if the upper floor is carried back to filling in, we have stop number two; then the plate upon top of wall forms the third stop in flue. And we have as nearly fireproof a house as the general run of brick buildings, if not better. Even in houses with no filling between studding, if the floors are carried back to the sheathing, or pieces cut between studding at this point, the mortar that always falls from the clinch will make an almost air tight joint. But carpenters who take a job of building, competing with perhaps a dozen o hers, cannot be expected to do any little extras, and now-a-days buildings are oftener thrown together than otherwise, built to sell, stylish outside, relying too often on paint and putty to cover bad joints. C. H. BARNES.

Chicago, Ill.

Relics of the Mound Builders.

To the Editor of the Scientific American:

On page 184 of your current volume, in an article entitled "The Relics of the Mound Builders," occurs the following sentence: "The most peculiar feature about the formation of the skeleton was that the arm at the shoulder connected with a short strong bone that was connected firmly with the sixth joint of the backbone, counting from the head." A bone reaching from the shoulder to the sixth cervical vertebra is a new feature in human osteology. This excited my curiosity, and I wish to enquire if other skeletons of these mound builders have not been found; and whether this extra bone is common to them all, or whether this is a single example, and ought to be looked upon as a *lusus naturæ*? If common to all, then we have some fragmentary knowledge of a race of human beings entirely unrelated to the race of Adam, but another and extinct species of the same genus. I say another, for the skeleton found in one of the caves of Italy, in immediate juxtaposition with the skeletons of the extinct tiger, cave bear, etc., shows pretty conclusively that these animals and man existed contemporaneously, probably long before Adam and Eve were created. In saying this I do not wish to be understood as denying revelation or any of the truth contained in the Old Testament. Of course it could not be expected that Moses, from his very limited means of knowledge, most of which was legendary, would attempt to enlighten mankind about the fossil remains of extinct men and animals, of which he could know nothing. Geology shows very conclusively that creation and extinction have been the natural order of nature, that the conditions favorable to a given form of life have ceased, and therefore, that that form must have necessarily become extinct; and the evidence is the fossil remains belonging to this or that geological age. Fossil remains of many animals and plants exist in latitudes where the living specimens have ceased to exist for an indefinite period of time. It seems a fair inference, then, that this Italian skeleton and, perhaps, these mound builders also were of species extinct long before our progenitors were created. This being true does not necessarily fix the stigma of untruthfulness on Moses, for he could not be expected to know what the combined researches of science for ages have but just unfolded. His history was in accordance with the best light he had, and he undoubtedly believed it to be true.

R. K. SLOSSON.

Deep Sea Soundings Without a Rope.

To the Editor of the Scientific American:

The present mode of obtaining deep sea soundings is extremely laborious, and by no means satiffactory. Not only is it requisite to lift an enormous weight of rope, but the large surface of the latter enables any deep oceanic current to carry it away from the perpendicular and so mislead the observer.

Recognizing these difficulties it occurred to me some years since that it might not be impossible to dispense with the rope altogether and to ascertain, at least approximately, the relative depths of various parts of the ocean with infinitely less trouble. By letting a stone fall down a shaft, and carefully noting the interval of time between its movement from the surface and its arrival at the bottom of the shaft, it is easy to determine the depth of the latter, which is the distance traversed by the falling body. All systematic works on natural philosophy give the rules for estimating the space passed through during each second by a heavy body falling in air. And it is surely possible to obtain the same information with respect to heavy bodies falling in water or light bodies rising in it. Now the plan which I have in view for deep sea soundings is based on the same principle as that long used to determine the depth of shafts, namely, by simply noting the time required for the falling body to reach the bottom; but in the ocean depths we could not readily tell when the weight touched the ground, and therefore a more complicated, but by no means insuperable, problem is there presented. Thus, if a body specifically heavier than sea water is allowed to sink at the surface of the ocean, it will at the end of a certain time, varying with the depth of water, strike the solid ground below the latter; and if at that moment the specific gravity of the body can be so changed that it becomes and remains lighter than water, it should at once begin to ascend until it again reaches the surface of the sea. Then by simply observing the time required for the descent and ascent of the body, and dividing that time properly according to ascertained laws for the descending and ascending movement of the body, the ocean depth at the spot would be approximately known. The arrangement which I should propose may be outlined in a few words. Have a strong iron cylinder, with a close fitting piston, so contrived that when the latter is at the top of the cylinder, both being placed vertically, the apparatus will readily sink in water; but when the cylinder is filled with gas, the piston being at the bottom of the cylinder so as to retain the gas and being prevented from compressing the gas by a mechanical contrivance, the apparatus will be lighter than water and consequently ascend in it. There is no difficulty about the sinking of the apparatus, and the ingenious devices now in use, for detaching extra weights and causing sand, etc., to adhere to part of the apparatus, might also form part of this arrangement. For changing the specific gravity of the apparatus at the bottom of the sea, I would employ a simple contrivance like that of some of the earlier torpedoes, by means of which some gunpowder, placed in or near the top of the cylinder, should be ignited. As soon as the apparatus struck the ground, the resulting gases would force down the piston and fill the whole space of the cylinder so that it should at once become lighter than the surrounding water.

Believing that any plan tending to facilitate the acquisition of more correct information respecting the depth and bed of the ocean is not without some public interest, I submit these rough ideas to the consideration of those more immediately interested in the subject. It is gratifying to observe that civilized governments are now more than ever recognizing oceanic science as a common field for peaceful international rivalry; and the naval department of the United States, especially in connection with the official labors of the late Captain Maury, has already honorably distinguished itself in this great and useful work. Experiments of the kind now proposed are beyond the means of private individuals, and would seem to be among those which national authorities may legitimately undertake.

New York city. GEORGE ROBINSON, M. D.

The Comet of 1866 and the November Meteors.

To the Editor of the Scientific American:

It is now admitted that the comet of 1866 and the meteors of November 14 move in the same orbit, and that the latter are the *débris* of the former's disintegration. This comet, near its ascending node, passes almost exactly through the orbit of Uranus; hence, in all probability, the present form of its path is due to the disturbing influence of that planet. The date of this change in the cometary orbit is fixed by Leverrier in the year 126 of our era. That the first appulse, however, of the planet and comet must probably have occurred at a more ancient epoch is undoubtedly indicated by the following facts:

1. The meteoric showers observed in the years 931 and 934, as compared with those seen from 1866 to 1870, show conclusively that the lengthening of the meteor cloud in the last 940 years has been less than that between the first perihelion passage of the comet and the year 931. In other words, the diffusion of meteoric matter in the early part of the tenth century was too great to have been effected in so short a period as 800 years.

2. Dr. Oppobser's period of the comet of 1866, computed from four weeks' observations, is 33·176 years, and this is the value which indicates a close approach to Uranus in A. D. 126. This period, it must be admitted, is liable to some uncertainty. Have we any probable data by which it may be corrected?

The identity of this comet with that of 1366 was suggested by Professor H. A. Newton soon after its appearance—a conjecture which subsequent research has strongly confirmed. It is also probable that the comet observed in China on the 29th of September, 1133, (Williams' "Observations of Comets," p. 65,) was a former return of the same body. The interval between 1366 and 1866 is equal to 15 mean periods of 33·288 years. With this value of the periodic time and the known secular variation of the node, it is found that the comet and Uranus were in close proximity about the beginning of the year 547 B. C. It is not improbable, therefore, that the former was at that time thrown into its present orbit by the attraction of the latter.

If then, as seems highly probable, the comet of October, 1366, was a former return of that which passed its perihelion in January, 1866, it is easy to find that the same body will make a near approach to the earth about the 16th or 17th of November, 1965, and to Uranus in 1982–3. At one of these epochs the cometary orbit will probably undergo considerable transformation. DANIEL KIRKWOOD.

The Boiler Explosion at Conshohocken, Pa.

To the Editor of the Scientific American:

We notice in your issue of April 5, in your Answers to Correspondents, a communication from W. S. B., who says he was at Conshohocken, Pa., with Mr. Le Van when he examined the boiler exploded there on February 3; and as we know the high standing of the SCIENTIFIC AMERICAN as well as its proprietors, before the public, we think you do not wish to have us misrepresented or to let errors and falsehood go uncorrected. If we saw what W. S. B. says in some of the sensational newspapers, we would let it go unnoticed; but cannot do so when it appears in your widely circulated journal.

We reply by saying that every word that W. S. B. says in that communication is false and malicious from beginning to end; and we only wonder what inducement or expectations Mr. W. S. B. can have in view in publishing such a string of falsehoods. He cannot find any part of the exploded boiler three sixteenths of an inch in thickness; it is all here yet and can be examined at any time. There were not so many persons killed as he represents, and none of the wounded are crippled for life, all being well and at work. We never carried 125 lbs. pressure on the boilers, but only 85 lbs., and we never exceeded it. There is no boiler here with 18 patches upon it, and never was, or anything near it. He never saw such a boiler here in his life. He never heard the proprietor say last summer, in reply to the engineer's opinion that they were carrying too much pressure (from 100 to 110 lbs.) that it was all nonsense, that those boilers were able to stand 150 lbs. pressure. He never heard such a remark in his life or any thing like it. He has made this story up out of the whole cloth. He says the trouble was that they wanted one man to do three men's work, and one man was doing it for less than one good man's wages. How absurd is this statement! A man is not likely to do three men's work for one man's wages, as you well know. The fact is that the engineer in charge of the boiler at the time had the engine to stop and start two or three times on his turn; he had six boilers to attend to, looking after the water only (no firing to do), beside oiling; this was about all he had to do whilst running, for which we paid him twenty-two dollars per week; about seven dollars per week more than engineers get here for running at blast furnaces where they run seven turns per week, and about six dollars per week more than most engineers get for running in rolling mills. We paid him extra because we thought he was a superior man, and we pay more to engineers than any one else in same business (to one we pay twenty-six dollars); and they have been here for over ten years. In many places engineers have double or treble the number of boilers to look after that we have here; so that it does not look as if one had to do the work of three men. We have the reputation of paying a good price for everything we get, labor not excepted; our men make as good wages and are paid as promptly as any in the country.

We wish to state to you, as it may benefit others as well as ourselves, that we had the boiler spoken of by W. S. B. (as taken out from the side of the exploded one) and the one which, he says, has 18 patches upon it, tested with hydraulic pressure, and it was taken out for that purpose. It was tested by Mr. Farren, one of the Hartford Boiler Insurance Company's inspectors, to 175 lbs., with ice cold water, without showing any signs of strain or leaking a drop, or sweating at a seam or rivet. This test, Mr. Farren says, (according to experiments made at Morris, Tasker & Co.'s works with boiler tubes, etc., who say that one pound of cold water pressure is equal to two of steam) is equal to 350 lbs. of steam pressure; we do not, however, assert this as a fact. It is no doubt much more severe than steam pressure; and under the steam boiler laws of Philadelphia, they allow steam one third less than the cold water test to which they subject them to be carried. This would have given us the privilege to carry 117 lbs. steam on this boiler; W. S. B. says there are worse boilers working in the mill today than this, carrying from 60 to 125 lbs. steam. This is false also; we have not worked any in this mill since February 3, not being ready yet to start. But what boilers we have at this mill have been all inspected by the Hartford Boiler Insurance Company, and they have no hesitation in giving us a policy of insurance to run them at their risk. We presume they ought to know something about boilers.

Mr. W. S. B. has the advantage of us, as he is unknown to us; and as we do not know where to look for him, and he knows us, we extend to him through you a polite invitation to visit us, as it would give us much pleasure to talk the matter over personally with him. He might give us some valuable information, perhaps. We will state one thing

more: The Hartford Boiler Insurance Company's inspectors say they do not care for the age of a boiler, that they only look for the quality of the iron, thickness of sheets, diameter, and workmanship, and that they often find old boilers better than some new ones. WOOD & BROTHERS.

Conshohocken, Pa.

THE GOVERNMENT SUBMARINE WORKS AT HELL GATE.

We should advise people of a nervous temperament, who contemplate visiting the excavations at Hell Gate, to refrain from entering the wooden shanty, in which a laboratory for the making and filling of the nitro-glycerin cartridges has been extemporized. Not that there is any positive danger—for 16,000 pounds of the material have been handled and used without an accident—but the sight of gallons of liquid destruction surrounding one, and the knowledge that should it explode utter annihilation would be the result, is calculated to send a disagreeable tremor even through the strongest organizations.

The nitro-glycerin destined for use at Hallett's Point is transported from the place of its manufacture and stored, several hundred pounds at a time, in a small arched concrete building, erected on a reef known as Flood Rock, situated in the middle of the river. From here it is carried to

THE NITRO-GLYCERIN LABORATORY,

which is located at some distance from the other buildings. The floor of this shop is covered with a thick layer of dry plaster of Paris, which serves to absorb, and render harmless, any drops that may fall upon it. Within the apartment an equable temperature of from 65° to 70° is maintained throughout the year; steam pipes, carefully guarded, affording the necessary heat in winter, and a chest of ice serving to lower the warmth in summer. The thermometer is in fact the principal safeguard, for if in cold weather the nitro-glycerin is allowed to fall below the above mentioned temperature, it is liable not to explode when fired, while if on warm days it should become heated to excess, spontaneous combustion is apt to ensue.

THE CARTRIDGES

are made of heavy manilla paper and vary in size, according to the amount of explosive they are to contain. A sheet of paper of suitable size is first wound over a roller, for half its length, then the other half of the leaf is covered with thick glue, when the whole is tightly rolled around the form. One end is folded and closed, and the case is slipped off the cylinder and covered with a waterproof mixture of Stockholm tar, resin and tallow, great care being taken that every portion inside and out receives a complete coat. This dried, the cartridge is filled with nitro-glycerin, the workman having several quarts of the explosive in rubber vessels on the table before him, and apparently handling and pouring it with as much coolness as if it were water. The case filled, the electric fuse is inserted. This is either one of the patented fuses or an arrangement of fulminating powder at the end of the wires. Chlorate of potash is principally employed, as it is some fifty per cent cheaper than either fulminate of mercury or of copper. The upper end of the case is then twisted around the wires and covered with a thick mass of the tar compound, when the cartridge is ready for use.

The principal point to be guarded against in making these cartridges is that they shall be impervious to leakage. This is plainly evident from the fact that, should such not be the case, a portion of the dangerous liquid might escape and spread through fissures in the rock after the charge had been inserted in the hole. Not sharing in the general explosion, the presence of the nitro-glycerin in the cracks would not be known until struck by a drill bit, when of course a terrible disaster would result.

The number of cartridges made in the laboratory depends upon the requirements of the works; it ranges from 100 to 250 per day. About 1,000 pounds of nitro-glycerin are used monthly.

EFFECTS OF NITRO-GLYCERIN.

Did we seek a word to express the effects of this powerful explosive, we should fix upon "pulverizing," for such is indeed the case. One hundred pounds of nitro-glycerin placed upon the surface of granite rock fairly reduces the stone to powder. Its action under water was well shown in the recent blasting of a reef near Hell Gate. The rock was entirely submerged, of considerable length and of peculiar shape, its upper portion forming an overhang. The first trial was made with a cartridge containing 12 pounds of nitro-glycerin, placed under the projecting ledge. It is supposed that a passing steamer generated a current which carried the charge some fifty feet away from the reef, for when it was exploded, a column of water hundreds of feet high was thrown into the air, while the surface was covered with dead fishes. The rock was untouched. On making the second attempt, several cartridges were firmly secured in proper position and fired. This time the water was raised hardly six inches, but a diver, after descending, reported that the reef had disappeared, leaving the bottom at a uniform level.

