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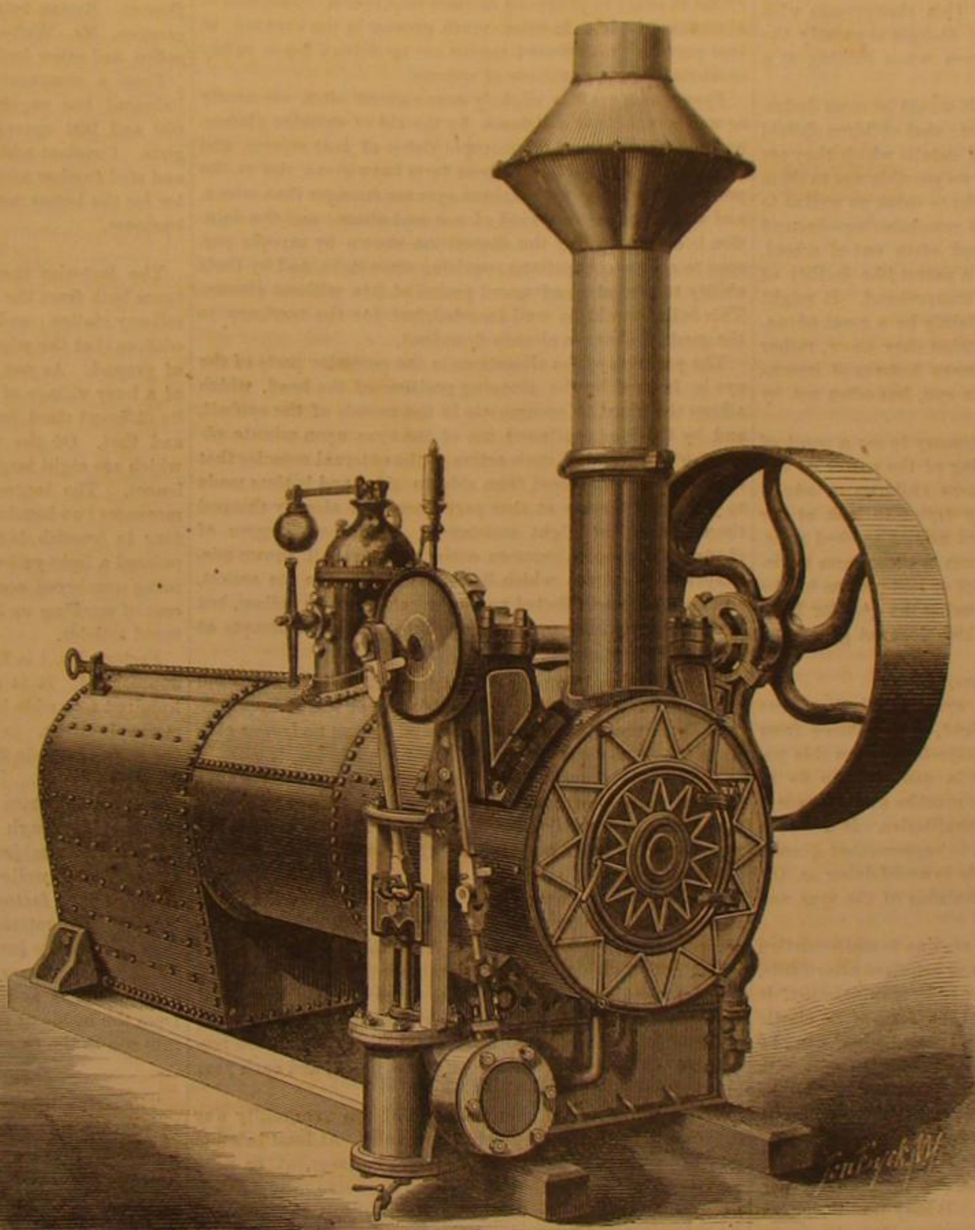
Improved Vertical Portable Engine.

This engine differs from other portable engines, in that the cylinder is placed in an upright instead of a horizontal position. The cylinder of the engine is attached to one end of a base or box, in which is placed the water heater, this box being furnished with bearings to support the front end of the boiler, directly under the tube sheet. Within this box is placed a succession of pans. The cold water being deposited on the upper pan, flows down, over the lower ones, to the bottom, by which means it becomes heated by part of the exhaust steam passing into it. This steam becomes condensed and is pumped back into the boiler. The box or base is cast with an opening at one end to admit the pans, and the open end is covered by a cap, which also forms the foot of the force pump. This force pump, which is not shown in our engraving, is furnished with ball valves, seats, and cages, of the best composition metal, and all fitted with ground joints. The force pump is driven by an eccentric placed immediately over it on the main shaft. On the side of the eccentric is cast a small pulley, which belts on to a larger pulley attached to the boiler by means of a stud, and which carries a crank wrist from which power is transmitted to the pump; the crank pin is also made square at the end so that by the application of a crank it can be worked by hand to fill up the boiler. This pump is attached to the fire box and is open at the top. Its plunger is furnished with hemp packing, and can be repacked by an inexperienced hand, without the necessity of sending to a machine shop to have a new plunger fitted. The saddle, together with the two pillow blocks for the main shaft to run in, as well as the smoke stack base, are all cast in one piece, which makes a strong and uniform casting. This saddle is bolted to the boiler over the tube sheet, and is connected to the lower box or base by means of a flat bar. This bar receives part of the strain between the saddle and base, and also forms the bearing for the guide yoke. The steam chest is placed in such a position on the cylinder that the valve motion is direct without the use of a rock shaft. The piston head, piston rod, cross head, wrist, and crank pin, are all made of steel, which enables lightness to be combined with strength. A weight cast at the back of the crank plate counterbalances the weight of the parts described. This enables the engine to be run at a high rate of speed with steadiness. At the Cincinnati Exposition, where it was run on trial, we are informed it made 428 revolutions per minute on twenty-four pounds of steam, and took a large medal for "novelty and meritorious construction." One of the advantages claimed for this engine is the attachment of the machinery to the strongest part of the boiler, the saddle being placed immediately over the tube sheet, and the base immediately under, doing away in a great measure with the strain of the machinery through the expansion and contraction caused by the varying heat of the boiler. It will be seen that by placing the machinery below the waist of the boiler, it is not so likely to upset in transportation. The throttle is placed at the top of the steam pipe, in the steam dome, and the pipe passing through the boiler and smoke arch is protected from the cold atmosphere, thereby preventing condensation in the pipe.

Letters patent have been issued covering all the main features in the construction. Date of patent, Nov. 29, 1870.

Address for further particulars, Griffith & Wedge, manufacturers of engines, boilers, and saw-mill machinery, Zanesville, Ohio.



THE GRIFFITH & WEDGE VERTICAL PORTABLE ENGINE.

The Place of the Mitrailleur in War.

It seems to us quite clear that the mitrailleur cannot take the place of field artillery. To say nothing of the fact that the field guns have thus far generally beaten it more or less decidedly in actual effect, even at short known ranges, there is the important consideration that the field guns are effective also at ranges to which the bullets of the mitrailleur could not even reach. Those who have compared the mitrailleur with field artillery have apparently been ignorant of the effects capable of being produced by a well-directed shrapnel fire. Shrapnel fire, indeed, is not really understood in any country except England; and until lately very few English artillerymen were aware what a formidable projectile the rifled shrapnel shell really is. The case-shot of the service have also been recently made more effective. The result is that the field guns, especially the capital little 9-pounder bronze muzzle-loading Indian gun, have exhibited a power which the supporters of the mitrailleur had not anticipated. Guns, too, possess other advantages. The moral effect of a bursting shell is greater than can be produced by any mitrailleur fire, however formidable. The fact that a gun can fire a great variety of projectiles—shot, shell, shrapnel, segment, and case—and that it is available at all ranges, gives it a position and importance which the mitrailleur can never hope to attain. Further, when the range is unknown, the mitrailleur fire is often entirely thrown away. Thus, on Tuesday last, the Gatling in 270 rounds only hit a large cavalry column 16 times, and the Montigny in 367 rounds only hit the same column 3 times. The supporters of these weapons would, therefore, do wisely if they were at once to withdraw from their pretensions to take the place of field artillery.

Nor can the mitrailleur ever effectively take the place of infantry in the field. It can neither skirmish nor charge; it is difficult to see how it could be usefully employed for the attack of an entrenched position, or generally as an offensive weapon at all; the men who serve it are also debarred from taking the offensive. However light it may be made, a wheeled carriage is always necessarily more hampered in its movements than an infantry soldier; if disabled, the effect is tantamount to the placing *hors de combat* of as many infantry soldiers as the machine may be supposed to represent; its effect is of too uniform, unvarying a character—there is, so to express it, too little intelligence and discrimination in its volleys, to enable it ever usefully to replace the infantry soldier in field warfare.