NITRO-GLYCERIN COMPARED WITH OTHER EXPLOSIVES.

Nitro-glycerin is some thirteen times more powerful than gunpowder, and consequently, from its greater force, it accomplishes different results. In using powder in the Hell Gate blasts, the rock was split off in masses often weighing several tuns each, which required a large amount of hard labor with heavy sledges to reduce to a portable condition. With nitro-glycerin the latter work is no longer necessary, as it is rarely that a fragment exceeds one hundred pounds in weight. Dynamite and dualin are considered as uncertain in effect and explosion, and consequently of greater danger than the pure nitro-glycerin. For small holes varying from 1 to 1¼ inches in diameter, dynamite, we were informed, had been used to good advantage but for larger blasts, of 2 inches and over, nitro-glycerin is the superior. Lithofracteur has not been tried, as it is stated that none can be obtained.

HOW THE WORK IS TO BE CARRIED OUT.

As we said in our previous article, it is the present intention to extend the headings until all shall reach a point above which 32 feet of water exists. After the seven galleries are completed, the floor of the entire excavation will be lowered some fifteen feet in order to give the roof a clear fall of about forty feet. It does not appear to be the design to follow out the original idea of cutting chambers in the supporting pillars in which to place the nitro-glycerin; though the exact method of arranging the exploding charges is not as yet definitely determined. The opinion among the officers of the work is that the piers will be cut entirely away, and the roof supported by heavy wooden crib work. The nitro-glycerin will then either be placed at suitable points in barrels, or else will be contained in tubing, laid close to the roof throughout the entire chamber, the whole arranged with electric fuses being connected with a battery. The water will then be allowed to enter the main shaft, completely fill the excavations and thus act as a tamping. The nitro-glycerin is designed to act upon the roof, shattering it to fragments which, falling to the floor, will at once leave a sufficient depth of water. By this means the slow and expensive process of subsequent dredging is hoped to be avoided.

Tremendous as the explosion will be, the water tamping, it is considered, will effectually prevent all danger to adjoining buildings, though in all probability a very near approach to an earthquake will occur in the neighborhood. When this final "blow up" will take place it is difficult to state. Congress has been by no means lavish in appropriating funds to carry on the work. About $600,000 we are informed, is necessary for its completion, but the progress toward the latter is dependent upon the rate at which the necessary money is doled out.

OTHER GREAT EXCAVATIONS AND CUTTINGS.

No better proof of the excellence of the plans of General Newton can be afforded than the complete success of similar operations undertaken to remove the obstructions in the harbor of Valetta, on the island of Malta. The same general design of work was copied and the result was a complete removal of the dangerous reefs. It may be acceptable, in concluding our notice of the Hell Gate excavation, to glance in brief review over other and similar works both completed and in progress, and in the same connection, to remark the performances of the drill which, in our previous article we demonstrated to be of such practical value. In

THE HOOSAC TUNNEL,

less than 8,000 feet remains to be cut. This will be done before November, 1873, and it is stated that cars will be regularly running through the great bore before March, 1874. The contractors for the work, the Messrs. Shanly, state that by using the Burleigh drill a gain of 33 per cent over hand labor was obtained, which will enable them to complete the tunnel in five years less time. It is only necessary to compute the loss (which would accrue if the capital invested in defraying the cost of the enterprise $10,000,000 were allowed to lie idle as it would do, if the tunnel could not be used for five years longer) to show, that by the use of the drill above mentioned, not only a saving of time, but a large saving of money has been effected. The cost per yard of the Hoosac tunnel, although the rock is harder, has been less than that of the Mont Cenis tunnel, where the Sommellier drill was employed.

THE ST. GOTHARD TUNNEL,

piercing Mont St. Gothard in Switzerland, is to be thirteen miles in length. As the Hoosac bore is 4¾ miles, and that through Mont Cenis 7¾ miles, the above mentioned great cutting will be longer than both together. The Burleigh drill, we learn, is to be used throughout the entire work. The

NESQUEHONING TUNNEL,

at Mauch Chunk, Pa., was completed in less than two years by the Burleigh drill, when it was plainly proved that, if hand labor had been employed, at least five years would have been required: 1,000 feet of the cutting was through conglomerate rock, the hardest known in the country. In headings where 15 feet per month was considered an excellent rate of advance by hand labor, the machine above mentioned accomplished from 80 to 90 feet in a similar period without difficulty.

Spring Dangers.

Doctor Hall, in his *Journal of Health* for April, says: March, April, and May are more fruitful of sickness and death than the other months of the year; not so many die as in July, August, and September, but there is more disease, arising mainly from sudden changes of the weather, injudicious changes in clothing, and errors in eating. The causes of sickness and death are avoidable; hence, we are the authors of our own sufferings, which are irrationally attributed too often to the "mysterious dispensations of Providence." The difference to the reader between attention to and neglect of some of the following suggestions may be vigorous health or a shroud before midsummer.

In March there is a searching rawness and dampness in the atmosphere which chills the blood in such a way as to lay the foundation for a multitude of colds, fevers, and inflammations. In April the atmosphere is not so much saturated with dampness, but the fires are early put out, and the winter clothing is too soon laid aside, in whole or in part. In the beautiful May, the mornings and evenings are damp and chilly; the warmth of midday tempts many to lay aside the warmer clothing, and this lighter clothing, together with the absence of fires, makes a difference sometimes of twenty, thirty, or even forty degrees. But, in addition to these, there is another cause of disease, almost universal, prevailing through all the three months. No one thinks of building as fierce fires in the spring time as in midwinter, because there is not the same necessity for artificial heat; the external air is not nearly so cold, but we kindle as great an internal heat, which is excessive, and that is fever, and fever is followed with cold within twenty-four hours as certainly as a pendulum, carried to the right, if let go will swing to the left; one is the re-action of the other, a fixed law of our being. If the system were kept in an equable condition of warmth within and without, we would have neither fevers nor colds, chills nor inflammations.

We eat for two reasons; to sustain and to warm. A large portion of our meats and butter and bread is composed of the warming principle, carbon, the province of which is to produce animal heat; hence, if we eat as much in the spring as in the winter, there is inevitably too much internal fire, and that is fever. In the spring everybody gets weaker because the weather is warmer, and yet we eat with the winter's appetite until Nature begins to take it away; then we begin to think that something is the matter, that we are going to get sick; but, instead of being content to diminish the quantity and quality of our food in proportion to the diminishing appetite, we begin to stimulate that appetite by "tonics" and "bitters," meaning thereby whiskey in disguise, for it is scarcely possible to find a tonic or a bitter or an appetizer of which alcohol is not a large constituent; if they do whet the appetite, they are injurious just in proportion as they do it; it is fighting against Nature; for, while she is endeavoring to moderate our desire for eating, we are trying to increase it; she aims to diminish the amount of fuel to supply the internal furnace; we try to increase it. In fact she goes further and absolutely changes the appetite. In February we revel on pork and fat and sweets and buckwheat cakes and corn bread, which are almost wholly "carbon;" we all know them to be "heating;" and as spring comes on, we relish "greens" and spinage, the early vegetables and fruits and berries, which we all know to be "cooling" with their delicious acidities. How we delight in cabbages and turnip tops, and other green things which are eaten with vinegar, and turn away from pastries and puddings and doughnuts, and other forms of fats and sweets!

If, in the spring, we eat with the appetite of winter, or goad ourselves to it with tonics, the inevitable result in all cases, infallibly, is that there is too much internal heat, meaning fever, followed by biliousness with its long catalogue of "ails," ending in dysenteries, diarrhœas and insufferable debilities.

Families make a great mistake, especially in the country, in early dispensing with fires. Where there are children there should be a good blazing fire on the hearth, at least in one room in the house, all day, until the first of May, and during May until after breakfast, to be kindled up at sundown. The instinct of the children will drive them to that room, and when they cease to gather around that fire, mornings and evenings, then, and not till then, ought fires to cease for the summer.

CHANGING CLOTHING.

Health and sometimes life itself is often lost by laying aside winter clothing too early. Laying flannels aside in the spring is a most pernicious practice. They are as necessary in July as in January. We can better do without woolens next the skin in midwinter than in midsummer. We do not get overheated in winter; we do in summer; and the most frequent exciting cause of coughs, colds, and consumption is a rapid falling of the temperature of the body. All are familiar with the fact that a sudden checking of perspiration is always dangerous; very little exercise causes us to perspire in summer, and a very slight draft of air checks the perspiration; hence, eminent French physicians have stated, after a long series of observations, that colds taken in summer excite the most incurable forms of consumption. White woolen flannel is a most efficient guard against these sudden changes, because it keeps the heat of the body in, while it repels the excessive heat from without; it conveys the water of perspiration to its outside, while the surface next the skin is drier. We all known that silk, cotton, and linen next the skin get saturated with water, and if, for an instant, the slightest draft of air gets between the skin and the material, there is a channel like chill when that material touches the skin.

The rule should be to wear white woolen flannel next the skin all the year round; thick in winter, a little thinner in April, a gauze material on the first day of July; on the first of October resume what was laid aside in July; on the first of December put on the thickest, extending to ankles and wrists.

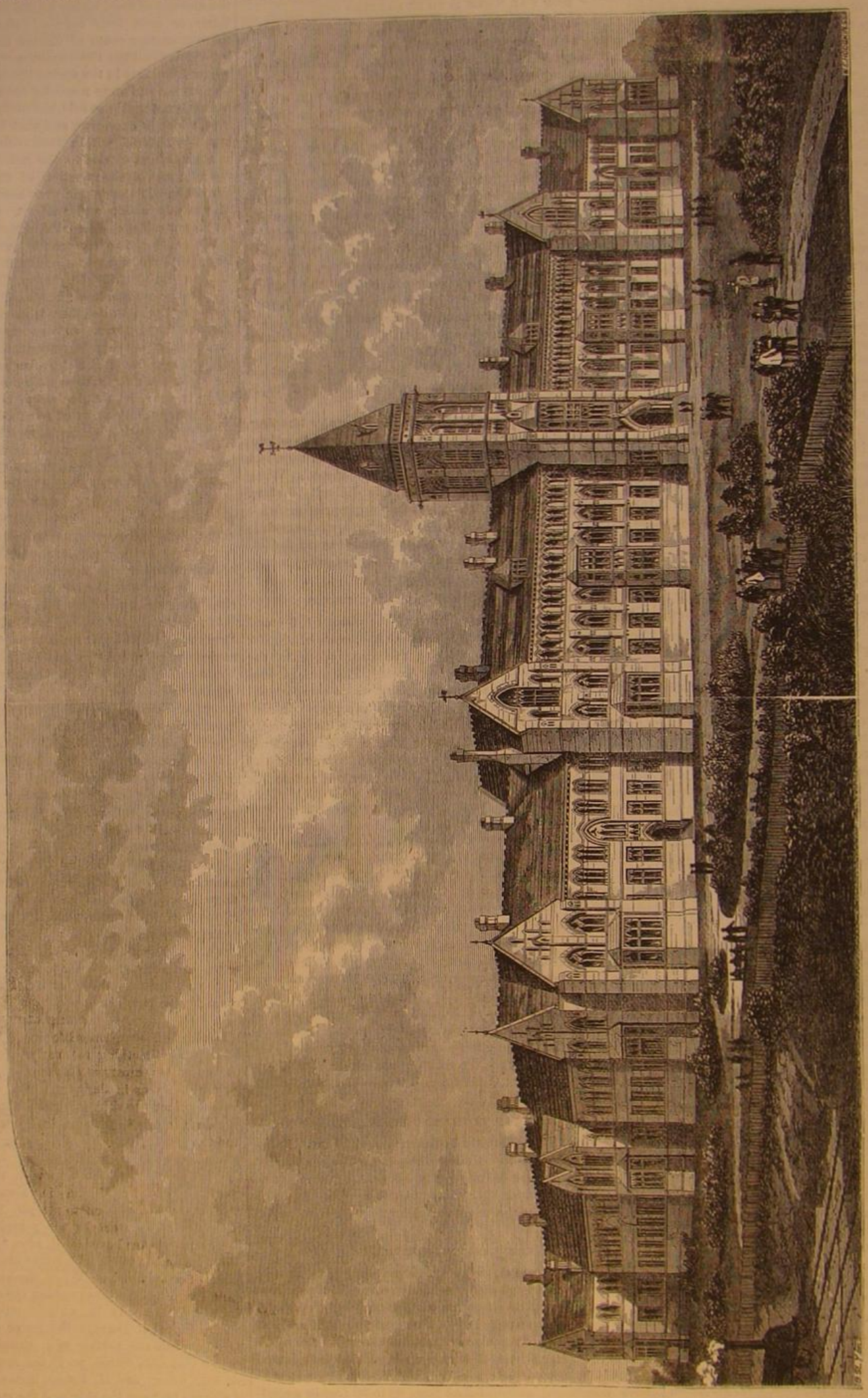
These rules of change are especially necessary to all old people, to all invalids and young children; day laborers and all out-door workers would be incalculably benefited by the same observances.

THE velocity of light is 192,000 miles per second, nearly. The velocity of frictional or static electricity over a copper wire is 288,000 miles per second. The velocity of sound in water is 4,900 feet per second.

LUNATIC ASYLUM, WINDSOR, ENGLAND.

The fine architectural design, presented herewith, is from the proposed plan for a very extensive lunatic asylum, to be erected at St. Ann's Heath, Virginia Water, Windsor, England. The material for construction is brick with stone decorations, though the latter will be few, the object being to give the edifice a thoroughly brick expression. Portions which cannot be executed in brick will be produced from terra cotta or Ransome's patent stone. Very little ornament will be used on account of the expense of stone carving, and from the fact that the design calls for simplicity without imposing display. The architect is Mr. Alfred Smith.

Another retreat for the insane, we learn, is to be shortly erected at Glasgow, Scotland. The building is to be a model of its class, to cost $300,000, and will be surrounded with some 170 acres of exercising and pleasure grounds. It may be noted in the present connection as an interesting fact that the largest as well as the greatest proportionate number of insane asylums in the United States are located in New England. Massachusetts alone has three State institutions—one of great extent at Worcester, another at Northampton, and a third at Taunton—besides many private retreats conducted by eminent members of the medical profession.



LUNATIC ASYLUM AT ST. ANN'S HEATH, WINDSOR, ENGLAND.

Sleeping Cars in France.

The well known French firm of Desouches, David & Co., Pantin, near Paris, are about to become the exponents of a new system of carriage construction for long through transit by rail, based upon that which has for some years been in operation in this country. The cars, now being prepared, are built upon the model of the Eastern of France railway carriages, being intended for the through route from Paris to Vienna, during the Universal Exhibition at the latter city. They will belong to a private company, and be provided with special attendants, apart from the railway companies' officials. Each carriage is intended for twelve passengers only, that being the number of beds made up. Sanitary, lavatory, and toilet compartments and appliances are to be provided; and one of the three compartments into which the car is divided is to be devoted to ladies, or separate traveling parties, as may be required. The cars will, it is understood, be heated by *briquettes* (artificial burning compound) on the German system, and a certain limited provision for refreshments will be made.

Steel Car Wheels.