But short of this—short of superseding artillery and infantry—it is impossible not to recognize in a good mitrailleur a useful auxiliary weapon. The lightness of the machine and of the ammunition required to produce a particular effect will enable it to compare favorably with field guns under certain circumstances. Theory and practice alike point to the necessity of keeping your artillery as much as possible outside the range of infantry fire. Within those ranges the mitrailleur, requiring, as it does, fewer men and horses, and being able to take up and withdraw from a position more promptly than a gun, may often be usefully employed to save the artillery; while in all those positions where it is necessary to multiply infantry fire over a small front, the mitrailleur can hardly fail to produce good effects. Such positions are numerous enough, though they are to be found more often on the side of the defense than on that of the attack. Among positions of this class we may mention the defense of the unflanked spur of a hill, the defense of a narrow gorge, of a street, roadway, or *tête de pont*, or for the flanks of short ditches, to sweep breaches, etc. It is a very distinct and important advantage of the mitrailleur that it has no recoil. This in a fixed position, or where the weapon is under cover, is a point in its favor which every one must recognize. In such positions as these the mitrailleur, skilfully handled, ought to be able to accomplish nearly all that either field guns or infantry could do, at a less cost of *matériel*, and a less exposure of horses and men; and for use in such positions it may be fitly introduced.

There are other uses to which these machines may also be probably applied; such as to accompany cavalry upon occasion, when it is necessary promptly to bring a hot fire to bear for a short time upon some one point. It has often been suggested of late years, that the cavalry soldier ought to be more like the old dragoon—a mounted infantry soldier, in fact. To the suggestion answer has generally been made, that if this were attempted the result would probably be a "Jack of all trades and master of none." It is not impossible that the mitrailleur may offer a solution of this difficulty, by enabling the cavalry to carry with them a means of swiftly establishing a rapid and effective infantry fire upon a certain point, without themselves abandoning their character as cavalry soldiers. If the mitrailleur is to be used in this way, it would be better, we think, to separate the limber from the carriage, attach a third wheel to the latter, and employ lasso harness.

The mitrailleur, it is hardly possible to doubt, will also have certain naval uses. It may be advantageously employed for the tops of men-of-war; it would be effective in repelling boat attacks; and some of these instruments might perhaps be advantageously supplied for use on board ships' boats.

In short, the rôle which we would assign to the mitrailleur, although it may fall far short of the hopes and anticipations of its supporters, is not an inconsiderable one. The instrument will not bring about a revolution in tactics. It will accomplish no real change in the art of war. It is not, in the broad sense of the word, a new arm or a new power. But it may often save and assist both our artillery and our infantry, and it may serve so to intensify the fire on critical points as to earn for itself a reputation which it would certainly not acquire in general field fighting.—*London Saturday Review.*

WHOSOEVER is afraid of submitting any question, civil or religious, to the test of free discussion, is more in love with his own opinion than with truth.

OUR EYES, AND HOW TO TAKE CARE OF THEM.

[Condensed from an article by Henry W. Williams in the Atlantic Monthly.]

Every normal eye is capable of a great variety and amount of use. It sees near or far with the same ease and with equal clearness. But these powers, extensive as they are, may be overtasked. Because the eyes can see minute objects without difficulty, it does not follow that they should be kept almost constantly looking at small objects. They were intended for varying use, and, like any other organ of the body, they may be enfeebled or injured by having their most delicate powers continually and exclusively employed in one manner.

One of the first rules laid down by a teacher to his pupils should be, *not* to keep their eyes fixed upon their books. Apart from the probable injury to the eye itself by too close application, I am satisfied that lessons, especially those requiring thought, cannot be as well committed to memory when the eyes are fixed upon the page, as when they are permitted to wander. The eyes must of course look at the book often and long enough to take in the idea, but if they be too steadily kept there, the perceptive power seems to occupy itself with the visible objects to an extent which is unfavorable to other mental processes. A distinguished engraver once said to me, "I know now how to make a face think." And he explained that the secret lay in giving a certain expression to the eyes by causing their axes to have a very slight divergence from each other. This corresponds with my observation; and this *position of thought* is exactly the opposite of that assumed by the eyes when looking at a book.

For the sake of even normal eyes, it would be most desirable that education should be simplified; that children should not be required to learn an infinity of details which they are sure to forget, and which could be of no possible use to them if retained; that they should be taught to think as well as to remember—and in fact as a means of remembering—instead of giving all their time in school, and often out of school, and by artificial light, to acquiring a parrot-like facility of repeating lessons which they do not comprehend. It might require more pains, but it would certainly be a great advantage if teachers would *teach* children what they know, rather than content themselves with being mere hearers of lessons which may have been learned by the eye, but often not by the understanding.

It would scarcely seem to be necessary to say a word of warning in regard to imprudent testing of the power of the eyes; but instances are not rare where children or adults have done their eyes serious harm by trying to look at the sun, or by observing an eclipse without using a smoked glass. The direct solar light and heat seems in these cases to destroy the perceptive power in a greater or less portion of the retina. Injury may also result from using the eyes for looking at small objects by moonlight, which does not give sufficient illumination for such purposes.

SOME POPULAR ERRORS.

There comes a time when normal eyes find their powers grown limited, and require more light, or assistance from glasses, when looking at small near objects. When this period arrives it is an error to persist in endeavors to do as formerly with the eyes; but much use must be avoided except in a clear light or with the required auxiliaries. It is also a mistake, as will hereafter be shown, to suppose that glasses should not be worn while it is possible to avoid doing so. On the contrary, they serve to prevent straining of the eyes, and preserve rather than injure vision.

Certain defects of refractive power are due to malformation of the eye, either existing from birth or acquired afterwards, and are not to be removed by remedies or by manipulation. It is a mischievous error to suppose that the form of an elastic globe, filled with fluid or semi-fluid substances, can be changed, except for the moment, by pressing upon it with the fingers, as has been recommended by charlatans. All the theories that the eye can have its form favorably modified by rubbing it always in one direction, or by any other manipulation, have no foundation in facts. But while persistent squeezing, according to these methods, can never do any permanent good, it involves great risks. It may lead to congestion and hemorrhage within the eyes; or give rise to destructive inflammation or the formation of cataract by dislocating the crystalline lens; or cause almost immediate loss of sight by separation of the retina from its neighboring parts; or increase the giving way of the back part of the globe, which is already often begun in near-sighted eyes.

The same warnings will apply with equal force against the use of the eye-cups fitted with rubber bulbs, to alter the form of the eyeball, as is asserted, by suction. Valueless and dangerous as they are, persons are often persuaded to purchase and try them—sometimes to their sorrow.

NEAR-SIGHTEDNESS.

Myopia, or "near-sight," is by far the most important, as it is also one of the most common of the refractive defects of the eye. In the other forms of abnormal refraction we have merely a defect of construction, giving rise, it is true, to annoying disabilities, but having no tendency to further changes of structure or function. Near-sightedness, on the contrary, where it exists in a high degree, is not simply an infirmity, as is usually supposed, but in many cases is associated with grave disease of the posterior parts of the eyeball, having progressive tendencies, and not seldom resulting in loss of all useful vision. It has, furthermore, a strong disposition to hereditary descent.

The defect in form, in short-sighted eyes, does not consist, as was formerly supposed, in an undue prominence of the front part of the eye, but in an elongation of the whole globe rom before backwards, so that it assumes an olive or egg shape, instead of being round. This lengthening mostly occurs at the back part of the eyeball, and is not to be observed at first sight; but in many cases we may see that the eye has this altered form, and extends back further than usual in the socket, by drawing the lids apart at the side next the temple, the eye being at the same time turned towards the nose.

All the coats of the eye are implicated in these changes, which take place, sometimes by gradual expansion at every point, but usually by a more considerable giving way around the entrance of the optic nerve. In examination of such eyes after death, a positive bulging of the sclera is seen at this point. During life we can observe these changes and watch their progress by means of the ophthalmoscope. This instrument, by which we are enabled to illuminate and explore the interior of the eye, has thrown new light upon the whole subject of near-sightedness. By its aid we are able to follow the morbid changes as they are successively developed.

As the retina expands with the general enlargement, the nerve tissue, in that layer of the retina which is the seat of its especial function, is of course extended over a larger surface, and its perceptive power is proportionally weakened. Many such eyes are therefore unable to see distant objects with normal clearness, even with the glasses which most completely correct their myopia, although they see small near things perfectly well. It seems to be necessary that a larger number of rays should fall upon a given area of the retina in order to produce a distinct impression. This lack of acuteness of vision is often much greater in the evening, so that persons thus affected cannot see to drive a horse safely or distinguish the outlines of objects.

Eyes which are but slightly near-sighted often see nearly as well as others at a distance by the aid of suitable glasses, and they have almost microscopic vision of near objects, and can read in a dim light; these facts have given rise to the popular belief that near-sighted eyes are stronger than others, and able to bear every kind of use and abuse; and the delusion is encouraged by the disposition shown by myopic persons to choose occupations requiring close sight, and by their ability to read at an advanced period of life without glasses. This belief would be well founded, but for the tendency to the gradual changes already described.

The progress of the alterations in the posterior parts of the eye is favored by the stooping position of the head, which allows the blood to accumulate in the vessels of the eyeball, and by too long-continued use of the eyes upon minute objects, which requires such action of the external muscles that the globe is compressed from side to side, and is thus made to yield still further at that part where the already thinned tissues offer but slight resistance. With each degree of change the process becomes easier, the eyeball grows misshapen to a degree which limits its motions in the socket, and the eye most affected no longer acts with its fellow, but is disposed to turn outwards, and to give up attempts at vision.