An improvement recently patented in England, by Hadfield of Sheffield, and described in *Iron*, is as follows:

An ordinary rolled crucible or Bessemer steel, iron, or other tyre, is heated as hot as possible (without burning), in a suitable furnace, and then placed in a casting box, the nave being first placed in the center and moulded thereto in the ordinary way. Molten crucible steel, or iron, or other metal, is then poured therein, whereby it becomes united together in one solid or hollow homogeneous weldless wheel, thus obtaining a combined wheel of great strength, elasticity and tenacity, free from the defects and liability to breakage of those in ordinary use. The wheel is afterwards annealed, if required.

For wheels of a similar construction to those at present in ordinary use upon railways, the tyre is first suitably heated and placed in the casting box, and then the nave placed in the center. Pieces of crucible or Bessemer steel, or wrought iron, of the necessary thickness, cut into suitable lengths to form the arms or spokes, are arranged around, and retained in their position by molding in the ordinary manner. Molten steel, iron, or metal, is then poured in or otherwise introduced, until they become united into and form one solid homogeneous weldless steel or metal wheel. These wheels are said to be peculiarly free from jarring and concussion, as well as more economical than ordinary wheels, and they are not so liable to sudden expansion or contraction. The absence of complicated tyre fastenings is another very advantageous feature.

PROFESSOR JAMES DEWAR has made a series of experiments by which he has ascertained that the boiling point of carbon is 18,032° Fah.

The Artificial Formation of Organic Substances.

By Dr. Henry E. Armstrong, F.C.S., Professor of Chemistry, London Institution: From marsh gas or methane, by series of operations similar to those whereby ethane is converted into ethylic alcohol, an alcohol is obtained which proves to be identical with methylic alcohol, or wood spirit, one of the main products of the destructive distillation of wood. These alcohols serve as the starting points for the preparation of other hydrocarbons and alcohols bearing relations to each other, similar to those which obtain between methane and ethane, and between methylic and ethylic alcohols. Many of the alcohols, as prepared artificially, are identical with the alcohols which are obtained, together with ordinary alcohol, by fermenting saccharine substances, or which exist in the form of compound ethers in the ethereal oils extracted from various plants.

A long series of products is obtained by the oxidation of alcohol. This is first deprived of a portion of its hydrogen and converted into aldehyde, which latter is then converted by direct assumption of oxygen into an acid: ethylic alcohol, yielding acetic acid, the acid of vinegar. The other terms of the series of alcohols to which ordinary alcohol belongs are acted upon in like manner, and thus a series of aldehydes and acids is obtained. Many of these acids are identical with those which enter into the composition of the natural fats. The aldehydes are extremely alterable compounds, and readily undergo change, almost spontaneously, in fact, being converted into bodies of more complex composition.

Formic aldehyde, the aldehyde of methylic alcohol, is probably formed in plants from the carbon and oxygen of the carbonic acid of the atmosphere (whence, as is well known, plants derive their carbon), and the hydrogen from water. One of the simplest transformations of formic aldehyde is its conversion into sugar; this conversion, however, has not yet been effected artificially, although formic aldehyde has been converted into a substance closely resembling the natural sugars. The aldehydes combine directly with ammonia, and the products readily part with the elements of water, and are converted into alkaloids, one of which, that obtained from butyric aldehyde, is identical in nearly all respects with conine, the poisonous alkaloid of hemlock.

A variety of interesting derivatives is also obtained from the acids of the acetic series, such as glycocine, leucine, glycollic and lactic acids, all of which are substances found in various mineral fluids.—*Iron*.

DETERMINING THE VALUE OF ANILINE COLORS.—The *Chronique de l'Industrie* describes a new method, the principle of which consists in the fixing of the coloring matter to be tested on a plate of glass, by means of collodion. The thin film thus obtained is compared with another of the typical coloring material prepared in the same manner.

SULKY PLOW.

This invention combines a number of useful and ingenious devices by which the plow may be elevated or depressed to furrow at any depth, and the land wheel raised or lowered in connection therewith by simply touching a lever, the actuating power being supplied by the advance of the machine. Other mechanism is provided, through which the plow may be adjusted by hand without altering the position of either frame or wheels.

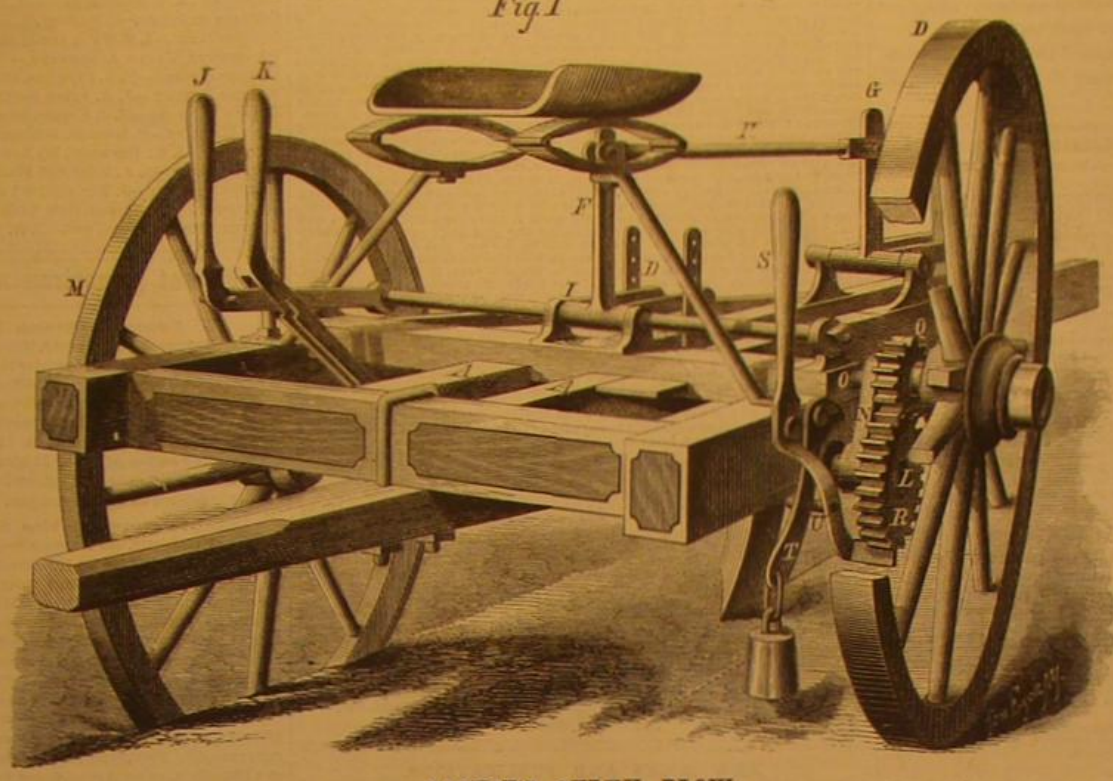
Fig. 1 gives a general perspective view of the apparatus, and Fig. 2, to which we shall first refer, shows the appliances governing the plow. The frame of the machine is clearly indicated in Fig. 1, and a portion of it is represented in Fig. 2, at A. B is the plow beam, the draft upon which is sustained by rods, C, secured to the rear end and also to the main frame. There are four of these rods, of which the inner two extend directly forward while the outer ones are inclined outward so as to serve as braces. To either side of each end of the beam, B, are secured straps, D and E, which pass up between the two parts of the frame—one portion of which is removed in our engraving. In the upper ends of these straps are formed holes, by means of which the straps are pivoted to the arms of bent levers, F and G. The object of the several holes is to enable the plow to be conveniently adjusted to work at any desired depth. By referring to Fig. 1, it will be noticed that these bent levers have each two rearwardly projecting and one upwardly projecting arms. The former are connected, as above stated, to the straps; the latter enter the slotted ends of a rod, H. The pivot pin of the vertical arm of the lever, G, works in a short slot in the rear extremity of the bar, H, in order that the forward end of the plow beam, B, may begin its upward or downward movement in advance of the rear end, to cause the plow to leave or enter the ground more more readily. The lever, G, is simply pivoted at its angle to a suitable support; the lever, F, however, is secured to a cross bar, I, which works in bearings on the frame of the machine. To this bar, and near its end toward the plowed land side of the implement, is attached a lever, J, which is provided, as shown, with a handle placed within easy reach of the driver. By this means it is clear that the plow can be raised or lowered at will without calling into play the devices below described. Referring now to Fig. 1, the arm of the lever, J, is seen passing through the slot of a connecting link, K, and is supplied with a pin which enters a short slot in said link; so that the lever and link may be locked together, and the former operated by the movement of the latter. A notch in the link allows of the detaching of the two portions whenever it is desired to raise or lower the plow by hand, as above described. The link, K, is prolonged by an arm which is secured to the axle, L, and which works in bearings attached to the frame. This is not shown in Fig. 1, being necessarily obscured by other portions. M is the furrow wheel which revolves upon a journal on the axle. To the opposite end of the latter is secured a crank arm, N, at the end of which is a spindle, O, on which the land wheel, P, rotates. To the hub of this wheel is attached a small gear wheel, Q, the teeth of which engage with those of a larger wheel, R, that revolves upon a journal on the extremity of the axle outside the crank arm. S is a lever pivoted to the frame and provided with a handle convenient to the driver. The lever is made with an outward bend, and an offset or foot which, engaging with the teeth of the wheel, R, serves to hold the latter stationary.

When the crank arm, N, is in a vertical position, as shown, the land wheel, P, will be raised, while the other wheel runs in the furrow; and when the arm is turned horizontal, the former wheel will be lowered so that both wheels will be on a level. To secure the latter effect, the driver pushes the lever, S, forward so that its offset catches the gear wheel, R. This wheel being held immovable—the machine meanwhile advancing—the small wheel, Q, must necessarily roll around it, and thus bring the crank arm, N, to a horizontal position. To retain the arm thus, a catch, T, pivoted at its upper extremity and supporting a weight is made at its upper end with a projection which is rounded off above but square below. When the crank arm turns forward the inwardly extending end of the spindle, O, strikes against this projection, which is thus shoved aside, but is immediately carried back by the weight, thus locking the crank arm in place, and permitting the disengagement of the lever, S. On the lower part of the last mentioned portion is a stop, U, which takes against the rear part of the catch, T. When it is desired to return the crank arm, N, to a vertical position, and raise the land wheel—by moving the upper end of the lever, S, to the rear, this stop pushes forward the catch, T, and releases the arm when the weight of the frame, etc., lowers the opposite end of the machine—and the arm becomes upright. The crank arm and lever or link, K, being both rigidly connected to the axle, as the former moves to raise or lower the wheel, through the medium of the link, the plow beam and plow are also raised or lowered at the same time. A suitable stop is provided which prevents the crank arm from being carried backwards beyond a vertical position.

The other portions of the device need no especial reference. The mechanism is not complicated and appears of a strong and durable nature, while the advantages offered as detailed above will, we do not doubt, favorably commend the machine to the notice of agriculturists.

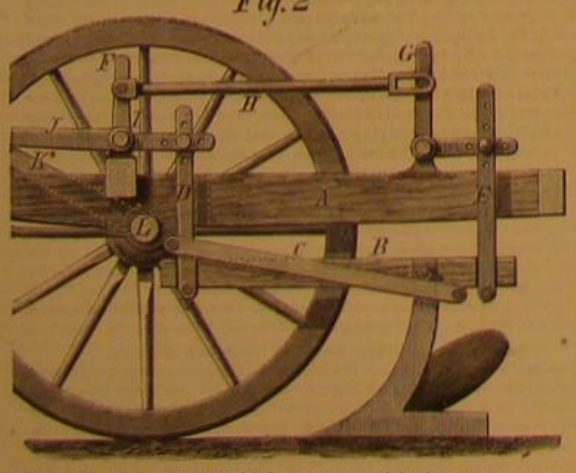
Patented through the Scientific American Patent Agency, March 11, 1873. For any further particulars required, address the inventor, Mr. Louis Sachse, Monmouth, Polk county, Oregon. [See advertisement on another page.]

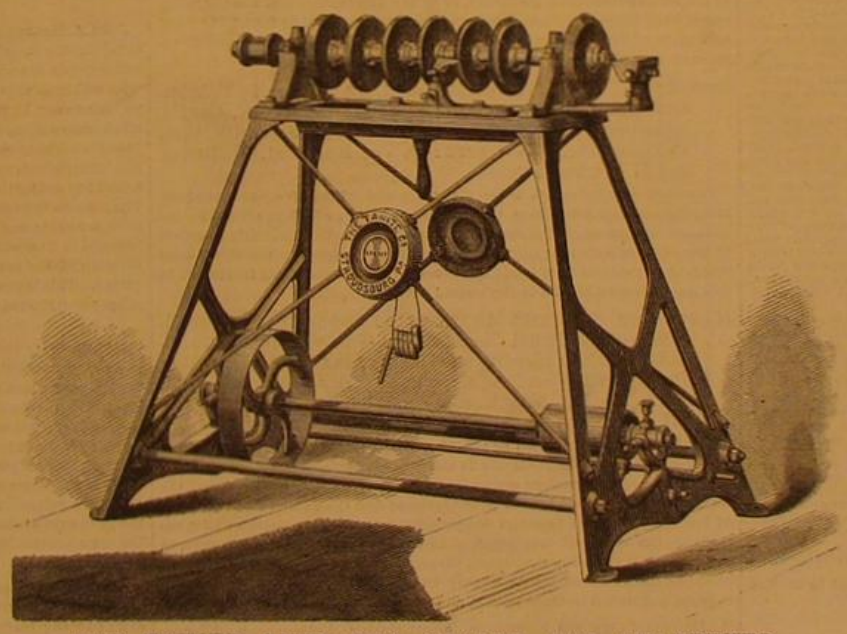
Fig. 1



SACHSE'S SULKY PLOW.

Fig. 2





THE TANITE COMPANY'S SHAPER AND SHARPENER.

Professor Tyndall at Home.

At a recent meeting of the Royal Institution of Great Britain, it was resolved that the warmest congratulations of the members be offered to their Professor of Natural Philosophy upon his arrival in England from the United States of America, in which, upon the invitation of the most eminent scientific men of America, he has been recently delivering a series of lectures unexampled for the interest they have created in that country, and the large and distinguished audiences who have been attracted to them. The members of the Royal Institution rejoice that the people of America have shared in the advantages of Professor Tyndall's teaching and illustrations of those sciences which have been so greatly advanced by the labors of his predecessors, and by his own, in the laboratories of the Royal Institution. They receive and welcome him, on his return to what they are proud to be able to designate as his own scientific home, with satisfaction and delight, and wish him all continued health and prosperity. The members of the Royal Institution have also to thank Professor Tyndall for his liberal gift to the Institution of the splendid and extensive apparatus employed by him in his lectures in America, and congratulate him on the generous spirit and the love of science which has led him to appropriate the profits of his lectures in the United States to the establishment of a fund to assist the scientific studies of young Americans in Europe.

The resolution was unanimously carried.

THE TANITE COMPANY'S SHAPER AND SHARPENER.