With increased implication of the retina in the morbid changes, its perceptive acuteness is more or less reduced, especially as regards distant objects, and glasses no longer give them the same clear outlines.

The morbid processes may be arrested at the early stages of their development, and by good fortune and prudent management the eyes may retain through life nearly the normal powers; or if even considerable changes have taken place, these may remain stationary and give rise to little inconvenience. But if they are not recognized, and means taken to avert their progress, they may go on till the retina becomes useless, being separated from the choroid by fluid which collects between these membranes.

After reaching a certain degree, there is little hope that further changes will be averted by any care or skill. The conditions have become so unfavorable that the morbid tendencies can no longer be successfully opposed, and each year sees a downward progress.

It is quite time that the attention of the community was drawn to a matter of so much importance. At least in some classes of society, the possibility of blindness, at or near middle life, from changes incident to excessive near-sightedness, as well as the predisposition to transmit the same infirmities and liabilities, ought to be taken into account in forming matrimonial alliances, like any other impending disability from incurable ailment. The fact of its being frequently inherited once understood, parents should watch for any early manifestations of its presence in their children, and take measures to prevent its progressive increase. Teachers should impose upon near sighted eyes as little as possible of studies requiring close application, even though at the time the child makes no complaint. It is questionable if our system of education, augmenting as it does the frequency and degree of near-sightedness, is an advance in civilization. It would be better to go back at once to the oral teachings of the schools of Athens, than to go on creating our favorite type of educated men and women, at the expense of their own and their children's eyesight.

No medical skill can bring back these delicate tissues, once distended, to their former healthy condition, or even in some cases prevent the steady onward march of the disease. But prevention is in a measure within our power. Near-sighted eyes should not be used continuously for small objects, and especially with the head bent forward; fine and bad print should be a fatal objection to a school book; the use of lexicons, or close mathematical work, should be limited and interrupted; written exercises should be almost dispensed with; and the child should be spared search upon the map for unimportant places. The book should be held up when possible, and the pupil should not keep his head leaned over his desk, nor be allowed to study by a feeble light.

If by these precautions the child reaches adult age without any considerable development of his myopia, he will thenceforth be comparatively safe, as changes are less likely to occur after this period. But if, from thoughtless mismanagement, large and progressive structural alterations of his eyes have been brought on during his years of study, he may not only find himself disabled from pursuing such other occupations as he may desire, but may be in a condition foreboding further misfortune.

THE RATTAN FACTORIES AT WAKEFIELD MASS.

[Condensed from the Boston Commercial Bulletin.]

Among the industries of the town of Wakefield, formerly South Reading, Mass., are several boot and shoe manufactories, razor-strop factories, etc.; but by far the most important enterprise is the great rattan factory owned and carried on by Cyrus Wakefield.

Mr. Wakefield commenced in life without any other capital than Yankee energy, pluck, and brains. Fifteen years ago he started the business of manufacturing in this country articles from rattan, which he imported from India.

With the exception of a rattan factory at Fitchburg, in which also Mr. Wakefield has a large interest, this is the only establishment in the United States engaged in this manufacture. The rattan used at the factory is all imported by its proprietor from Singapore, who has in his employ no less than fifteen vessels sailing constantly between India and Boston. Rattan being too light and bulky to comprise entire cargoes, Mr. Wakefield also imports spices, tin, gambia, coffee, and other Indian productions.

From a comparatively modest commencement, this establishment has rapidly grown until now it employs between 800 and 900 operatives, including men, women, boys, and girls. Constant additions of large buildings have been made, and still further additions are contemplated by the proprietor for the better convenience of different departments of the business.

THE GREAT FACTORIES.

The factories themselves are situated at a convenient distance both from the main street of the village and from the railway station; and comprise so many and such spacious edifices that the whole establishment covers over seven acres of ground. As you approach them they have the appearance of a busy village of factories, with its streets and open plots, its different sized buildings, and its roads passing this way and that. Of the main buildings there are four, besides which are eight large storehouses, offices, and other conveniences. The largest factory is one recently built, which measures two hundred and eighty-five feet in length by fifty-four in breadth, is four stories high, substantially built and painted a light-yellow. This is factory No. 3; the factories being numbered according to the different stages of the process of working up the rattan into finished stuff or manufactured articles.

Factory No. 1 is first reached as the group of buildings is approached. It is a very large, solid-looking building two hundred feet wide by two hundred and fifty long, and three stories in hight. In this building the first processes by which the rattan is made fit to be fashioned to its various uses, are performed.

The rattan comes from India in large bundles, the various pieces being rough and of irregular thickness and length. The first is to subject it to a washing, by which it is at once cleansed and swelled; for this purpose there are, on the lower story of the factory No. 1, a series of revolving "wash boxes." The rattan is then assorted according to its size, and then follows the interesting operation of scraping down the joints by machinery, and splitting the rattan, separating by a very curious and rapid process, the outside, or bark part, from the inside or pith. Both of these parts of the cane come into use in the establishment.

HOW RATTAN IS WORKED.

The strips, into which the outer part is quickly fashioned by passing through a machine, which, as it were, peels and separates them, are used for chair seatings, which, in its finished state, is sold to furniture manufacturers. This is naturally considered the most useful part of the rattan. The processes of cleansing, soaking, scraping the joints smooth, splitting and separating the outside from the pith, and the making the different strips of uniform thickness and width, being completed, the rattan is carried to the various other departments of the factories, to be devoted to a great variety of other processes, and to many various uses.

The strips of enamel are all sorted, measured and tied up in bundles of one thousand feet, one hundred of which compose a bale.

At first, the pith, shavings, and other refuse of the rattan, after splitting and trimming the strips which are formed of the outer bark or covering, was carted away and burned as useless. But a man of Cyrus Wakefield's Yankee thrift, ingenuity, and perseverance, soon perceived that this was a waste of stuff that might be turned to many valuable uses. Now none of the rattan whatever is regarded as waste, but additions have been made to the establishment purposely to accommodate the work that is done upon it. The machinery rounded pith is woven into baskets, tables, chairs, etc., in a thousand fanciful shapes and forms.

UTILIZING WASTE.

The shavings, with which the rooms in this factory, No. 1, are covered, are spun by women into roping and fashioned into matting—the kind of matting so much used in offices, railway stations, etc. This is done on machinery; and it is astonishing to observe how rapidly, and apparently easily, neat and substantial articles of this sort are made out of the confused mass of shavings on the floor. The mats which are made are curiously sheared by machinery with lightning rapidity; and are woven with astonishing skill and precision by the men who are to be seen hard at work at the hand looms in one of the rooms.

In the lower part of factory No. 1 is the machine shop, where all the machinery used in the establishment is not only manufactured but is repaired and set to rights. Everything can thus go on like clock-work, without any of that delay which usually occurs from dependence on others.

The two factories not yet mentioned—Nos. 2 and 4—are respectively one hundred feet by one hundred and twenty, and one hundred and twenty by forty feet, three and two stories high. One of them is the dye and finishing house, and is used for dyeing and finishing off the various rattan strips and shavings. It contains large vats and machinery, and the processes here, as in other parts of the factories, are very rapid and curious, as showing how comparatively useless material may be rendered a serviceable, popular, and even a tasty and elegant article.

In the large new building, factory No. 3, are long weaving rooms and finishing rooms, where the weaving of mats and mattings is done by power. Here also, in an upper room, may be seen the men and women fashioning arm chairs, baby chairs, work tables, and large round tables, baskets, lounges, and many other articles, some of them made in very fancy and handsomely ornamental styles, and others substantial and plain.

Testing Machine for Building Stone.

The testing machine used at the St. Louis Bridge, the design of which was made by Colonel Henry Flad, assistant engineer, has been in operation for several months, and has given the greatest satisfaction. By means of a very simple little instrument, suggested by Chancellor Chauvenet, and matured by Colonel Flad, the most delicate changes in the length of the specimen can be accurately recorded, with a degree of minuteness never before obtained or even approximated, in any testing machine, so far as my information extends. By this instrument it is perfectly easy to detect a change, in the length of the piece, equal to the two hundred thousandth part of an inch.

A brass collar is slipped over each end of the specimen, and these are secured by three-pointed set screws in each collar. Any shortening or lengthening of the piece will of course alter the distance between the two collars. One collar has on the side of it a small flat surface or vertical table. Against this table is placed a little vertical steel cylinder, which is held against the table by the end of a little flat horizontal bar that is secured at its other end to the other collar. This bar is held against the steel cylinder by a spring, having sufficient strength to keep the cylinder from falling. It is evident now that if one collar be brought nearer, or is moved farther away from the other, the steel cylinder will be rotated, as one side of the cylinder is pressed against the table, which is attached to one collar, while the other side is pressed by the little bar that is fastened to the other collar. If the specimen be subjected to pressure it will be shortened, and the collars will approach each other. If tension be applied to the specimen, the piece will be stretched according to its intensity, and in either case the rotation of the little steel cylinder will indicate the measure of the disturbance that has occurred between the two collars, and it will give it absolutely without any element of error entering into it from any change of the dimensions of parts of the machine under strain. By placing on the top of this little cylinder a small vertical mirror, the extent to which the cylinder has been rotated may be determined in the following manner: Twenty-five feet from the mirror, an arc of a circle is struck, the little steel cylinder being the center of the arc. On this arc is erected a scale of inches with decimal subdivisions. This scale, being illuminated by gaslight, can be easily read in the mirror by means of a small telescope placed immediately above the scale. The angles of incidence and reflection at the surface of the mirror being equal, it follows that one fourth of a complete rotation of the mirror would be equal to a half circuit of the circle of which the arc is a part; or, in other words, a movement of the mirror of but one degree would be shown on the scale, by the reading of a space equal to two degrees, or the one hundredth part of an inch on the scale would really be only half so much, or the two hundredth part of an inch, when seen in the mirror.

The diameter of the little cylinder is so proportioned to the radius of the arc as to make the smallest subdivision of the scale equal to the twenty thousandth part of an inch, but the observer, after a little practice, can subdivide these divisions, which are magnified by the telescope, so as to observe the two hundredth part of an inch.

The power is applied to the specimen under trial by means of an hydraulic press, the ram of which moves horizontally. The ram has a steel rod extension passing through the rear end of the cylinder. Specimens for testing by tension have one of their ends secured to this steel rod, and the other to the end of a scale beam. Specimens for crushing are placed at the other end of a cylinder, and are compressed between the end of the ram and a crosshead. This crosshead is attached to the end of the scale beam before mentioned, by four powerful rods of steel surrounding the cylinder and leading back to a crosshead attached to the beam. This latter crosshead is detached from the beam when tensile experiments are being made.

It will be obvious, on reflection, that when a piece is being crushed by the thrust of the ram, the four bolts sustaining the crosshead against this thrust must stretch in proportion to the power applied, and hence the specimen will be moved bodily in the same direction, and that this will affect the accuracy of the readings of the mirror, as it too will be moved horizontally with the specimen to which it is attached. To correct this minute error in the readings, a second mirror and scale are used to ascertain the extent of this horizontal movement. The table holding the second mirror, against which the little cylinder rotates, is secured to the frame of the testing machine, which has no strain on it, and the little bar for rotating the cylinder is attached to the crosshead; of course, any movement of this head causes a rotation of this second mirror by which the extent of the movement can be at once ascertained.

It is equally important to know the exact weight applied to the specimen as well as the change of form assumed by it when subjected to the weight. Having no faith in the accuracy and durability of the ordinary mercury and spring gages for such high pressures as are required in a hydrostatic testing machine, I determined that the absolute strain on the piece must be weighed on the balance. This, Colonel Flad has very ingeniously accomplished by a system of levers, balanced on hardened chrome steel knife edges and boxings, sufficiently powerful to stand a strain of 100 tuns and yet so delicate as to be turned by the weight of one half an ordinary cedar-covered drawing pencil when placed in the balance. One pound weight placed in the balance equals a tun of 2,000 pounds weight on the specimen.

I feel safe in asserting that the company have a testing machine which can scarcely be excelled in the accuracy, delicacy, and minuteness of its results.

It has been placed in charged of Mr. Paul Dahlgren, C.E., by whom a carefully tabulated record is kept of all tests made with it. A great variety of these have already been made upon specimens of steel, iron, woods of various kinds, granite, brick, limestone, concrete, cement, models of tubes, trusses, etc. Much valuable information having direct reference to the work in hand, has been already obtained by these experiments.—*Report of the Chief Engineer, Capt. James B. Eads.*

Sugar from Melons as Compared with Sugar from Beets.

Mr. W. Wadsworth, in a letter to the *Sacramento Union*, maintains that sugar can be made more profitably from melons than from beets. He says:

The sugar from cane, maple, beets, parsnips, the sweet-gourd, and all the varieties of melons, when manufactured perfectly pure, are chemically identical. In Hungary and Italy there are numerous large establishments for the manufacture of melon sugars. The cost of melon sugar as compared with beet sugar, is in favor of the melon. Every German or French authority on the culture of beets for sugar, admits the necessity of two, and recommends three, deep and thorough plowings of the land to properly fit it for the culture of beets. With melons it is quite otherwise. To secure the largest yield and best beets, the seed should be planted in rows two feet apart and from eight to ten inches apart in the row. For beets, all the land—for illustration say fifty feet in width—must be plowed at least twice. For melons, only four beds, twelve feet apart and each only four feet wide, or sixteen feet in width of plowed land, against fifty for beets will need plowing.

The great expense of beet culture is in the hand-hoeing and weeding of every row, and in most lands as many as three of these weedings are required in a season, before the leaves are large and spreading enough to keep down the weeds. The difference between the weeding of four rows of melons and twenty-five rows of beets is very considerable; whilst the exhaustion of the fertility of the soil is in the same proportion. With both crops the land between the rows is kept free from weeds with the horse-hoe or cultivator, at the same expense. Young melon plants are not as tender and delicate for the first eight days as beets. It is evident, therefore, that the expense of culture is largely in favor of melons, it being less than one third the cost of beets per acre.

In gathering the two crops the difference is again in favor of melons, for they only have to be picked from the vine and thrown into carts; then, without washing or any other process are ready for the mill. Beets must be first pulled, thrown into heaps to protect them from the sun, then each beet must be handled in having its crown of leaves and rootlets cut off, and then, before it is ready for the rasp or cutter, must be washed thoroughly clean.

The gathering and handling of melons is an agreeable and cleanly operation compared with that of beets. Large quantities of melons in certain localities can be sold for direct consumption in the early part of the season, or whenever worth more in that way than for sugar, spirits or vinegar; it is not so with beets. Sugar making can commence a full month earlier from melons than from beets, and with winter water melons, as in Hungary, continued as late as with beets. Melons yield their seed every year with no extra expense for cultivation. Beets require a second year, with land, and careful culture and gathering of the seed. Melon seeds will yield sixteen per cent of their weight of excellent table oil. Beet seeds, beyond what are needed for seed, are of no value. The oil from the surplus seeds of melon sugaries in Hungary pays one half the cost of cultivating the entire melon crop. The yield of melons per acre, in favorable soils, is equal to that of beets. The yield of sugar is as seven per cent from melons to eight per cent from beets; but the cost of manufacture is decidedly in favor of melons; they require less time, less bone black, less machinery, less power, and less fuel, because no water is added, which cannot be said of beet juice by the ordinary process of extraction.

The natural purity of the juice of melons is so superior to that of beets, that whilst the melons furnish an agreeable "food and drink," and a delicious sweet, the juice of beets is so acrid and herbaceous as to be wholly unpalatable. The defecation and refining processes for melon juice and sugar are therefore attended with far less trouble and cost. That part of the beet which in many instances grows above ground, exposed to the sun, is of little or no value for sugar, whilst the hotter the sun and the drier the air, the better and sweeter the melon. The larger the sweeter, generally, whilst the reverse is true of beets.

Beet juice and pulp exposed to the air, will turn black in fifteen minutes, and fermentation commences immediately from the rasp. Melon juice and pulp will not blacken at all, and will not begin to ferment in the open air before the third day from the melon. Beets are remarkable for their power of extracting alkaline and saline substances from the soil, which injures their value for sugar. Melons are equally remarkable for letting these salts entirely alone in the soil.

No centrifugals or presses are required to separate the juice from the pulp, as with beets; but all except the rinds and seeds go into the defecating kettles together. Cloth filters, concentrators, and a vacuum pan are as necessary as for beets. The buildings are less costly, because requiring less strength to hold in position the centrifugals and other necessary machinery for beet sugaries. The chemical processes of melon sugar making do not differ materially from those for the making of beet sugar, except in their simplicity. Spirits in large quantities can be extracted from the fermented juice of melons and the refuse of the sugarie, and "pure cider vinegar" is made therefrom in ten hours, that cannot be distinguished from the genuine article. The melon rinds, with dry grass or straw, make an excellent food for milch cows.

Whereas a beet sugar establishment is a costly concern, a melon sugarie costs comparatively but little, whilst both can be made exceedingly profitable. A small beet sugarie that will pay an annual dividend of 30 per cent upon the entire investment, will cost $75,000. A melon sugarie that will pay 24 per cent per annum on its cost, can be put in operation for $20,000.

A beet sugarie to pay a dividend of 35 or 45 per cent per annum, will cost from $100,000 to $150,000.

In-growing Toe Nails.

This most painful of the diseases of the nails is caused by the improper manner of cutting the nail (generally of the great toe), and then wearing a narrow, badly-made shoe. The nail beginning to grow too long, and rather wide at the corners, is often trimmed around the corner, which gives temporary relief. But it then begins to grow wider in the side where it was cut off; and, as the shoe presses the flesh against the corner, the nail cuts more and more into the raw flesh, which becomes excessively tender and irritable. If this state continue long, the toe becomes more and more painful and ulcerated, and fungus (proud flesh) sprouts up from the sorest points. Walking greatly increases the suffering, till positive rest becomes indispensable.