The annexed engraving represents a machine especially designed for use in wood working establishments. It is arranged to run six wheels between journals and one overhung wheel, the latter being especially intended for sharpening or gumming saws. The rest shown in front of the wheel can be adjusted on a line parallel with the arbor on either side of the table. It can also be supported across the trough in the bed of the table, thus allowing it to come between the emery wheels. The rest shown at the end of the machine outside of the overhung wheel has finished surfaces, and can be easily set so as to allow the grinding of a bevel at any desired angle. The arbor is of steel, one inch in diameter between bearings, arranged to carry wheels from one fourth to one and a half inches face, movable collars being supplied for this purpose. Wheels as large as eight inches in diameter can be used if desired. The water or oil trough being cast into the bed of the table is not liable to injury from rust or misplacement, and can be emptied by removing a plug, the handle of which is shown underneath the table. The base of the machine is four feet by two feet six inches, and the distance to the center of the arbor is but about three feet. The apparatus stands very firmly and is well and strongly braced. The countershaft is here shown underneath the table, as it is usually preferred, but it can easily be placed on hangers above. While especially designed for shaping and sharpening molding bits, cutters, saws, and other wood working tools, yet the machine can be applied to a variety of purposes by workers on metal. For further particulars address the Tanite Co., Stroudsburg, Pa.

POSTAGE STAMP AFFIXER.

The convenience of the device represented in our engraving will, we think, be at once recognized by all who have ever had occasion to affix the postage stamps to large quantities of mail matter. It consists of an ordinary spring hand press-

er, as shown, beneath which is a small box in which the stamps are placed, pasted sides up. Within this receptacle is a plate supported by a fixed standard, which passes through an aperture in the bottom. When the box is pushed down to the presser, the stamps do not follow its motion.

The letter is first moistened at the place on which the stamp is to be stuck, by pushing it between the roller and dampened sponge. Then it is laid above the box and the presser is brought down upon it. The case is thus forced downwards, and the letter carried in contact with the uppermost stamp, which adheres to the wetted surface. A coiled spring on the standard raises the box back to its place.

This ingenious invention was patented through the Scientific American Patent Agency, January 21, 1873, by Mr. E. B. Morgan, of Paterson, N. J.

PATENT OFFICE DECISIONS.

IMPROVEMENT IN SUSPENDER STRAPS.—J. W. WATTLES.—APPEAL.

LEGGETT, *Commissioner*:

An amendment should not be received which introduces into the application a feature not described in the specification as originally filed, and which has not been sworn to by the inventor.

There is no novelty in making a suspender strap by uniting several layers of a fabric which is well known although it has never been used for that purpose before, if such straps have been previously made from other similar fabrics in the same way.

To claim a production as "a new article of manufacture" does not entitle it to a more favorable consideration.

In order to render an article of manufacture patentable, it should require invention to produce it just as much as a machine.

If any one has the right to use a certain fabric he is not to be restricted in his right by a patent for employing the fabric in a way which did not require invention.

IMPROVEMENT IN SKATE FASTENINGS.—BEHR & MONGEL, ADM.—EXTENSION.

LEGGETT, *Commissioner*:

The extension of a patent refused because the application was sustained only by the affidavits of the petitioners, and also because the invention was never in extensive use, and the demand for it had ceased.

It is a grave objection to the extension of a patent if an interest in it has been assigned upon the purchaser's agreeing to employ counsel, and, if it can be made to cover subsequent improvements, to take measures for that purpose.

DECISIONS OF THE COURTS.

United States Circuit Court---District of New Jersey.

SAWING MACHINE PATENT.—E. S. EMERSON *et al. vs.* EDWARD SIMM *et al.*

This was a suit in equity under letters patent granted to Robert G. Emerson and John Myers, under date of May 23, 1854, for an improved sawing machine.

It appeared that the defendants, without knowledge of the patent, had purchased a single machine which was acknowledged to be an infringement of complainants' patent; and, further, that when they were notified that they were infringing they promptly abandoned the use of all the devices protected by the patent. It also appeared that the complainants had an established license fee for persons of the class of the defendants for using machines made under the patent.

The case came up upon exceptions to the master's report, to whom it had been referred to state an account of the profits received by the defendants and to assess the damages suffered by the plaintiffs.

NIXON, *Judge*:

I have examined the testimony taken by the master, returned and filed with his report, upon which he bases his award of $1,200 for damages to the complainants. It appears that the defendants purchased the machine in the open market, without a knowledge of the patent; that they used it about nine months, commencing in September, 1870, and ending in June, 1871; that it was used solely in their own business in sawing boards for the manufacture of trunks, and that they abandoned all the patented appliances to the machine when notified of their infringement, and before the suit was commenced. No case is therefore made for exemplary damages, and the sole question is whether the amount fixed by the complainants for a license fee to be paid by persons engaged in business of the character carried on by the defendants is a fair criterion by which to judge of and measure the damages suffered by complainants from the defendants' infringement.

The courts have always found it difficult to lay down any precise rule of damages in patent cases. The legislation of Congress in the matter is quite suggestive. By the 5th section of the act of 1793, if any person made or used an invention without the consent of the patentee he forfeited and became liable to pay to the patentee a sum that should be at least equal to three times the price for which the patentee had usually sold or licensed to other persons, the use of the said invention. This was found in actual practice to be a measure of damages both inconvenient and harsh; inconvenient, because it did not make provision for those cases where the patentee manufactured and sold his invention and depended upon the profits thus realized for his remuneration; and harsh, because it did not allow any discrimination to be made between the innocent violator and the wilful pirate. The 14th section of the act of July 4, 1836, before referred to, restricted the jury to actual damages, but allowed the court in its discretion to treble the amount, according to the circumstances of the particular case. This section has been re-enacted in the law of July 8, 1870, and, in addition thereto, authority has been conferred upon the court, sitting in equity, to ascertain and assess, not only the profits of the infringer, but the damages of the inventor, with power of a corresponding increase in its discretion. But, although no rule can be laid down applicable to all cases, there is one which ordinarily applies to cases of this sort, where the patentee depends upon license fees or royalties for his compensation for the use of his invention. If he has an established license fee, the amount of such fee is his loss or damage for the use of the invention without a license.

The Supreme Court, in Seymour *et al. vs.* McCormick, 16 How., 490, says: "Where an inventor finds it profitable to exercise his monopoly by selling licenses to make or use his improvement, he has himself fixed the average of his actual damages, when his invention has been used without his license." The same rule was applied in Sickles *vs.* Borden, 3 Blatch. C. C., 543; in Goodyear *vs.* Bishop, 2 Fish., 160; and in Spaulding *vs.* Page, 4 Fish, 641.

The defendants seek to avoid the application of this rule in the present case by showing that they ceased to use the complainants' invention when apprised of the patent, and substituted other appliances which render the machine quite as effective and useful for their purposes. I do not now listen to the suggestion of complainants' counsel that these substituted appliances are mere mechanical equivalents, for this is not the proper time and mode of trying that question; but, surely, the defendants are not permitted to get rid of the consequences of a confessed infringement by alleging that they might have used some other machine as advantageously as the complainants'. However available such proof might be in considering the question of the defendants' profits, it has no weight in measuring the complainants' damages.

I am, therefore, of the opinion that the exceptions must be overruled and the master's report confirmed, and it is ordered accordingly.

Such decree in this case will give to the defendants the right to use the invention of the complainants during the life of the patent.

F. H. Betts, for complainants.
S. J. Glassey, for defendants.

Supreme Court of the United States.

DENTAL VULCANITE PATENT.—BENONI E. GARDNER, APPELLANT, *vs.* THE GOODYEAR DENTAL VULCANITE COMPANY *et al.*

[Appeal from the Circuit Court of the United States for the District of Rhode Island.]

Mr. Chief Justice Chase delivered the opinion of the court:

The original suit in equity was brought by the Goodyear Dental Vulcanite Company against Gardner to enjoin him from the use of certain patented subjects belonging, as alleged, to the company, and for an account. The case was heard upon a bill, answer, and testimony, and there was a decree in favor of the company in the Circuit Court for the District of Rhode Island in September, 1870. Upon appeal to this court the decree below was affirmed on the 6th of May, 1872, but the opinion has not been read.

The defense was conducted by counsel originally employed and paid by Newbrough, under whom Gardner was licensee. On the 1st of July, 1869, before the decree in the circuit court, Newbrough and the company compromised all matters of difference between them, with the understanding that this suit should go on to the final hearing and determination, both in the circuit court and in this court on appeal, as if the compromise had not been made.

The company, however, paid the counsel employed for the defense as well as for themselves in the circuit court, and subsequently in this court.

These facts appear from the record and from the admissions of the company in the ninth article of their answer to the motion to dismiss the appeal. They are the only facts which we think it necessary to notice.

It may be that the company has not become the legal or equitable owners of the opposing interests involved in the suit. There may be, and doubtless are, large opposing interests of which they are neither the legal nor equitable owners. But it cannot be admitted that one party to a suit can pay the fees of counsel on both sides, both in the court below and on appeal, without being held to have such control over both the preparation and argument of the cause as to make the suit merely collusive in both courts. It can make no difference that the counsel fees were charged to the party, apparently though not really liable to pay them, and payment from the other party procured through him. This, indeed, is a circumstance against the party who pays the fees rather than in his favor.

The motion to vacate the decree of affirmance heretofore made, and to dismiss the appeal, must, therefore, be granted, and an order made to recall the mandate which has been issued to the circuit court. We take occasion, however, to say that we see nothing in the conduct of the counsel who actually represented the company which merits blame or which ought to affect in any degree the high esteem in which they have been held. Neither of them appears to have had any knowledge of any arrangements made by their clients with the opposing party.

United States Circuit Court---Southern District of New York.

HAND STAMP PATENT.—THOMAS I. W. ROBERTSON *vs.* JOHN GANETT AND MICHAEL HOLIHAN.

BLATCHFORD, *Judge*:

The letters patent sued on this case, being reissued letters patent granted to the plaintiff, December 12, 1871, for an "improvement in hand stamps," the original letters patent having been granted to him, September 22, 1857, and extended for seven years from the 22d of September, 1871, are the same that were involved in the suit of the same plaintiff against the Secombe Manufacturing Company in this Court. The only defences set up in this Court, in the answer in this suit, are that letters patent for inventions embracing substantially the same devices and combinations that are described in the plaintiff's patent, were granted in Europe to three different persons at dates prior to the date of the plaintiff's patent; and that the plaintiff's invention is of no use, and has never been introduced into public use, and the combination of devices described in his patent has never been and cannot be successfully used as a hand printing and dating stamp, or for any of the purposes set forth in his patent.

No evidence as to the European patents referred to has been put in.

To say that the plaintiff's invention is of no use, and that the combination of devices described in his patent has never been, and cannot be, successfully used as a hand printing and dating stamp, or for any of the purposes set forth in his patent, when it appears that the defendants have made and sold large numbers of stamps containing the inventions set forth in the claims of the plaintiff's patents, and have introduced them into use, and that, in such stamps, the combination of devices described in the plaintiff's patent is used in the manner directed by the plaintiff in the specification of his patent, is to overlook the true state of the evidence in the case, when considered in view of the proper construction of such specification. The defendants' stamps contain precisely what the claims of the plaintiff's patent set forth and claim, and this is not denied in argument. Yet it is said that the plaintiff's apparatus will not work with such inking process as he describes in his patent, and will only work with such an inking ribbon as the defendants use. But the plaintiff describes no particular inking process. He says: "When the face of the stamp is inked over by any suitable inking device, and the stamp duly pressed upon a letter or other suitable substance, an impression will be left thereupon of the types contained in the ring, C, an impression of those types of the type wheels, *c, d, e*, that are in line with the types in the ring, C." He does not show, by description or drawing, any form or arrangement of inking device. His invention does not concern an inking device. He states that his stamp will work with a suitable inking device. The defendants show that it will work with a suitable inking device, and that they make and sell stamps containing the plaintiff's inventions which do work with an inking ribbon as an inking device. All their evidence is directed to show that the plaintiff's stamp will not work with an unsuitable inking device, which is, in effect, what he himself says, in his specification, and such evidence clearly shows that the plaintiff's stamp, when used with an inking ribbon, as a suitable inking device, will do what the specification says it will do. It is, therefore, useful. It is shown that an inking ribbon, as an inking device, was well known at the date of the plaintiff's patent—so was an inking pad and an inking roller. Any one of them falls under the head of a suitable inking device, referred to in the specification. One may give less trouble than another. The pad may require care to be used in keeping the type wheels clean, where the stamp is frequently used. But all this has nothing to do with the completeness of the invention, in a legal sense.

So in regard to the use of a guide or plunger in connection with the handle. The specification says that the stamp is to be "duly pressed" upon the substance on which the impression is to be made. It shows no guide or plunger, or any means of pressing or guiding, except that of the hand directed by the skill of the user. The evidence shows that, for some uses, it is desirable not to have a guide or plunger. But a handle in a guide, although the guide may make it more useful for some purposes, is none the less the handle of the plaintiff, carrying the apparatus for the purposes set forth by the plaintiff.

The other objections suggested by the evidence have no force and require no consideration.

The good faith of the defense in this case is more than questionable, in view of the statement, in a circular issued by the defendants, that the arrangement of dates on revolving cylinders was "an improvement which revolutionized the manufacture and use of stamps" by superseding the type setting stamps formerly in use. That improvement is conceded to the plaintiff by the absence of all evidence attacking the novelty of the patent.

There must be a decree for the plaintiff, for a perpetual injunction, and an account of profits, and an ascertainment of damages, with costs.

Frederic H. Betts, for the plaintiff.
James B. Robb, for the defendants.

[The Chamberlain Manufacturing Company, No. 10 Courtlandt Street, New York, and N. L. Chamberlain, Boston, Mass., have, we understand, acquired the exclusive privilege of working this patent.]

NEW BOOKS AND PUBLICATIONS.

THE ROMANCE OF ASTRONOMY. By R. Kalley Miller, M. A., Fellow and Assistant Tutor of St. Peter's College, Cambridge, England. New York: Macmillan & Co., 38 Bleecker Street.

This is a most entertaining and pleasing little volume, the contents of which were originally prepared for delivery in lectures, and were subsequently published in the *Light Blue*, a Cambridge University magazine. The readers of the SCIENTIFIC AMERICAN need not here be told of the wonders of modern astronomical discovery, or of the fascination and absorbing interest with which they are read: and in this book will be found the most attractive of these facts and phenomena, exhibited in a pleasing and graceful style by a thorough and capable scientist.

REPORT ON THE HYDRAULIC LIME OF TEIL, its Fabrication and Use in Construction of Marine Work, Canals, Aqueducts, Sewers, etc. By Leonard F. Beckwith, Civil Engineer, etc. New York: D. Van Nostrand, 23 Murray and 27 Warren Streets.

The work now before us is an elaborate and exhaustive account of the properties of the lime from the quarries of Teil, which is a place on the banks of the Rhone, in the department of Ardeche, France. The question of the value of hydraulic cements, especially in the preparation of artificial stone, is now one of very great importance; and the material treated of in this report is well known in the United States markets.

MANUAL OF CHEMICAL ANALYSIS, as applied to the Examination of Medicinal Chemicals; a Guide for the Determination of their Identity and Quality, and for the Detection of Impurities and Adulterations. By Frederick Hoffmann, Ph. D. New York: Appleton & Company, 549 & 551 Broadway.