Treatment.—We omit all modes of cutting out the nail by the root, and all other cutting or torturing operations. Begin the effort at cure by simple application to the tender part of a small quantity of perchloride of iron. It is found in drug stores in a fluid form, though sometimes in powder. There is immediately a moderate sensation of pain, constriction, or burning. In a few minutes the tender surface is felt to be dried up, tanned, or mummified, and it ceases to be painful. The patient, who before could not put his foot to the floor, now finds that he can walk upon it without pain. By permitting the hardened, wood-like flesh to remain for two or three weeks, it can be easily removed by soaking the foot in warm water. A new and healthy structure is found, firm and solid, below. If thereafter the nails be no more cut around the corners or sides, but always curved in across the front end, they will in future grow only straight forwards; and by wearing a shoe of reasonably good size and shape, all further trouble will be avoided.—*Bostwick's Medical and Surgical Journal.*

On the Air in Workshops.

The *Bowdoin Scientific Review* contains an article from Dr. Sigerson, in which he says of the air of iron works:

Although a quantity of this iron, carbon, and ash, must daily pass in and out of the lungs, and besides, although a certain percentage must remain in them (as shown by Pouchet's dissections and Professor Tyndall's experiments), it is difficult to find a healthier body of men than those who work in such factories. Dr. Sigerson observed one exception, a young man whose lungs were weak, and who had suffered from blood spitting, with cough, contracted in an American foundery, where the heat was excessive. He inquired whether the atmosphere heavy with dust did not affect him injuriously. The artisan replied in the negative; he said that he found himself well in it; his cough came on at home on rising and lying down. These facts seem to indicate that the carbon poured into the air of cities from gas lights and fires may not have so injurious an effect as is sometimes fancied.

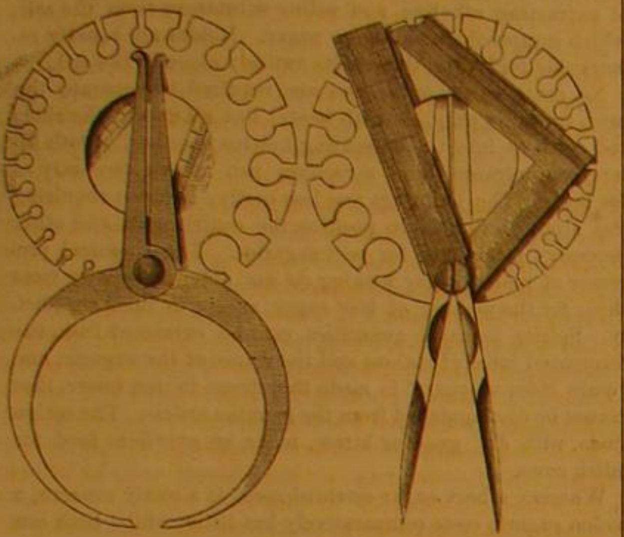
A New Chinese Composition.

Dr. Scherzer, an Austrian official at Pekin, has sent to his Government some specimens of a Chinese composition called "Schioicao," which has the property of making wood and other substances perfectly water-tight. He says that he has seen in Pekin wooden chests which had been to St. Petersburg and had come back uninjured, and that the Chinese use the composition also for covering straw baskets, which are afterward employed for carrying oil long distances. Cardboard, when covered with the composition, becomes as hard as wood, and most wooden buildings in Pekin have a coating of it. It consists of three parts of blood, deprived of its fibrine, four of lime, and a little alum.

COMBINED TOOL.

Of late many useful combinations in tools have been invented and patented, many of which have found much favor with the public, and met with an extensive sale. Our engraving shows a neat combination of this kind patented November, 1868, by John D. Wilkinson and E. O. Boyle, of Plattsburg, N. Y.

It is, as will be seen, a combined wire gage, dividers, rule, square, and calipers, making a very convenient and useful tool for the machinist's lathe and work bench. All the parts



are pivoted together by a single screw pivot, as shown, making a device tasty in appearance, compact, and capable of all the uses to which the elementary tools composing it are applicable.

American Zinc Ores.

Though the ores of zinc are abundantly concentrated in very many of the other States, yet, says the *American Exchange and Review*, Pennsylvania and New Jersey (with perhaps the addition of some amount from Missouri) furnish almost all the zinc and zinc oxide produced in this country. The Lehigh Zinc Works, at Bethlehem, Pennsylvania, and those of the New Jersey Zinc Company, at Newark, are both extensive establishments, the first drawing its supply of ores from the Saucon valley, in its immediate vicinity, and the last from the remarkable and peculiar deposits of mixed oxide of zinc and franklinite of northern New Jersey. Spelter, or metallic zinc, is produced at both establishments, the first manufacturing it directly from the ore, and the last having an intervening process of production of artificial oxide, which is subsequently densified, and then reduced to the condition of metallic zinc. The residue from the oxide production is a highly ferruginous mass, containing considerable manganese, which is adapted for treatment for metallic iron. Both companies manufacture oxide of zinc, or zinc white, for purposes of the painter. The same substance is produced at the Keystone works also, though it is here contaminated by the presence of some plumbic-sulphate, from the galena in the original ore.

At Mineral Point, Wisconsin, and near La Salle, Illinois, are zinc works, though we believe those at the last-named place are not at present in operation. In Southwestern Virginia and in Eastern Tennessee, in Arkansas and in Southern Missouri, ores of zinc are abundant, and generally of excellent quality and high percentage. Few of these deposits are, we believe, utilized at present, or, if wrought, contribute but a small quota to the zinc and oxide product of the country, if those of Missouri be excepted. The last-named State is rapidly developing into the position of the chief among the zinc centers of the country. The total consumption of the metal in the United States, during the year 1869, reached 62,000,000 pounds, of which 7,000,000 pounds were of home production, and 55,000,000 pounds were imported.

Remarkable Gas Wells in Ohio.

Mr. J. S. Newberry, in the *American Chemist*, writes as follows:

"In June, 1866, I visited two remarkable gas wells, bored by Mr. Peter Neff. in the valley of the Kokosing, a few miles east of Gambier (where Kenyon College is located) in Knox county, Ohio. I wrote a description of them, which was published in the Cleveland *Herald*. As gas wells are just now attracting some attention as sources of supply of gas for illumination and fuel, I have thought it might not be uninteresting to your readers to have this description repeated for their benefit.

"It will probably add to the interest with which it will be read to say that the wells described below have been flowing gas in apparently undiminished volume to the present time.

"From Gambier our route lay down the valley of Kokosing, some twenty miles, to the junction of that stream with the Walholding. Within this interval the valley has nearly an east and west course, and is excavated in the 'Waverley' (lower carboniferous) formation, in the direction of the dip of the strata, which is here, eastwardly, about twenty-two feet to the mile. Near Millwood, however, a few miles below Gambier, we crossed a belt of a mile or more in width, in which the rocks are much disturbed, the dip being increased to 30° with the horizon. Such disturbances are hopeful signs in an oil region, as they indicate the existence of subterranean fissures. When liberated, after confinement of a few minutes, and ignited, the gas formed a volume of flame as large as a house. At night, an exhibition similar to that witnessed by us at midday is said to be wonderfully impressive, the gas illuminating the whole country like a conflagration.

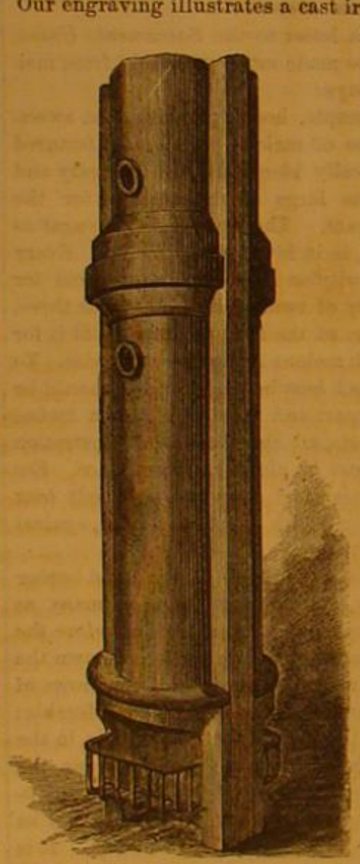
"The gas from these wells seems to be pure, having no other smell than an agreeable one of naphtha, and has high illuminating qualities. Its volume is sufficient to light a large city, and, if differently situated, the value of the material thus wasted, for lighting or heating, would be greater than the product of the best oil-well known."

Remarkable Cure of Aneurism.

The present Lord Mayor of London, Mr. Alderman Dakin, whose term of office was postponed from last year on account of ill health, was cured of an aneurism of the carotid artery by the ingenuity of a London surgeon. The position of the carot'd, and the impossibility of reaching it for the purpose of tying without disturbing the jugular vein and other vital centers, rendered the task of stopping the flow of blood, to give rest to the artery, one of extreme difficulty; and the seat of the disorder prevented the application of pressure by mechanism. Mr. Dakin's surgeon arranged for a number of students from a London hospital to attend in rotation, and keep a manual pressure on the proper part of the patient's neck. This was continued for several weeks, the operators, of course, knowing the exact spot requiring pressure to restrain the flow of blood and so rest the artery until it recovered its tone and contractile power. The device was completely successful, and the patient, whose life was despaired of, and who was convinced that a few weeks would bring him to an end, is now in perfect health. The simple and scientific remedy was devised by Mr. Buxton Shillitoe, a surgeon whose skill in diagnosis has already raised him to the foremost rank of the profession in Europe, and to whom the arrival of the highest honors is only a question of time.

CAST IRON CHIMNEY.

Our engraving illustrates a cast iron chimney for dwelling houses and other buildings, patented a couple of years ago.

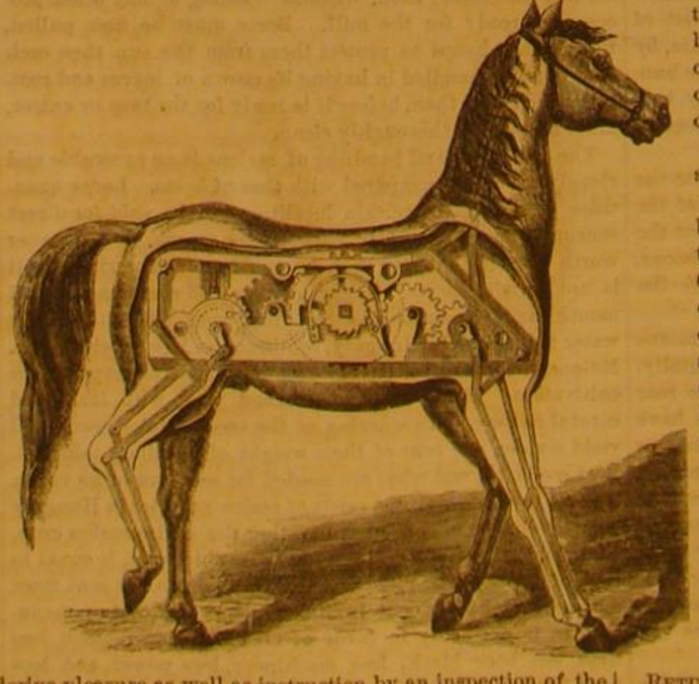


A chimney of this kind may be made to occupy much less space than the ordinary brick chimney. The casting is done in semicircular sections with flanged edges and shoulders at the joints, and with apertures for inserting the ends of stove pipes. The lower end may be adapted to an open grate, or to a stove, or heater.

It is not necessary to cover such a chimney with plastering, as it may be made of ornamental form, and painted to match the finish of other parts of the rooms through which it passes. The action of the gases would corrode the metal gradually, but such a chimney, if properly made, would probably last many years.

AUTOMATIC TOY.

The ingenuity and skill displayed in providing for the amusement of the little ones, is truly wonderful. One may



derive pleasure as well as instruction by an inspection of the displays in the toy-shop windows during the holiday season. Whoever takes the time to inspect these displays will see much that is really interesting, especially in the line known as automatic toys.

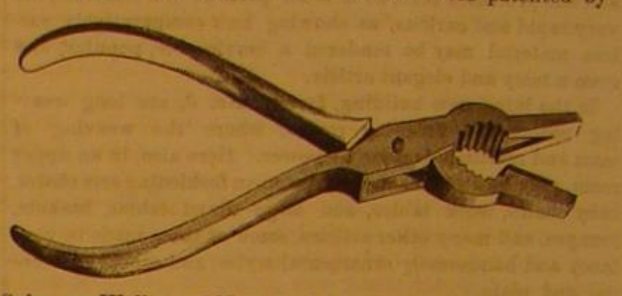
Our engraving shows an ingenious toy of this kind, and illustrates the method by which the movements of walking in automatic figures of men and animals are simulated.

The engraving represents a toy-horse, patented by William F. Goodwin, Jan. 22, 1864.

The legs are flexed by the motion of the compound levers shown, operated by a spring and trains of gearing, the articulations of the joints and the natural movements being thus imitated in appearance, and the automaton being caused to progress whenever the train of clockwork is wound up and set in motion.

IMPROVED PLIERS.

Our engraving illustrates an improved form of pliers, its construction being calculated to greatly increase the general usefulness of the instrument. This tool was patented by



Sylvanus Walker, of New York, January 8, 1867. The engraving shows so plainly the form of the pliers that we need only remark that the jaws are plain at the ends, and have opposing grooves for holding a bolt longitudinally, and serrated transverse hollows for use as a wrench.

Camels in Washoe.

A Nevada paper gives the following interesting account of the acclimation and use of camels in that State:

"On a ranch on the Carson river, eight miles below the mouth of Six-mile Canon, and about seventeen miles east of the city, is to be seen a herd of twenty-six camels, all but two of which were born and raised in this State. But two of the old herd of nine or ten brought here some years ago are now living. It would seem that the original lot fell into the hands of Mexicans, who treated them very badly, overloading and abusing them. The men who have them now are Frenchmen, and men, it seems, who had formerly some experience with camels in Europe. They find no difficulty in rearing them, and can now show twenty-four fine healthy animals, all of Washoe growth. The camel may now be said to be acclimated to Nevada. The owners of the herd find no more difficulty to breed and rear them than would be experienced with the same number of goats or donkeys. The ranch upon which they are kept is sandy and sterile in the extreme, yet the animals feast and grow fat on such prickly shrubs and bitter weeds as no other animal would touch. When left to themselves, their great delight, after filling themselves with the coarse herbage of the desert, is to lie and roll in the hot sand. They are used in packing salt to the mills on the river, from the marshes lying in the deserts, some sixty miles to the eastward. Some of the animals easily pack 1,100 pounds."

A New Cement.

In the specification of a recent French patent granted to Mr. A. Warner, of London, he claims a new cement composed in part of silicate of iron (preferably obtained from the scorious product of iron manufacture), or of oxides of iron or iron ore combined with sulphate of lime in proper proportions. To the latter, silex can be added. To give the cement the greatest durability forout-door work, Mr. Warner employs the determined proportions of the soluble phosphates, acids, or other chemical equivalents.

Practically the manufacture of this cement consists in reducing to fine powder, *laitier*, (dross) or scoria, and thoroughly blending it in an ordinary flour mill with sulphate of lime, which has been mixed with a previously certain quantity of soluble phosphate. The proportions should be varied in accordance with the intended use of the cement. The following are suggested: 700 parts calcined sulphate of lime, 200 silicate or oxide of iron or iron ore; 2½ soluble phosphate of lime.

Superphosphate of lime may be used in place of soluble phosphate, and in this case equal quantities of superphosphate and silicate or oxide of iron must be employed. Phosphoric or boric acid may be substituted for the soluble phosphate in the proportion of 6, 10, or 14 parts (according to strength) to 300 silicate of iron. And again, any phosphoric or boric salt, or indeed any chemical equivalent capable of forming a cementing substance when combined with silicate of iron, with or without the addition of sulphate of lime, may be substituted for the phosphoric or boric acid. When the cement is made without sulphate of lime it is well to use a larger proportion of soluble phosphate of lime.

The above mentioned substances being intimately mixed in powder, there only needs sufficient water to make the cement of the necessary consistency for the purpose.—*Translated from Le Génie Industriel de Paris.*

Returning to the subject of the Oakes-Ames catastrophe, we quote from the Boston *Times*: "We are able to state that the Ames company will, after its debts are liquidated, find itself enjoying a surplus of at least $8,000,000. The idea of insolvency as connected with this company, is simply absurd." We hope the vision will become reality.

Something about Fresh Air---What we Breathe.

We have all heard of the Black Hole at Calcutta. It was a room eighteen feet square. In this room one hundred and forty-six persons were confined. It had but one window, and that a small one. Dr. Dungilson, in his "Elements of Hygiene," says—"In less than an hour, many of the prisoners were attacked with extreme difficulty of breathing; several were delirious, and the place was filled with incoherent ravings, in which the cry for water was predominant. This was handed to them by the sentinels, but without the effect of allaying their thirst. In less than four hours many were suffocated, or died in violent delirium. In five hours, the survivors, except those at the grate, were frantic and outrageous. At length, most of them became insensible. Eleven hours after they were imprisoned, twenty-three only of the one hundred and forty-six came out alive; and those were in highly putrid fever."

There are many "black holes" like this used for sleeping rooms, says the London *Co-operator;* the difference between them and the one at Calcutta is—that they are not crammed quite so full of human beings. In a word, then, we may say a sleeping apartment should be large, lofty, and airy. It is a poor economy for health to have large and spacious parlors, and small ill-ventilated bedrooms. Fashion, however, is a reigning deity in this respect, and will (no doubt) continue to bear sway, notwithstanding our protest against her dominion.