In this book, Dr. Hoffmann has given a most valuable aid to the practical and scientific pharmaceutist. As he states in his preface, the preparation of drugs and *materia medica* generally has passed out of the hands of the retailers and compounders of prescriptions: and the value of a knowledge of tests and reagents becomes doubly apparent when we consider how various are the modes of manipulation in use by manufacturing chemists, to say nothing of the numerous ways, dishonest and otherwise, by which the qualities and effects of chemicals may be altered. Dr. Hoffmann's book is especially directed to these points, and is compendious and complete.

A DICTIONARY OF SCIENCE, comprising Astronomy, Chemistry, Dynamics, Electricity, Heat, Hydrodynamics, Hydrostatics, Light, Magnetism, Mechanics, Meteorology, Pneumatics, Sound and Statics. Preceded by an Essay on the History of the Physical Sciences. Edited by G. F. Rodwell, F. R. A. S., F. C. S. With numerous illustrations. Philadelphia: J. B. Lippincott & Co.

This work is a valuable compendium of scientific knowledge, which has, during the last few years, made such unexampled strides. Among the contributors are Professors Bottomley, Crookes, Guthrie, Proctor, Tomlinson, Wormell, and Rodwell, the work being edited and supervised by the last named scientist, who has also contributed the introductory essay, the articles which may be included under the generic title of "Heat," and many others. As an authoritative text book for the sciences as they are in the present day, this work can hardly be overestimated.

EXPRESSION: ITS ANATOMY AND PHILOSOPHY. By Sir Charles Bell, K.H. With Notes and Illustrations. Price $1.50. New York: S. R. Wells, 389 Broadway.

An acceptable reprint of a well known work. No writer of modern times has more deeply studied the subject of expression in art and nature than Charles Bell; and his writings are not only valuable for the student and the artist, but are enjoyable by every cultivated mind.

A TREATISE ON THE STRENGTH OF BRIDGES AND ROOFS, with Practical Applications and Examples, for the Use of Engineers and Students. By Samuel H. Shreve, A. M., C. E. New York: D. Van Nostrand, 23 Murray Street and 27 Warren Street.

There is no branch of engineering science which is of greater value and interest to the public than bridge-building; and American engineers are justly proud of the many structures which carry our railroads over difficult places. The ingenuity and fertility of resource which American engineers have employed in these works have elicited the applause of the profession in older countries, and have pointed out the American timber bridge as a model of originality and economical construction. The book now before us, which we have not hitherto been able to review at any length, is a complete and detailed treatise on the practice of the best engineers, as shown in the most exemplary specimens of this department of civil engineering. The explanations of the theoretical part of the subject and the calculations are admirably lucid, and are intelligible to the most unlettered reader; and the book is likely to be eminently useful to the student, and to raise the reputation of its author.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From March 14 to March 20, 1873, inclusive.

ARTIST'S SCRAPER.—H. J. Haight, New York city.
BLASTING.—E. A. L. Roberts, Titusville, Pa.
BOOT PEGS, ETC.—J. B. Winslow, Boston, Mass.
BUILDING MATERIAL.—G. De Witt, J. Fairman.
CASTING STEEL.—W. Dougherty, Philadelphia, Pa.
CLAMP.—W. H. Goodchild, Bayonne, N. J., S. F. Hay, Brooklyn, N. Y.
CURTAIN FIXTURE.—C. Buckley, L. L. Sawyer, Meriden, Conn.
LAYING PIPES.—J. F. Ward, Jersey city, N. J.
LOCOMOTIVE WATER APPARATUS.—W. E. Prall, Washington, D. C.
MAKING CHEESE.—H. A. Freeman, Sherburne, N. Y.
MAKING SCREWS.—J. A. Ayres, Hartford, Conn.
MOSAIC VENEERS.—H. F. Kranse, Brooklyn, N. Y.
PEAT MACHINE.—C. Luxton, Hudson city, N. J.
PUMP, ETC.—I. K. Harwood, W. Newcomb, Baltimore, Md.
ROTARY PUMP.—S. A. West, San Francisco, Cal., L. Goodwin, Virginia, Nev
SEWING MACHINE.—J. Boyle, New York city.
STAY BOLT.—J. Cochrane, New York city.
TRANSMITTING MOTION, ETC.—T. A. Weston, Ridgewood, N. J.

Recent American and Foreign Patents.

Improved Breech Loading Fire Arm.

Henry Hoppenau, Kansas City, Mo.—It consists in a spring lifter peculiarly constructed and arranged to allow the slide freedom of movement, while it is itself always kept in proper position for use. It also consists in a slotted post placed on a slide so as to serve as a handle for moving it and as a guide for an adjustable sight. It also consists in a device for retracting the bolt consisting of a slide grooved on the under side and shouldered to act against a lug on top of bolt. It also consists in a bolt or needle carrier provided with a notched side piece by which it may be locked with a screw until it is desired to fire the weapon.

Improved Device for Emptying Stoves.

Bernard Connelly, 100 Duane street, New York city.—This invention has for its object to furnish an improved device by the use of which the ashes and cinders may be discharged from the body of the stove and removed without raising a dust. In the middle part of the bottom of the stove is formed a recess to receive the ashes from the grate. Upon the outer surface of the sides of the recess are cast flanges. The rear end of a plate, when pushed fully in, enters a recess or groove in a flange cast upon the lower edge of the rear end wall of the recess. The forward end of the slide is turned upward, and is so formed as to fit upon a flange cast upon the outer surface of the forward end wall of the recess. To the forward end of the slide is attached a handle, by means of which it may be drawn out and pushed in conveniently. Downwardly projecting flanges are formed upon the bottom at a little distance from the side and rear end walls of the recess, said flanges having inwardly projecting shoulders formed upon their lower edges. A pan is provided, the sides and rear end of which have their upper edges bent outward to fit and rest upon the shoulders of these flanges. With this construction, when the stove is to be emptied, the slide is drawn out and the grate is dumped, the ashes and cinders falling into the pan. The slide is then pushed in, closing the bottom of the stove. The pan may then be detached and emptied whenever desired or convenient, so that the stove may be emptied and the ashes and cinders removed without allowing a particle of dust to escape into the room.

Improved Metronome.

John A. Heckenbach, Mayville, Wis.—This invention relates to a new instrument for keeping the time during musical performances or exercises; and consists in such an arrangement of clock work, and connection thereof with an adjustable index hand, that a suitable number of vibrations of a pendulum can be produced, and from the pendulum a suitable number of strokes on a gong or bell. The pendulum vibrations are regulated by an adjustable slide on the pendulum stem, and serve, by means of cams on the pendulum pivot, to vary the speed of the rotating escapement wheel, which wheel has projecting pins on one side for moving the clapper of the bell. The pins on the escapement wheel are set in circles, with varying numbers in each circle; and the clapper can, by the aforementioned index hand, be brought in line with either one of the circles, so that in a given speed of rotation of the escapement wheel the number of bell strokes can still be varied. This latter adjustment is for the purpose of giving the 6th 4th, or other subdivisions of measure.

Improved Police Nippers.

John B. Craig and Michael Haughey, St. Louis, Mo.—The invention relates to a policeman's nippers. The handle of this instrument is, by a shank, connected with a sort of box, between which two curved jaws are pivoted by pins. The pivoted ends of the jaws have toothed portions meshing into each other to cause their simultaneous movement in opposite directions. A spring is fitted into the box and bearing against the edge of one jaw. A spring trigger is pivoted within the box and catching into the teeth of the other jaw. When the jaws are open they are ready to be applied to the wrist of a prisoner. As soon as the trigger is touched the spring will force the jaws shut around the prisoner's arm. In this position the lower ends of the jaws become locked together by a spring catch.

Improved Cultivator.

William Willerton, Jacksonville, Ill.—The invention consists in the improvement of cultivators. The wheels revolve upon the journals of short axles; to the rear ends of the plow beams, are attached the standards, upon the lower ends of which are formed seats for the plows, which may be of any desired kind. The plows are connected with each other and held at the proper distance apart by the bar, which is made in the shape of an inverted U, and has arms projecting from its opposite side bars. The arms are secured to the plow standards so that the plows may be readily adjusted further apart or closer together, as may be required. The forward ends of the plow beams have clevises attached to them, which are connected with eyebolts, attached to the lower ends of uprights. The upper ends of the uprights are secured to the front cross bar of the frame so that the forward ends of the plow beams may be adjusted at a distance apart corresponding with their rear ends. The uprights are strengthened against the draft strain by the inclined braces. The rear ends of the braces may be adjusted to correspond with the adjustment of the uprights. To the plow beams near their points of intersection, are attached the lower ends of two chains which pass over two pulleys, placed loosely upon a long keeper, so that the pulleys may adjust themselves further apart or closer together, according to the distance apart of the plows, and so that the pulleys may move as the plows are moved in guiding them. At a little distance in front of the cross bar the forward ends of the chains are attached to the rear end of a single chain, which passes around a pulley, pivoted to the forward cross bar of the frame, and its other end is attached to the forward end of a notched bar, which passes through a keeper, and has a handle formed upon its rear end, so that the driver can adjust the plows to work at any desired depth in the ground or raise them entirely away from the ground as may be desired. To the rear end of the tongue is pivoted the draft box, to the ends of which are attached the rear ends of the draft chains. The seat can be raised and lowered as the hight of the corn may require.

Improved Die for Shaping Hatchet Blanks.

Jonathan Yerkes, Frankford (Philadelphia), Pa., assignor to Yerkes and Plumb, of same place.—The die has, near the forward end where its surface is concave or flat, projecting lips at the sides, the inner faces of said lips being beveled. Where the face of the die is convex or ridge shaped, the lips are not required, as the lateral enlargement of the blank over the rounded ridge is desirable. The upper die is of the same form as the inverted die. The blank to be shaped is placed on the lower die, and the upper then brought down. The lips embrace the blank before the surfaces can reach and press it; therefore, the lips prevent all lateral enlargement and serve, in fact, to bevel the corners of the blank, and start the octagonal shape of the hatchet head.

Improved Car Coupling.

Melvin C. Doubleday, Sharon, Vt.—The invention consists in an improvement in car couplings. The drawhead consists of an upper plate and a lower plate connected at the outer end by a bumper plate, from which plate they extend back and are fastened so as to remain parallel with each other. The coupling link consists of two bars confined in a reversible box. This box fits between the plates of the drawhead, and is attached thereto by a central pin upon which the box turns. The bars forming the coupling link are placed in the box with their coupling ends projecting from the box and through the bumper plate of the drawhead. To allow the box to be reversed, or turned end for end, with the bars thus arranged, the bumper plate is slotted. Springs confined in the box serve to force the coupling bars together. In one coupling the bars project and form the coupling link; in the other the box is reversed, the coupling bars being turned inward, while the other end of the box receives the link and coupling pin. When the two couplings come together, the ends of the bars enter the spring jaw as they snap around the coupling pin. This jaw prevents the ends of the bars from spreading, and makes the coupling secure. The jaw slides on a rod upon which is a spiral spring. The advantage of making the coupling box reversible is that any two cars may be coupled together. For uncoupling the cars, the pin is withdrawn, while they couple automatically.

Improved Tobacco Pouch.

Daniel Read, New York city.—This invention has for its object to furnish a combined tobacco pouch and wallet; and it consists in the combined tobacco pouch and wallet, composed of the pouch, made of rubber or other suitable waterproof material, and provided with a metallic frame, and the pockets of a wallet arranged upon one or both sides of said pouch.

Improved Machine for Upsetting Tires.

Charles J. Peterson, Brevard Station, N. C.—The object of this invention is to provide means for lessening the diameter of a wheel tire without cutting the tire. The tire to be upset is bent inward on the machine, and then fastened by the keys between serrated jaws; and while hot the bent portion is hammered down flat to the bed plate, thus upsetting it. The tire is afterward dressed upon the anvil and applied to the wheel. The bend in the tire before operating with the machine may be more or less according to the amount of upsetting required.

Improved Mosquito Net Frame.

Nicolai Petersen and Rosa Roescher, of Memphis, Tenn.—The object of this invention is to supply a portable mosquito net frame which may easily be placed in position for use, adjusted to any desired hight, and, after use, be readily folded and stored away. The device consists of a top center piece, composed of two parts hinged together, which may be folded and opened. It supports four diagonal arms, which are laterally movable therein, which again have pivoted to their ends four legs, adjustable to any desired hight by tubes and spring arrangement. A string connects the ends of the arms firmly, and is used also for tying when the frame is folded for storage.

Improved Gig Saddle Tree.

John Bauer, Newark, N. J., assignor to Chas. M. Theberath and Jacob H. Theberath, of same place.—The invention consists in interposing between the skirt and jockey of a saddle a one-piece metallic plate with pendent pins. These pins, passing through the flap at an oblique angle, hold the same in place without further fastening. Therefore it is only necessary on a gaged machine or otherwise to punch the skirt at the places where the pins are to pass through it, which will insure the proper adjustment of the flap. The upper leather or jockey covers a plate and is held in place by the fastening of the top piece or saddle seat and also by the turret fastening. By the use of this the flap can be properly applied by unskilled persons, and a perfect finish will be insured without effort.

Improved Dress Elevator.

Moris Fox, New York city.—This invention relates to a new attachment to ladies' bustles, hoop skirts, or other dress supports, by means of which the dress can be raised to clear it of mud or rain water during bad weather, or during passage over muddy streets or roads, and subsequently lowered at will.

Engraving and Carving Machine.

Thomas W. Minter, 132 Nassau Street, New York city.—This invention relates to improvements on a carving and engraving machine for which letters patent of the United States have been recently granted to the same inventor. The present invention consists, principally, in simplifying the supports for the article under operation, and for the pattern, and the means for adjusting the same. The holders are fitted into a slotted tilting frame so that they can be adjusted any desired distance apart, and combined with a single longitudinal screw that hangs in the tilting frame, for turning them on their axes in equal degree. The invention also consists in connecting the swivel frame of the cutting tool, by rods, with a crank of the feeling pin; so that when one is turned on the vertical pivot, the other will also be turned in equal manner. The invention finally consists in making the vibrating tool and pin holding beam longitudinally as well as vertically adjustable on and with its holder, so that it can be set to all kinds and sizes of work.

Improved Whip Socket.

John W. Coe and Daniel Merritt, Williamsburgh, N. Y.—The invention relates to whip holders which have on the same standard a pair of clasping jaws above and a basket below. The standard has a shoulder and a screw thread formed upon its lower end to adapt it to be screwed into the timber of the carriage frame. Its upper part has a shoulder formed upon it, and has a screw thread formed upon its upper end, to which are attached spring jaws which curve outward and inward to form a recess to receive and hold the whip. A basket is provided to receive the butt of the whip, which is made in the form of the inverted frustum of a hollow cone. In placing the whip in the socket the butt of the whip is placed in the basket and the whip is then pressed into the space or opening between the jaws, which presses a movable jaw back and allows the whip to pass into the recess between the jaws. To remove the whip all that is necessary is to draw it outward, which presses the movable jaw back.

Improved Knitting Machine.