You will scarcely drink after another person from the same glass, yet you will breathe, over and over, the same air, charged with all the filth and poison of a hundred human bodies around you. You cannot bear to touch a dead body, because it is so poisonous and polluting; but you can take right into your lungs, and consequently into your body, your system, those poisonous particles and noxious exhalations which the bodies around you have refused, and which have been cast into the atmosphere by their lungs, because the health of their bodies required them to be thrown off. If the "timorously nice creatures who can scarcely set a foot upon the ground," who are so delicate that they run distracted at the crawling of a worm, flying of a bat, or squeaking of a mouse, could see what they breathe at the midnight carousal, the very polite ball, and the bright theater, they would never be caught in such company again. Nay, if they could see what they breathe in their own dwellings, after the doors and windows had been closed a little while, they would soon keep open houses. More sickness is caused by vitiated air than can be named. It is one of the most prominent causes of scrofula, which is but another name for half the diseases that attack the human body. It vitiates and destroys the whole fountain of life—the blood.

In the sick room it often augments the disease, or renders it incurable. If the physician comes in and opens the window, or a door stands ajar for a moment, the good nurse, or the tender mother, or the kind wife, or the loving sister, will fly up and close it, as though the life of the sick were at stake. All this is well-meant kindness, but really cruel. If you would have health, breathe fresh air, throw open your windows every morning, and often during the day; leave off your mufflers from the chin. For 20 years, I was accustomed to never going out without a handkerchief tied closely around the mouth, and for nearly that period have left it off. I have had fewer colds, and suffered far less, from changes of climate than previously. Let air into your bedrooms; you cannot have too much of it, provided it does not blow directly upon you.

Many students are injured by vitiated air in their studies. These are small and when the doors and windows are closed, the atmosphere soon becomes loaded with noxious vapors. The man is intent upon his subject; he scarcely knows whether he breathes or not, much less does he think of what he breathes. Many, also, are seriously injured by the manner of heating their studies. All closed stoves should be avoided. The good old-fashioned, open, large chimney, with a fireplace sufficiently capacious to receive the wood with but little chopping, is much preferable to the stoves and grates, and the whole paraphernalia of modern fuel-saving inventions, which have racked the brains and tortured the intellect of many laymen, and some clergymen.

PERPETUAL MOTION.

NUMBER IX.

Innumerable are the devices by which men have sought to make wheels permanently retain an excess of weight on one side of their centers, while revolving. Our engraving, Fig. 20, illustrates one of these absurd attempts. An endless chain, A, passes over pulleys, B, over the idler pulley, D, and under the idler pulley, C. It is expected that the increased weight of the greater length of chain on one side of the upper pulley, B, will more than counterbalance the weight of the chain on the other side, and also compensate for friction created by the pulleys, and so impart a constant rotation to the pulleys and fly wheel.

The device described is, however, outdone by the one shown in Fig. 21, prepared in 1829, by a correspondent of the *Mechanics' Magazine.*

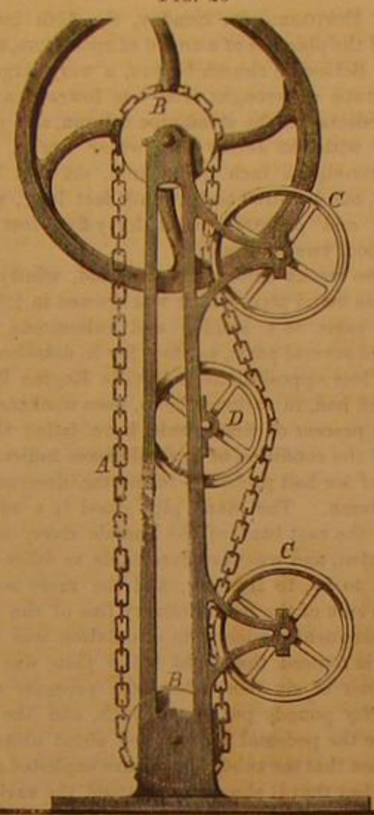
This was to be a self-moving railway carriage. The genius who devised this machine thus writes in regard to it:

"In treating of perpetual motion—'that grand secret for the discovery of which those dictators of philosophy, Democritus, Pythagoras, Plato, did travel unto the Gymnosophists and Indian priests'—it would add considerable interest to give some account of its early history. Regarding the fallibility of every contrivance hitherto planned or experimented upon, we may gather sufficient from the writings of Bishop Wilkins alone. The 'little world' of Paracelsus and his followers—the planetarium invented by Cornelius Dreble, for King James—the 'magnetical globe of Terella,' suggested by Pet. Peregrinus, with the wheel that he, Taisner, and Cardan thought might be kept in motion by 'pieces of steel and loadstones'—are, like the Bishop's own wheel and plummets, and his application of Archimedes' screw, inadequate to the grand end for which they were designed.

"Without enlarging on this head, we shall proceed with the description of a machine which, were it possible to make its parts hold together unimpaired by rotation or the ravages of time, and to give it a path encircling the earth, would assuredly continue to roll along in one undeviating course till time shall be no more.

"A series of inclined planes is to be erected in such a manner that a cone will ascend one (its sides forming an acute angle), and, being raised to the summit, descend on the next (having parallel sides), at the foot of which it must rise on a third and fall on a fourth, and so continue to do alternately throughout.

Fig. 20



"The diagram is the section of a carriage, with broad, conical wheels, resting on the inclined plane. The entrance to the carriage is from above, and there are ample accommodations for goods and passengers. The most singular property of this contrivance is, that its speed increases the more it is laden; and when checked on any part of the road, it will, when the cause of stoppage is removed, proceed on its journey by mere power of gravity. Its path may be a circular road formed of the inclined planes. But, to avoid a circuitous route, a double road ought to be made. The carriage not having a retrograde motion on the inclined planes, a road to set out upon, and another to return by, are indispensable.

"I am indebted to a much-respected friend for the hint of this means of effecting a veritable perpetual motion."

"The Perpetual Motion Hunter" is the title of an article in the *Imperial Magazine*, vol. 6, 1824:

Fig. 21.

It gives me much pleasure (says the writer) to observe that you notice scientific subjects; you are very right in so doing, as it will not only give variety, but add considerably to the value of your very useful miscellany. It is my humble opinion that such a procedure is infinitely better than filling it with the splenetic effusions of angry minds, the ebullitions of disappointed envy, or, what is worse, dealing out large portions of scandal, and making use of personalities to wound virtuous sensibility, as is the constant practice in some similar publications.

I am now, sir, an elderly man, and am sorry to inform you that I have lost much valuable time, and, of course, money, too, from having been infected, in the early part of my life, with the vanity of hunting after that *ignis fatuus* called the "perpetual motion." Common report informed me that it would immortalize the name of the inventor; that by it the longitude would be discovered; and that, on this account, the British Parliament had offered a premium of ten thousand pounds for its discovery! This was something like assailing a man at all points at once; the acquirement of such prodigious fame flatters his vanity; and the "ten thousand pounds" could be looked upon in no other light than as the reward of distinguished genius!

Under these impressions I began my career, and pursued it with an ardor which, in any other case, could not have failed to ensure me success. I read with the greatest avidity all the accounts of such machines I could anywhere meet with. For a short time I was amused with the ball of iron and the magnet, mentioned in Bishop Wilkins' "Mathematical Magic." I afterwards studied the properties of Orffyreus' wheel, which, as Gravesande informs us, continued in rapid motion for two months; and the end of which period it was stopped, he says, to prevent the wear of materials. This astonishing wheel was, you know, destroyed by the inventor, soon after the time of the above-mentioned experiment. I endeavored with all my might to recover the long-lost secret, and success partly crowned my efforts; for, after a great deal of wearisome labor, I constructed a machine which I then believed would amply compensate the loss which the crazy philosopher had occasioned, when, in a fit of frenzy, he dashed it to pieces. The delight which Newton felt, on discovering the law of gravitation, did not exceed mine when I found that my machine would answer the intended purpose. 'Tis true, it would not put itself in motion—but what then? It was sufficient for the purpose if it would move perpetually when put in motion; and at that time, like many others, I did not quite understand how many requisites were necessary in order that a machine might become a "perpetual motion."

You can scarcely imagine how my heart palpitated when I sent off a description of this, my first invention, to the Board of Longitude. It was a machine which I had no doubt would determine the longitude, both at sea and land, with the greatest ease and accuracy. During the first week, my nightly slumbers were frequently broken by the violent perturbations of my mind; and my day dreams almost continually represented to me the postman knocking at my door with the wished-for letter, that was to crown all my hopes. So certain was I of success, that I actually began to look about for an estate which the ten thousand pounds were to purchase; for, in my mind's eye, I had it already in my grasp. The humble occupation I had till then followed, I now looked upon with disgust; and I saw myself at once elevated to opulence and fame. I waited with patience—yes, Mr. Editor, with all the patience I could muster—but no letter arrived. However,

"Day presses on the heels of day,
And moons increase to their decay."

After a few weeks, my mind recovered its wonted serenity, and in about three months more my machine was as free from any violent perturbations as my mind, for, at the end of that period, it had completely lost all power, either of perpetuating or continuing its motion. This circumstance occasioned me some uneasiness; and I was not much amused with the taunting remark of one of my friends, who, on viewing it, exclaimed, "Well! it is a perpetual motion *still!*" At the end of nine months, I received a letter from the Secretary of the Board of Longitude, informing me of what I already knew—namely, that my machine would not answer.