Edouard Taillouis and Ambroise Renevey, St. Just-en-Chaussée, France, assignors to Joseph Freeman, Windsor Locks, Conn.—This invention consists in the improvement of knitting machines. There are two systems, which comprise knitting mechanisms, which, working together, produce plain ribbed work of the ordinary sort; but each may be worked separately to produce plain work, or either the vertical or horizontal needles may be worked alone; and one set may be making plain work while the other set is making fancy work. The mode of working the two sets of needles together for plain ribbed work is similar to the mode of operation in other knitting frames having vertical and horizontal needles, and need not be described; but for working each set separately to produce a separate fabric on each, a separate thread is supplied to each set, the one for the vertical needles being fed through one guide where the horizontal needles will be forced back before they take the thread, thus throwing the horizontal needles out of action at that place where the vertical needles take the thread and form the stitches. But at the next feeder the horizontal needles will take the thread while the vertical needles will be prevented from working so as to throw off their stitches, so that said needles cannot rise high enough for the loops to pass below the latches, and they will be prevented from taking the thread supplied to the horizontal needles by reason of the said thread being fed through an eye which is so far in advance that their hooks pass below a comb before the thread comes within their range. But at this feeder the said horizontal needles will, in this case, be forced backward further than when they are working in connection with the vertical needles, in order to draw in thread enough to form the stitches. This is not necessary when the two sets of needles are working together, because the vertical needles govern the length of the stitches. The separate fabrics can be instantly merged in one by suitable appliances. In this manner double fabric of any length or shape may be made. By other arrangements several changes in the order of working the needles may be effected. Double ribbed work on the vertical needles and plain ribbed work on the horizontal needles may be made at the same time. If, in these operations, threads of different colors be used at the different feeders—say a black one on one feeder and a white one on the other—the result will be a black surface on one side of the work and a white one on the other; but, if the work be pulled or stretched out laterally, a white interior will be seen from that side which shows a black surface and a black interior will be seen from that side which shows a white surface. These double ribbed stitches can either be continued all the time or be alternated from time to time by plain or other work, at will. With the threads of different colors, both vertical and horizontal stripes can be varied at pleasure. The same kinds of work can be produced on both sets of needles, at the same time making the work alike on both sides, whereby it will be reversible at pleasure, or one set may make different kinds of work, while other kinds are made by the other set. In addition to this capacity of the horizontal needles for performing work of the same kind that the vertical needles do, they can make stripes, squares, and many other useful combinations of different stitches.

Improved Machine for Making Plow Irons.

James M. McGinty and Thomas Nolan, Moulton, Texas.—This invention has for its object to furnish an improved machine for forming plow bars. To the driving shaft is attached a segmental cog wheel, the cogs and blank space being so arranged that the bar or plate to be cut will be fed forward the required distance, and then allowed to be stationary while the dies are operating. The teeth of the segmental gear wheel mesh into the teeth of a gear wheel attached to a second shaft that revolves in bearings in the frame, and which by suitable means is connected with the feed rollers. As the bar or plate from which the plow bars are to be cut is fed forward by the rollers, it passes along a table between guides, which keep the said bar or plate in proper position to be operated upon by the dies. The lower or stationary die is secured to the table. The upper or movable die slides up and down, in ways attached to the frame. The dies are so formed as to form two plow bars at each operation. Each die is provided with two punches to form the holes in the plow bar, and with holes to receive the punches of the other die, and which extend out to carry off the plugs. The plow bar is lifted off the punches of the lower die by two pivoted bars, and which are so arranged that they cannot raise the plow bar above the level of the table, so that it may be pushed from the machine by the bar as it is fed forward by the rollers. The plow bar is held while the upper punches are withdrawn by stops, which, when the upper die descends, enter a notch in it. When the die descends the first time after a bar is fed into the machine, it forms the whole of one plow bar and all the second one but separating it from the bar. The second time the die descends it cuts off the second plow bar, wholly forms the third, and forms the fourth all but cutting it from the bar, and so on until the bar is cut up.

Improved Cooking Vessel.

William Y. Thomson, Oyster Bay, N. Y.—This invention has for its object to furnish an improved cooking vessel or boiler. Upon the inner surface of an ordinary cooking boiler, near its upper edge, is formed a flange for the cover to rest upon. To the inner surface of the boiler, upon its opposite sides, are formed projections at such a distance above the flange as to afford space between them for the cover. In the forward part of the cover is formed a number of small holes, through which the liquid contents of the boiler may flow out when the said boiler is tilted. The perforated part of the cover is covered with a flap, the edge of which is so formed as to fit against the inner surface of the boiler, to prevent the escape of steam through the holes. In the edge of the perforated part of the cover are formed notches corresponding in position with stops upon the boiler, so that by turning back the flap and turning the cover around that edge of the cover may be raised, allowing the cover to be detached. In the cover is formed a hole of sufficient size to allow a fork to be inserted through it to "try" the contents of the boiler, whether they be fully cooked. The ordinary bail is pivoted to the boiler in the ordinary manner. Upon one side of the lower part of the boiler are cast two lugs at a little distance apart, which lugs project outward, and incline toward each other. The ends of a small bail, which are bent outward, are passed through holes in the lugs. By this construction, when no weight is upon the bail, the elasticity of the wire forming the bail and the inward inclination of the lugs will hold the bail in an upright position. When weight is thrown upon the bail in tilting the boiler, the elasticity of the wire that forms the bail allows it to work in the lugs as readily as if they were straight.

Improved Bottle Washer.

William Dick, New York city.—This invention has for its object to furnish an improved device for washing bottles, lamp chimneys, globes, etc. A hollow cylinder, the lower end of which is flanged, is attached to a base of sufficient weight to anchor the device in a pan of water. In the bottom of the cylinder are formed openings, which are closed with valves opening upward. A piston fits into the cylinder and has a hole formed in its center and is attached to the lower end of a tube, which passes up through the cover of the cylinder and has a pan attached to its upper end to receive the water from the article being washed, and guide it back into the pan. The tube has holes formed in its upper part to allow the air to pass in and out freely. The lower end of another tube revolves upon a pivot attached to the bottom of the cylinder. Upon the lower larger part of this tube is formed a screw thread of steep pitch, which fits into a screw thread upon the piston, so that the tube may be revolved by the up-and-down movement of the said piston. The upper part of the tube is made smaller and passes up through a hole in the pan. The brush is formed upon the upper end of the tube. In using the device the bottle or other article to be washed is held over the brush, and the first tube and piston are moved up and down by means of the handle, formed upon the pan, revolving the brush. As the piston is raised a vacuum is formed in the lower part of the cylinder, and the atmospheric pressure forces the water in, opening the valve and filling the lower part of said cylinderr. As the piston is forced downward, the valves are closed, and the water is forced up through the second tube, and is discharged against the inner surface of the article to be washed while the said surface is being rubbed by the brush.

Improved Apparatus for Rendering Tallow, etc.

Peter W. Dalton, Jersey City, N. J.—The object of this invention is to provide means for "rendering" tallow and grease, and cooking and drying the fertilizing animal matters left after the tallow or grease has been separated, together with such other animal matters as may be added thereto; and it consists mainly in the means of connecting the tank or inner chamber for containing the substance to be rendered, etc., with an annular steam space surrounding the same, whereby the surplus steam from the tank is discharged into said space, carrying offensive odors with it, and enabling them to be condensed by introduction of water through a suitable pipe.

Improved Washing Machine.

Cyrus Watson, White Cloud, Kansas.—This invention has for its object to improve the construction of that class of washing machines in which the clothes are washed by passing them back and forth between a pair of rollers connected with the box or tub. The bottom of the tub inclines downward from the center toward each end. The lower roller, which is made smooth, and its journals revolve in bearings in blocks, the lower ends of which are notched, to rest upon the angle of the bottom. The blocks are connected and held in positions by cross bars. The upper edges of the cross bars overlap the sides of the lower roller to prevent the clothes from working in beneath it. The upper parts of the blocks are slotted vertically to receive and serve as bearings to the journals of the upper roller, so that the said roller may move up and down to adjust itself to the varying thickness of clothes that may be passing between the rollers. The upper roller is corrugated or fluted, and its journals project, and to one of them is attached the crank by which the machine is operated. Vertical connecting rods are placed in vertical grooves in the sides of the box, and upon their upper ends are formed hooks, which hook over the journals of the upper roller. Upon the lower ends of the rods are formed cross heads to receive the ends of a spring.

Improved Apparatus for Cooling Liquids, etc.

Heinrich Meidinger, Carlsruhe, Germany.—This device is based on the fact that a concentrated solution of salt will, in contact with the proper weight of ice, produce a temperature of 3° Fahrenheit. If, however, an excess of salt is added, the temperature will always be constant—that is, 3°—as long as any ice is left undissolved, because the excess of salt will preserve the solution always in its highest concentration. This apparatus is worked in the following manner: A cylinder is filled with a certain weight of pounded ice, and then a certain volume of concentrated salt solution is poured over it. Then a ring sieve is filled with coarse salt and hung into the cylinder; last, a conical vessel is put through the central opening of the ring sieve and pressed into the floating ice, when the latter will rise up to the rim of the cylinder.

Improved Life-Preserving Float.

Theodore Hosmer, Sandusky, Ohio.—The frame somewhat resembles a horseshoe in form, and is made of wood, in two sections, the inner sides of which are grooved, with the groove filled with cork to make the frame buoyant. It is made, say, three feet wide and four feet long, and about three inches in thickness, with a circular orifice therein to receive the weight of the person using it. Through the opening is a safety belt attached to the frame, which is buckled around the chest of the person, under the arms or around the waist. Loops are provided, by means of which other persons in the water may hold on to the frame and support themselves. In the frame are slots in which are rotating paddles or propellers. The shaft is revolved by means of the levers, which the person in the frame seizes, the shaft being rotated, when he pulls on the levers, by means of ratchet wheels and other mechanism.

Process and Apparatus for Making Carbonate of Soda.

Ernest Solvay, Brussels, Belgium.—This invention consists: In forcing carbonic acid gas, obtained from any convenient source, through a high column of a solution of salt and ammonia, the hight of which always exceeds and is generally several times as large as its greatest width, and so make the liquor descend and the gas ascend mainly in a vertical direction, by which means a very active reaction is obtained, and a complete prevention of the heating of the liquid: The use of a single vessel of considerable hight in proportion to its width, called the "absorber," for treating the solution of salt and ammonia by carbonic acid: The use of plates perforated with small holes and provided with teeth round their circumference in the said absorber, in order to divide the gas as often as practicable: The peculiar form of calotte or globular segment given to these plates: The use of plates provided with one or a few large holes in the said absorber to prevent the mixing of the liquor at the bottom and top of the said absorber: Feeding the liquor into the absorber at about half of its hight, for obtaining the liquor in the upper half of the absorber in a fit state to retain the ammonia carried off by the gas from the lower half of the absorber: The use of a vacuum filter for separating the bicarbonate from the liquid: The drying of the bicarbonate and its conversion into mono-carbonate of soda with the same filter by passing a current of air or other gas through it: The drying apparatus, consisting of a cylinder in which are placed circular shelves with proper openings, and which is provided with shaft arms and scrapers, which cause the drying substance to move from the top to the bottom of the cylinder: The use of hollow shelves heated internally in the said drying apparatus: The drying apparatus, consisting of a hood provided with a central shaft, arms, and scrapers: The regeneration of the ammonia from the liquid from which the bicarbonate has been separated by magnesia or a basic chloride of magnesium, and the subsequent treatment of the liquid thus obtained, by which muriatic acid or chlorine is obtained, and the magnesia, as well as all the salt which has not been converted into bicarbonate, are recovered.

Improved Apparatus for Protecting Grain and Seed.

Jean Methodios Joannides, of Mark Lane, London, England.—This invention has for its object to prevent the mildew and rotting of seed or grain of all kinds, and other things, during the period of being stored on board ships, or in other places; and this by an apparatus so arranged that fresh air is conducted into and about the mass of seed or grain thus stored. The apparatus consists of a perpendicular cylinder of suitable material, with eight or more horizontal pipes of like material, all connected with and branching from the perpendicular cylinder. The said cylinders, both perpendicular and horizontal, are perforated with small holes for the circulation of the air, but so as not to allow of the grain, seeds, or other things passing through. A series of small tubes are placed in the insides of the large ones for the return of the confined air and to keep up the circulation. The apparatus thus formed is placed in the compartment of the ship, or where the grain or seed may be stored, but is not a fixture of the storage chamber. The perpendicular cylinder, projecting above into the open air, has attached to it a funnel-mouthed ventilator fitted with sponges chemically prepared for purifying the air before its admission into the cylinder. Thus fresh air is introduced down the perpendicular into the horizontal perforated cylinders, and, thus distributed, secures the object in view.

Improved Cartridge Made of Fusible Metals, etc.

William Henry Tooth, Brixton, England.—This invention has for its object to furnish metallic cartridges which can be expelled from fire arms with the projectiles without leaving any residue behind to foul the barrels. The invention consists in constructing the cartridges and projectiles or bullets either of one piece, or they may be made of two or more pieces joined together, and for some purposes metallic cases are made to take in the projectiles and powder or explosive composition. In the manufacture of these cartridges, any metal or compound is used which is not corrosive, such as compositions of lead and tin, and any other metallic substance which will fuse or melt at a comparatively low temperature, whereby the destruction of the cartridge is completely effected; or for a cartridge which is itself explosive. In making the body of the same, the metallic substance is employed, with the addition of bismuth, such cartridge to be filled with powder or other explosive composition.

Cigar Bunching Machine.

Henry B. Bunster, 10 Barclay Street, New York city.—This invention has for its object to furnish an improved machine for bunching cigars. The base frame of the machine is a light casting, and is designed to be secured to a table or bench. Upon the forward end of the frame is formed a raised projection in which is formed a T groove to serve as a guide for the tongue or guide bar of the table or top frame and cause it to move back and forth in a straight line. Upon the rear end of the base frame are formed two upwardly projecting lugs, in the upper ends of which are formed screw holes to receive the screws, which serve as centers to the ends of the roller. The top frame moves back and forth between the arms of the base frame, and in its side bars are formed longitudinal slots, through which the roller passes, which roller thus supports the upper part of the machine while moving back and forth. The frame is guided, as it moves back and forth, by the arms, between which it moves, and by the tongue, and has grooves in its sides to fit into the T groove of the projection. At the rear edge of the platform is formed a trough or recess, into which the proper amount of filling for a cigar is packed. In the end parts of the recess are formed holes to allow the dust that may enter said recess to escape. Upon the forward edge of the platform are cast hooks, upon which the bunch is received. The forward end of an apron or strip of cloth, or other suitable material, passes down through a slot in the forward edge of the platform, and is attached to a rod of such a size and length that it cannot be drawn through the said slot, and which is held up against the under side of the platform by an adjustable spring. The other end of the apron or strip passes over the roller and is attached to a rod, to enable it to be lengthened and shortened by turning the rod in one or the other direction to wind said cloth from or upon it. In using the machine, the frame is pushed fully forward, and the slack of the cloth is pressed down into the recess. The binder is then laid upon the cloth upon the platform, with one end or corner extending down into the recess. The proper amount of filling to form the bunch is then placed in the recess and the frame is drawn back. This rolls the bunch over and over in the hight or fold of the cloth, winds the binder around it, and brings it into proper condition to receive the wrapper, which is applied by hand in the ordinary manner.

Improved Lamp.

Frank A. Flanegin, Fagundus City, Pa.—The collars of glass lamps are usually fastened to the body of the lamp by means of plaster of Paris or cement. Collars thus fastened are very apt to get loose, and are consequently rendered useless until repaired. This invention relates to an improvement in the class of lamp collars in which springs are employed to secure the same to lamps, and the improvement consists in the arrangement of a tubular screw and its attached springs with a lamp collar.

Improved Saw Set.

John W. Leslie, Cairo, Ill.—The invention consists in the mode of fastening a saw set to a handle. The saw set attachment, which consists of a short, narrow, but strong plate of metal is firmly attached to the ferrule so as to project from it, radially. It has a notch or slot in the end, at right angles to the handle, suitable for bending the teeth sidewise by the handle when engaged in the notch.

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Notes & Queries

S. C. M. asks how to whiten the red of white ash.

N. H. H. asks how to put a polish on steel after it is filed.

A. C. T. says: Please give me a method of making a japan of superior quality.

C. F. D. asks: What can I put on a copper exhaust steam pipe to make paint stick?

J. H. asks: How can I make the best paste or cement to use in making paper cop tubes?

G. L. F. asks: What color should a mill pick be when cooled, to cut the hardest quality of burr?

J. H. says: Please inform me what will make ink used for ruling machines dry faster than alcohol.

W. L. asks what is the quickest way to season elm hubs, which are bored through first and then rounded up in the lathe.

E. B. C. wants recipes for making red and blue stenciling ink for marking unplaned wood. "I prefer a liquid to dry ink."

W. H. G. asks: Is there any way that mica, used as windows in anthracite coal stoves, can be kept clean and transparent? If so, how?

W. E. says: W. T. B. tells us that he drives a 4½ feet millstone with a 12 inch belt. Will he tell us the size of pulleys and the speed of his belt?

T. N. asks: What can I mix with wood charcoal to make it in a solid mass and still be porous? I want to use it for a filter, for water to drink.

G. W. S. says: Can you inform me what preparation is used for the bright yellow lacquer on brass castings, such as gas fixtures, and how it is made?

E. F. L. asks: How can a varnish, made from resin dissolved in boiling water by means of carbonate of soda, be made insoluble by water after being applied and dried?

S. says: The V of a railroad terminates in solid limestone in the foot of the mountain; its thickness is about 15 feet. I propose to bank up the cut with several car loads of slack coal and refuse coke, which are worthless, and set them on fire. Would that lessen the labor of deepening the cut and to what depth would the stone probably be burnt?

E. C. M. says: A body weighing 5 lbs. descends vertically and draws a weight of 6 lbs. up a plane whose inclination is 45°. How far will the first body descend in ten seconds? [We would like a solution of this problem, relating to accelerating forces, from any reader who may have more leisure than we have to devote to intellectual gymnastics.—ED.]

E. W. H. says: I should like to have the opinions of some of your readers on the following problem, as it may elicit some original ideas. A rigid body A B, is supposed to be without weight and in a state of rest in space, uninfluenced by any external forces. Required the motion imparted by a given force, P, applied at any point as A, supposing there be no resistance of the air. [This is a neat problem in the higher mathematics which we suspect will be respectfully considered by our readers, and of which we shall be pleased to see a concise solution.—ED.

E. B. C. asks: Will iron, that has been boiled in oil, rust?

W. E. says: I wish to run a stone with a belt without the twist, and sometimes I wish to run the rest of the mill without the stone. How can I disconnect in the simplest manner?

M. M. H. asks: How can I preserve or keep meat, such as beef and mutton, sweet and good for table use, for a week, during the summer months? I have a large ice chest, but I find that the meat sometimes sours.

ANSWERS TO CORRESPONDENTS

Owing to the illness of one of our editors, the replies to several of our correspondents relating to chemical subjects have been delayed, but will shortly be given.

G. McK. says: Of what metals and in what proportions does the enclosed specimen consist? Answer: It is lead with a trace of mercury.

F. W. says: I have an induction coil of sufficient power to give a spark about the eighth of an inch in length, and I wish to know if I can make a gage for determining the number of pounds a person can hold on it; if so, how? How should I proceed to charge a Leyden jar, or a tumbler of water? Answer: A simple method of constructing an electric gage is to connect one end of a silk thread with the iron wire core of the coil, and have the other end wrapped around a small shaft (a darning needle will do) with a pointer, a fine cambric needle, soldered at one end so as to indicate, on a graduated disk, as the iron core is withdrawn; any gage you may use is to be understood as relative, that is, it is not like pounds pressure, supported by steam. Your machine has not quite sufficient power to charge a jar satisfactorily; connect the outside coating of the jar, with one end of the secondary coil, and bring the other end to within an eighth of an inch of the brass knob.

W. C. V. says: I wish to prepare a battery composed of blue vitriol, copper, porous cup and zinc. 1. Will common sheet copper, such as can be had at tin shops, answer the purpose? 2. After the battery is set up, how long will it be before action commences? Answers: 1. Yes. 2. About eight minutes, or as soon as the solution soaks through the porous cup.

E. B. asks: Is there any such thing as a watch that will tell the distance you walk? Answer: Yes. Watches of this kind are to be had in this city for $15.

H. says: I hand you a specimen of a peculiar sand found in Iowa. It lies on a kind of peat and is mixed with it. What is it and can it be used beneficially as an artificial manure; and if so, on what class of soils? Answer: It is calcareous tufa, deposited from water. We do not think it would benefit the soil.

J. H. C. says: I am running an engine (14 x22, driving a 54 inch saw) which requires 96 lbs. of steam to drive it properly, which I think is twice too much, as I have run more than double the amount of machinery with the same boiler, but a different engine. The boiler is 52 inches diameter x 24 feet long, with two 18 inch flues. Engine and boiler are in good order. If we work at a lighter pressure, the steam soon runs down. We have no trouble to make steam with saw dust. The engine is only eight feet from boiler, connected by a three inch pipe, but it works more water in cylinder than I like. There is a plain slide valve, and a steam chest on top of cylinder. She lets on steam just before passing her centers. Answer: Try valve and piston, and see if there is no serious leak past either. Take off valve chest bonnet; see if valve has a little lead on steam side, cuts off at about two thirds and does not close exhaust until stroke is nearly completed. If this examination results in discovery of no fault, see if steam and exhaust passages are not choked by faults in the casting. Is it certain that the boiler is all right? A careful examination of that, and the application of an indicator to the engine would be very certain to detect the fault if in either boiler or engine.

H. D. N. asks our price for replying to a question relating to the use of belting. We reply that the subscription price of the SCIENTIFIC AMERICAN is three dollars per year, in advance. We make no other charge, and we believe that we meet with some success in our effort to give our subscribers more than an equivalent for their money. H. D. N. will find his question answered in the article on "Driving Power of Belts," which will be found in the editorial columns of this issue.

P. P., Jr., says: I contemplate building a small boat to be worked with a screw by hand; and my object is to attain as great a speed as possible. I would like to know what size of screw it would take, and how many blades it should have; and if it would make any difference if the wheel would project below the bottom of the boat. The dimensions of the boat are to be as follows: Length of keel 18 feet, beam 2¾ feet, depth of hold 1¼ feet. Answer: Make the screw as large as possible. There would, in most cases, be found fewer objections to so placing the screw as to project above the water than below the keel. The great objection to the latter plan is the liability to take the ground. We should suppose a screw of 2 feet diameter and 2 feet pitch with either three or four blades would answer, and could be put in.

J. H. H. asks: What is the relative proportion of size of the cylinders of a compound marine engine? 2. I have been informed that there is no way of effectually governing the compound engine, the theory being that the live steam cylinder gives off enough steam to drive the condensing cylinder from 12 to 20 revolutions (the screw being out of water and the engine having only itself to carry) and that it is only after the emergency has passed that the governor begins to act; and then, probably, is the time when the engine requires all the steam it can get. I claim that, by a different arrangement of valves, a compound engine can be made to govern instantly. I have consulted a mechanical engineer on the subject, but although he says he believes there is something in it, yet he does not think that a mere change of position of the component parts of a machine is patentable. What I want to know is this: If I can accomplish a result not before attained, does it matter by what means I accomplish it, in order to make it patentable? Common sense would seem to suggest that, if by simply turning a hitherto useless thing upside down, it could be made of great value, the discoverer of that fact was entitled to profit thereby. Answer: The proportions vary in every individual case. If desirous of obtaining designs, consult some able mechanical engineer who has had some opportunities to learn the proper proportions. A common proportion gives the high pressure cylinder not far from one half the diameter of the larger. 2. We should consider your ideas correct, but can form no idea of the value of the proposed device without seeing it. The problem attacked is certainly a difficult one.

D. H. P. asks: Can sheets of metal, either plain or with numerous apertures left in, 3 feet square or over, and of a thickness of from ·001 to ·002 of an inch be obtained by the electrotype process? If so, what will be the time required in making such a deposit, and what will be the probable cost if copper is employed? Could such a sheet of metal be deposited on paper so as to adhere firmly? Answers: 1. Yes. 2. Ten cells of Daniell's battery, to plate the surface and thickness mentioned, would require about two hours. The cost would depend mainly on quantity; no price could be mentioned without a preliminary trial. 3. By rubbing plumbago into the pores of the paper, thereby making it a conductor, and then plating it with copper, we have no doubt but that the metal will adhere as firmly as you may need. Will not gold or silver leaf paper answer your purpose?

N. C. sends three samples of rock said to be rich in silver and cinnabar. Are they of any value? Answer: The specimens received show no signs of either silver or cinnabar.

L. P. asks: 1. Is the strength of wood impaired when the wood is dried by steam? 2. Does a large wagon axle draw more easily than a small one? Answers: 1. Wood consists of carbon, oxygen and hydrogen, the latter gases being in the proper proportion to form water. When in its ordinary state, wood also contains some uncombined moisture which is removed by drying or seasoning. If the process is carried on, whether by steam or otherwise, at a temperature which is not much above 212° Fahr., the drying takes place without injury to the wood. If the temperature is carried much above the boiling point, however, the wood is charred, losing all its water of combination, and only charcoal is left. If this occurs, even partially, the strength of the timber is impaired. 2. The smaller the axle the easier the draft, provided that the bearing surface does not become too small to allow of proper lubrication, thus inducing "cutting" of those surfaces.

S. P. S. asks: What is the largest diameter of the drivers in use on the English locomotive engines, and also that of the American? Answer: The diameter of the largest drivers generally used in England is six feet. The same size in this country.

T. G. G. asks: Could an engine be constructed with two steam cylinders, one in front of the other, and use the same steam twice, once in each cylinder? For instance, let the piston rod run through one cylinder into the other. Then let the steam in at the front end of rear cylinder, and let it pass out through a pipe to rear end of front cylinder, so as to get power twice from same steam before it passes out. As the steam enters the back end of rear cylinder, let it pass through a pipe to front end of front cylinder, etc. Answer: Our correspondent describes a "compound engine." With cylinders of equal size, no more power would be obtained, per pound of coal consumed, than with one alone. If the second cylinder be made larger than the first, as T. G. G. will find them proportioned on nearly every steamer now built for ocean navigation, expansion will occur and economy will be effected. The subject of compound engines is too extensive to be treated of here. Our correspondent should know that Nature never gives anything without receiving an equivalent. The same power cannot be obtained twice from the same steam under any conditions.

W. S. D. asks: How can I remove plaster of Paris after it has set hard in metal sockets without injuring them? Answer: Calcine the plaster by putting the socket in a hot fire.

S. E. M. says: 1. I would like some advice in regard to a steam blower. We have a 25 horse boiler for steam heating, etc. The boiler sets about 10 feet from the chimney, and a 16 inch pipe connects the boiler and chimney. I put a spiral coil of ¾ inch pipe, with numerous ¼ inch holes opening upward to create or increase the draft; but it does no good. This coil of ¾ inch pipe enters the smoke pipe near the top of the boiler. If a jet were carried into the chimney, would it do any good? 2. Could I use a hydraulic press for making fluid extracts from roots and barks? 3. Do you think it good practice to test a steam boiler by filling it full of water and starting a light fire? I propose to test ours so once in a while, unless there is some good reason why it should not be done. Answers: We should expect a a jet to work better in the chimney. A jet is never as efficient as a blower. 2. We should not expect a press to work as satisfactorily as the usual method of steeping. Steeping first and the use of the press afterward should extract the juices very completely. 3. Boilers are sometimes tested as proposed. We should prefer heating the water to the boiling point nearly and then using the pump. Water heated under a pressure of 100 lbs. per square inch may reach a temperature 126 degrees above its ordinary boiling point. Should rupture occur, scalding hot water and as much steam as this excess of temperature would suffice to form—that is, about one eighth the total weight of water in the boiler—would be set free to do, possibly, no little damage.

F. S. A. says: I send herewith specimens of formations found in the boilers of the steamship R. R. Cuyler. The tubes were covered with these crystals. Can you tell me of what they are composed? The vessel has been in South American waters off the Pacific coast. Answer: The specimen is an unusually large crystal (considering its method of formation) of gypsum or sulphate of lime, and was derived from the water, which must have been exceedingly "hard."

J. C. H. asks: What is the proper name of an acid that will eat itself out of glass bottles? Answer: Hydrofluoric acid will dissolve glass.

W. F. P. sends a specimen of mineral and asks what it is and the value. Answer: It consists of quartz and hornblende: of no use in the arts.

R. M. S. asks in regard to the construction of chimneys, whether or not they should be built larger or smaller at bottom. Answer: We build our chimneys "straight."

J. M. C. says: If I should set a hydraulic ram 100 feet from and 10 feet below the level of my spring, how much of that water can I raise perpendicularly 20 feet above the ram? Answer: Probably about ten per cent.

S. P. S. says to W. E. G. who asked if boiling pickles in a brass kettle renders them injurious to health, and will a brass faucet in a vinegar barrel injure the vinegar: Yes; in both cases acetate of copper is formed. This is a violent poison and many cases are on record of its injurious effects. The manufacturers of the best pickles made boil them in oak tanks by means of a platinum worm. This is not practicable of course in a small way, but they may be cooked in porcelain lined kettles.

S. P. S. says to R., who asked how to dissolve bones to be used as a fertilizer: If you have but a few to dissolve, the best way is to pack them in wood ashes in a hogshead and let them stay there for about a year, keeping them moist. At the end of this time they will all have disappeared except some of the larger knuckles; these may be returned with the next lot. They may also be burned, but this is extremely wasteful. After burning they should be treated with two thirds of their weight of sulphuric acid, in order to convert them into superphosphate. It costs about ten dollars a ton to grind them while green, and requires the aid of powerful machinery.

S. P. S. replies to S., who asked how to make a red stain that will give, when burnished, a bright clear color: Make a strong decoction of logwood and then add a few drops of sulphuric acid. This works well on wood.

A. O. says in reply to M. E. P., who asked what are the best materials for soldering iron and steel, and how are they used: For large and heavy pieces of iron and steel, copper or brass is used. The surfaces to be united are first cleaned off by filing: then they are bound together with steel, and upon the joint a thin strip of sheet copper or brass is laid, or, if necessary, fasten to it with a wire. The part to be soldered is now covered with a paste of clay, free from sand, to the thickness of one inch, the coating being applied to the width of a hand on each side of the piece. It is then laid near a fire, so that the clay may dry slowly. The part to be soldered is then held before the blast, and heated to a white heat, whereby the clay vitrifies. If iron is soldered to iron, the piece must be cooled off in water. In soldering steel to steel, however, the piece is allowed to cool slowly. The semi-vitrified clay is then knocked off, and the surface is cleaned in a proper manner. By following the hints given, it will be found that a durable clean soldering is obtained. If brass instead of copper is used, it is not necessary to heat so strongly; the former method is recommended, therefore, for steel. Articles of iron and steel of medium size are best united with hard or soft brass solder. In both cases the seams are cleanly filled and spread over with the solder and borax, when the soldering seam is heated. Hard brass solder is prepared by melting in a crucible eight parts of brass, and adding one part of previously heated zinc. The crucible is then covered and exposed to a glowing heat for a few minutes, then emptied into a pail of cold water, the water being strongly agitated with a broom. Thus the metal is obtained in small grains or granules. Soft brass solder is obtained by melting together six parts of brass, one of zinc and one of tin. The granulation is carried out as indicated above. Small articles are best soldered with hard or soft silver solder. The former is obtained by mixing equal parts of fine silver and soft brass. In fusing, the mass is covered with borax, and, when cold, the metal is beaten out to a thin sheet, of which a sufficiently large and previously annealed piece is placed with borax upon the seams to be united, and heated. Soft silver solder differs from hard silver solder only in that the former contains one sixteenth of tin, which is added to it during fusion. Very fine articles of iron and steel are soldered with gold, namely, either with pure gold or hard gold solder. The latter can be obtained by fusion of one part gold, two parts silver, and three copper. Fine steel wire can also be soldered with tin, but the work is not very durable. Hard and soft brass solder are used for uniting copper and brass to iron and steel, silver solder for silver, and hard gold solder for gold.

A. O. says, in reply to L. M. L. who asked if limestone could be successfully employed for the production of steam in a furnace suitably constructed for the purpose: Limestone is a carbonate of lime and will not slake unless burned. As burnt lime commands a ready sale, to produce steam from such lime would be about as reasonable as to use China bark as welding powder, when saw dust will do as well. Besides, you could only produce steam of atmospheric pressure.

A. O. says, in reply to I. C. B. who asked if drinking water, standing in a pail, should be covered, to prevent absorption of noxious gases in a room: The absorption of gases by water, unless they are conveyed through it, is very small or almost imperceptible, and hence no precaution need be taken to prevent it. If containing carbonic acid or oxygen, it will be deprived of it and become stale in an open vessel. The cause why water gets spoiled if not running is attributable to organic matter gathering in it.

A. O. says, to J. C., who asked "if milk and coffee produce leather soup," etc: It is about as true that bread and butter, taken together, will make cheese.

A. H. sends a mineral specimen and asks what kind of stone it is. Answer: The mineral you send is iron pyrites or fools' gold—of no value.

W. B McI. sends a mineral specimen and asks what it is. Answer: Iron pyrites or fools' gold. Of no value.

G. W. asks: Is there any thing that will remove lime scales from boilers? I have used many remedies with but little success. The so-called "disincrusting compositions" offered for sale do not help me in the least. Can you suggest anything that will clean my boilers? I am now using pure water. Answer: Scale once deposited can usually be best removed by mechanical means. To prevent deposition, the lime salt must usually be precipitated before the solution reaches the boiler. Heating to the boiling point will cause deposition of the carbonate. Chloride of barium will throw down the sulphate. Look through our back numbers and select for yourself from the many recipes and methods discussed and described therein.

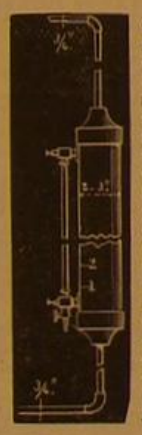
E. G. A. asks: What horse power can I get from a well protected 2½ inch pipe, 75 feet from the boilers, with 40 lbs. of steam? Answer: Judging from our experience, we should suppose that the loss of pressure in such a pipe would not be more than a pound or two. If the boiler can make the steam, this 2½ inch pipe should be sufficient for an engine of 25 or 30 horse power.

W. J. K. says: I have about 300 lbs. of this mineral, and ask you what it is, and is it valuable. Answer: The mineral you send is iron pyrites. Of no special value.

W. F. C. says: I am building a sawmill with 24 feet head, penstock 8 feet x 4 inches clear, fed by trunk 30 inches clear x 50 feet long. I have a balance weighing 700 lbs. Shall I attach it to the shaft of the water wheel, which is a flutter wheel with two feet buckets, *or* use a single crank? Some advise one thing, some another, and I have my own views. The stream is small and I depend on a large dam and high head. Do you think of any other wheel that would answer a better purpose? Some think a balance deadens the quickness of the mill. Will it take more power to run with balance than without? Answer: We should balance the crank by a weight on the opposite side equal to its own, in order to avoid jerking at each center; with a crank thus balanced an extra balance wheel would be of no use. A balance wheel may also be used with a crank (or pitman pin) in one side, with the opposite side loaded equal to the weight of the pitman pin. It is always better to balance a crank, especially in a quick motion. As a principle, a balance wheel is always run at the expense of power which is stored up in the motion of the wheel and more equally distributed, and may be used at any time when periodical force is required, such as for punching, shearing, cutting off sticks of cord wood with a circular saw, etc. There are many turbine water wheels, some advertised in the SCIENTIFIC AMERICAN, that are better than the old fashioned flutter wheel; we would advise sending for the circulars of various makers.

F. A. S. asks in your last number how to make a round hole in a pane of glass without a diamond. My answer is: Shoot it through with a pistol or rifle. There are frequent examples of this mode of perforating glass to be seen among the shop windows of Broadway, New York.—O. D.

A. M. says: "I am running a circular saw mill making 500 revolutions per minute. The saw is 60 inches in diameter, with cast steel mandrel 3¼ inches in diameter, running in self oiling Babbitt-lined boxes. The box next to the saw runs hot in spite of all efforts. I use lard oil," etc. Answer: Wet a piece of thin writing paper with oil, and wrap it around the journal on the mandrel (the oil will cause the paper to stick to the journals); let the joint in the paper come on the side of the journal between the boxes; heat the boxes before pouring off; lay the mandrel in, and let it remain until the journal and box are both warm, but not so as to burn or scorch the paper. The mandrel should then be taken out, and the oiled paper stuck around it. Pour the metal around the outside of the paper after the lower boxes are poured; pack between the two boxes with layers of paper, and put on the upper box, bolting it down. After the upper box is poured, take it off and take off the paper, which will leave the journal of the mandrel free to run without heating. As the journals wear down so as to become too loose, take out a layer of paper from between them.



W. T. says, in reply to our correspondent G. M. who stated on page 187 of the current volume of the SCIENTIFIC AMERICAN, that he cannot get his engine room water gage (which is at a considerable distance from his boiler, the connections being made by tortuous pipes) to indicate correctly, as the water will not rise to the level of the water in the boilers, and is, moreover, in constant agitation owing to condensation in the pipe elbows and other obstructions, which he found it difficult, if not impossible, to overcome: Make your engine room gage something like the simple one illustrated in the engraving herewith, and I think you will not have any more trouble by the gage failing to indicate correctly, from the agitation of the water. [A very good and very generally used arrangement.—ED.]

S. T. O. says, in reply to W. H. W., who asked if shrinking tyres on locomotive driving wheels will affect the central hole: I would say that it will, and I learned it 15 years ago. We used to force our wheels on to the axle with a screw with two men at the bar, and afterwards shrink the tyre on; but we never could remove them with any amount of force applied, until we had removed the tyre, then the two men would remove the wheel in the same press easily; these were our heaviest wheels, with very thick hubs. Will some one explain how this can be done with any thickness of hub?

W. R. J. says that G. T. P., can make a good sealing wax by melting together 1 lb. yellow rosin, gum shellac, 4 oz. white turpentine, ½ oz. gum camphor and 2 ozs. vermillion, stirring until cool.

W. R. J. says that G. E. H. has nothing new in his process for tinning cast iron, as he may learn by inquiry at any hardware store. Tin has long been used inside of cast iron tea kettles and boilers.

L. W. E. says that T. W. M. can make tracing paper by melting rosin in turpentine, and varnishing both sides of the paper with the preparation.

G. H. says: I notice your remarks on a collapse of a copper still at Phelps, N. Y. A somewhat similar case happened some two years since at an apple distillery. The owner, in filling his still, neglected to open a vent provided for the purpose at the top of the still; the result was a collapsed kettle.

COMMUNICATIONS RECEIVED.

The Editor of the SCIENTIFIC AMERICAN acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On the Use of the Thermo Pile in the Determination of the Phrenological Character of the Cranium. By G. D.

On the Bursting of Cylindrical Boilers. By R. C.

On Sailing Faster than the Wind. By A. B.

On Quartz Mining in California. By G. P.

On Scientific Hanging. By J. D. H.

On the Power of Compound Levers. By R. D. W.

On the Computation of Logarithms. By G. W McC.

On the Comet of 1866 and the November Meteors. By D. K.

On a Plan for Perpetual Motion. By J. L. C.

On a Recent Display of Zodiacal Light in Louisiana, and on the Flight of Birds, and on Boiler Strains. By J. B.

On the Intellectual Enjoyments of Science. By J. S.

On the Effect of Light on Combustion. By E. B.

On Boiler Strains. By J. C.

Also enquiries from the following:

W. & K.—T. C.—G. S.—R. F.—G. M. G.—H. D. S.—W. T. K.—W. N. G.—S. H. S.—S. L. B.—H. C. K.—H. L.—G. W. L.—E. H.—F. A. S.—J. A. S.—A. H.—T. S.—J. C. R.—W. D. G.—O. J. P.—H. L. M.—E. H. S.—W. A. M.—W. J.—H. B.—C. S. M.—J. P. D.—C. Z. M.—T. R. H.—J. C. J.

Correspondents who write to ask the address of certain manufacturers, or where specified articles are to be had, also those having goods for sale, or who want to find partners, should send with their communications an amount sufficient to cover the cost of publication under the head of "Business and Personal," which is specially devoted to such enquiries.

[OFFICIAL.]

Index of Inventions

FOR WHICH

Letters Patent of the United States

WERE GRANTED FOR THE WEEK ENDING

March 18, 1873,

AND EACH BEARING THAT DATE.

[Those marked (r) are reissued patents.]

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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:

24,446.—STRAW CUTTER.—R. Daniels. June 4.
24,456.—HEATING BUILDINGS BY STEAM.—S.F.Gold. June 4
24,481.—PAPER PULP.—J. B. Palser, G. Rowland. June 4.
24,495.—HARVESTER.—W. & T. Schnebly. June 4.
4,563.—RAILROAD CAR COUCH.—E. C. Knight. June 11.
4,571.—FINISHING BRUSHES.—T. Mitchell. June 11.

EXTENSIONS GRANTED.

23,291.—BALE BAND.—G. Brodie.
23,509.—ENVELOPE.—S. E. Pettee.

DESIGNS PATENTED.

6,493.—BELL.—O. F. Fogelstrand, Kensington, Conn.
6,493 to 6,504.—FLOOR CLOTHS.—C. T. & V. E. Meyer, Lyon's Farms, N. J.
6,506.—BEER MUG.—J. E. Miller, Pittsburgh, Pa.
6,507.—LOUNGE.—J. B. Rohrer, Philadelphia, Pa.
6,508.—BASKET.—S. I. Russell, Chicago, Ill.
6,509 to 6,511.—ORGAN CASES.—S. Hayward, Boston, Mass.

TRADE MARKS REGISTERED.

1,166 & 1,167.—TOBACCOS.—L. Bremer's Sons, Philadelphia.
1,168.—FILES.—Crocker Cutter Tooth File Co., Norwich, Conn.
1,169 & 1,170.—SIRUP.—Fairbanks & Gilman, New Orleans, La.
1,171.—COUGH BALSAM.—F. W. Kinsman, Augusta, Me.
1,172 & 1,173.—TOBACCO.—Robinson Manufacturing Co., Louisville, Ky.
1,174 & 1,175.—HOSE.—Boston Elastic Fabric Co., Mass.

SCHEDULE OF PATENT FEES:

On each Caveat	$10
On each Trade-Mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On application for Extension of Patent	$50
On granting the Extension	$50
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On an application for Design (7 years)	$15
On an application for Design (14 years)	$30

VALUE OF PATENTS

And How to Obtain Them.

Practical Hints to Inventors

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the TWENTY-SIX years they have acted as solicitors and Publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents BETTER and CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents.*

This 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?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually, by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

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 besecurely 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.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of fomer, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing MUNN & Co., 37 Park Row, New York.

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row New York.

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.

Reissues.

A reissue is granted to the original patentee, his heirs, or the assignees of the entire interest, when, by reason of an insufficient or defective specification, the original patent is invalid, provided the error has arisen from inadvertence, accident, or mistake, without any fraudulent or deceptive intention.

A patentee may, at his option, have in his reissue a separate patent for each distinct part of the invention comprehended in his original application by paying the required fee in each case, and complying with the other requirements of the law, as in original applications. Address MUNN & Co., 37 Park Row, New York, for full particulars.

Design Patents.

Foreign designers and manufacturers, who send goods to this country, may secure patents here upon their new patterns, and thus prevent others from fabricating or selling the same goods in this market.

A patent for a design may be granted to any person, whether citizen or alien, for any new and original design for a manufacture, bust, statue, alto relievo, or bas relief any new and original design for the printing of woolen, silk, cotton, or other fabrics, any new and original impression, ornament, pattern, print, or picture, to be printed, painted, cast, or otherwise placed on or worked into any article of manufacture.

Design patents are equally as important to citizens as to foreigners. For full particulars send for pamphlet to MUNN & Co., 37 Park Row, New York.

Trademarks.

Any person or firm domiciled in the United States, or any firm or corporation residing in any foreign country where similar privileges are extended to citizens of the United States, may register their designs and obtain protection. This is very important to manufacturers in this country, and equally so to foreigners. For full particulars address MUNN & Co., 37 Park Row, New York.

Canadian Patents.

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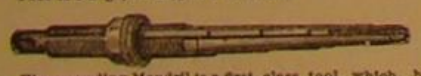

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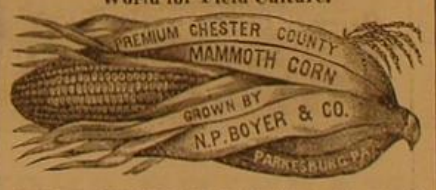

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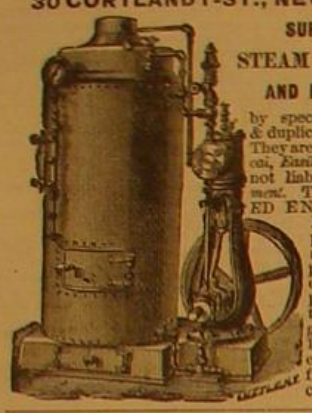

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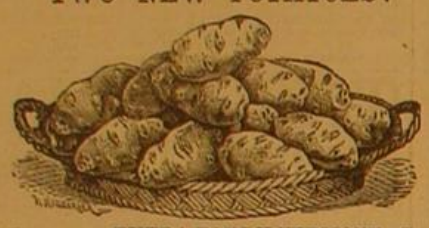

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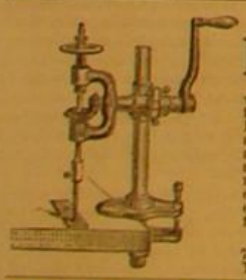

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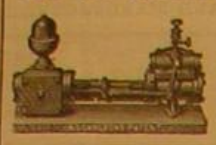

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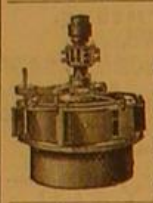

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