It is now carefully stowed in my brother Jonathan's garret, at Brigg, in Lincolnshire, where it may be seen by all who are curious in such matters.

I now turned my mind into a different channel. I thought it possible that the object of my search might be accomplished by means of some of the fluids. I considered, with care, the almost continued oscillation of the mercury in the tube of the barometer; but I could deduce from this motion no practical result. I afterwards endeavored to turn the tides to some account; but I failed here also. At length, after turning my mind in a variety of ways, as I was one day reading an account of the rise of water in capillary tubes, it at once occurred to me that, as the water rises in such a tube to more than an inch above the surface of the water in the vessel in which the tube is immersed, if I placed the tube in an inclined position, the water would run over its top; and as it would fall into the same vessel, the motion thus produced would be perpetual. At this moment my mind was again agitated; I exclaimed, like Pythagoras, "I have found it! I have found it!" I now supposed myself to be as great a man as any Pythagoras that ever lived. I did not, however, run out, like him, naked into the street; but I remember the discovery was made in the winter season, when I was warmly and comfortably clothed. Had it been in the summer, I cannot tell what might have happened.

I soon procured a capillary tube, and proceeded very carefully to make the experiment; but the water did not flow! Well, said I, this is curious; but a syphon will run: that the water does not run from the top of the tube is owing to the pressure of the atmosphere upon it. I now ordered a capillary syphon, and was again disappointed; for the sluggish water, as if envious of my fame, still refused to move.

Having recovered a little from the stupor into which I had been thrown by the failure of another of my schemes, it occurred to me that if I employed a syphon to carry water over the bank of a river that communicated with the sea, the syphon would run if the outer leg on the outside of the bank was longer than the inner leg; and because the water would find its way into the ocean, and be brought back by the process of evaporation, which is constantly going on, the motion would be perpetual. I could not, however, employ this method to discover the longitude, either at sea or land, and of course, I was not entitled, from this invention, to the ten thousand pounds.

Another of my machines consisted of two wheels, A and B: the wheel A had a number of buckets, at equal distances, round its outer rim. These buckets were so placed that they would each contain a ball of iron. Seven such balls were always on one side of the wheel A, urging it downwards; and one was in the inside of the wheel B. When the wheel A had arrived in a certain position, the lowest ball fell out of its bucket, and rolled down an inclined plane, placed for that purpose, into the interior of B; and then it rolled down another inclined plane into the top bucket of the wheel, A, and so on. This machine had a very specious appearance, and was mistaken for a perpetual motion by thousands of well-informed persons. I need scarcely add that the persons I mention were ignorant of the laws of motion and the theory of mechanics. A similar machine was lately exhibited for a perpetual motion, and a great deal of money made by showing it to the good people of New York, in North America.

My last invention of this kind consisted of an iron wheel and four magnets, similar to the one exhibited some time back in Edinburgh, and other places. As the wheel did not move uniformly, and as the power of the magnets soon began to diminish, I suspected it would ultimately fail, and abandoned it altogether. It is necessary to inform you that my modesty—or, rather, my honesty—would never permit me to exhibit any of my inventions for money, as I had always very strong grounds of suspicion that they would not answer, and my suspicions were always verified in a short time. It was only after a great number of disappointments that I began seriously to think on the subject. I at first wondered how it happened that my schemes should always prove abortive; but I soon discovered that I was entirely ignorant of the theory of mechanics. Not long after, I had also the mortification to perceive that I had totally mistaken the specific nature of the machine which had been so long the object of my search; so that it would have been next to a miracle if I had found it. I now began in earnest to acquire a knowledge of the principles of natural philosophy, and I very soon found that I had begun at the wrong end of my business.

My misfortunes had created in me serious musings. Yes, said I, in all ages mankind have had some favorite object to pursue—a something bordering on the limits of impossibility. Astrology, or the foretelling of future events, was once the grand charm that led men astray. People are fond of prying into futurity. All men are naturally delighted with what is wonderful; and what pains do they take to deceive themselves! Astrology ruled with despotic sway during the reign of ignorance; but, as knowledge advanced, the chimera retreated; and the few votaries it has now left are ranked either among the most ignorant or the most knavish of all the human race.

Alchemy was another favorite pursuit. To be able to transmute the baser metals into gold, was certainly an object of the greatest consequence, and now the discovery would be particularly desirable. There is no doubt that it would be liberally patronized by the Ministers of State and the members of the British Senate; because, if properly managed, it would enable them to pay off the national debt, and ease the good people of England of the intolerable burden of taxation. In case of such an event taking place, what joy would be diffused throughout the whole of this great empire! The people would be wealthy, and the Ministers again able to create places and to give pensions *ad infinitum*. But I must return to my subject. The search after the perpetual motion is of the same nature as those of astrology and alchemy. It has long amused the ignorant and deceived the credulous; but men of science, properly qualified to judge of its merits, look upon it as a nonentity, and laugh at its proselytes as deluded creatures, who are pursuing a phantom of their own creation.

I have not much hope of being able to convince those persons who are in search of this shadow of a shade that their labors will be fruitless. I will proceed, however, to describe the machine they are endeavoring to construct. The perpetual motion is a machine which possesses within itself the principle of self-motion; and because every body in nature, when in motion, would continue in that state, it follows that every motion, once begun, would be perpetual, if it were not acted upon by some opposing force, such as friction, the resistance of the air, etc. In order, then, to produce a perpetual motion, we have only to remove all the obstacles which oppose that motion; and it is obvious that if we could do this, any motion whatever would be a perpetual motion. But how, let me ask, are we to get rid of these obstacles? Can the friction between two touching bodies be entirely annihilated?—or has any substance yet been found that is void of friction? Can we totally remove all the resistance of the air, which is a force continually varying? And does the air at all times retain its impeding force? They cannot be removed, then, so long as the present laws of nature continue to exist, and who will attempt to destroy them? Besides, it is a well-known principle in mechanics, "that no power can be gained by any combination of machinery, except there be at the same time an equal gain in an opposite direction;" and must there not be some absolute loss arising from opposing forces, as friction, etc.? How, then, can a perpetual motion be found by any combination of machinery? Another necessary circumstance is, that the motion of any such machine be uniform; for, if it accelerate, it will in time become swift enough to tear itself to pieces; if it retard, it will at length stop. Now, among all the numerous forces acting on machines—forces, too, which are continually varying, according to known causes, and to the influence of which every machine is constantly liable—who is there so hardy as even to imagine that a machine can be constructed, the motion of which shall be constant, and uniformly the same?

There is one perpetual motion, and but one—that is, I know of but one—and that was constructed by Infinite Wisdom. The Divine Creator of the universe has balanced this earth with such exquisite art, that its diurnal revolutions are performed so precisely in the same time that it has not varied the hundredth part of a second since the time of Hipparchus, which is now more than two thousand years.

All that we can hope is, that the beams of science will diffuse truth more generally through the world; for, otherwise, dreamers of every kind will continue to dream to the end of time.

Correspondence.

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

The Jersey City Stand Pipe.

MESSRS. EDITORS:—On Sunday, the 14th inst., about 4 P. M., amid the plaudits of a crowd of spectators, and the bell-ringing of Belleville church towers, a very large, weighty, and costly tube of wrought iron was lowered away on the masonry pedestal of the stand-pipe column, and prepared for connection with the Jersey City water works. This tube was of three-eighth inch boiler iron, six feet in diameter at the base, one hundred and twenty feet long, resting on a lower tube and pedestal, about forty-five feet high, and weighed about twenty tuns.

About two weeks before this, one cold, wintry night, the wrought-iron stand pipe, which was erected in 1859, at a cost of $4,076, came to a sudden and calamitous end of its service. Its several parts, as they lay in detached pieces on the vacant lots opposite the Belleville Engine House, show that the iron had, in various places, been weakened by oxidation, and in process of time would have failed through this action; but the condition of several pieces indicates that the formation of ice had probably forced the destruction of the massive column. The stand pipe stood in a very exposed position on the east bank of the Passaic river, without outside protection, and was therefore liable, as other stand pipes are known to be, to freezing, and the more so, as it was located one side of the main delivery line of the east pump, and the consequent tendency to circulation was less active.

When it is noticed that light boiler plate was used for a base diameter of six feet, where the pressure at intervals exceeded fifty pounds per square inch, and the column of water above the pedestal represented about ninety tuns, the wonder is, not that the tube should have exploded and crushed down now, but that it should have stood the various strains so long.

As Jersey City, and its suburbs, with a large population and manufacturing interest depended on the Belleville works for water supply, and the main engines were virtually shut down by this accident, the papers have daily represented the manifold inconveniences, and actual losses sustained by this community, which have amounted in the aggregate to an enormous sum, and attracted attention from all parts of the country.

There has been a very severe and important practical lesson taught here, which cannot be too closely studied; a lesson which the occurrence of a large fire might have made much more impressive. It is a lesson for those who assume the management of city affairs, for those who invest in insurance stocks, for those who use and depend upon water supply, and particularly for civil engineers who take the much underrated responsibility of such public constructions.

Among the visitors attracted to Belleville by this public disaster, probably the great mass accepted, without study, the stoppage of the engines, and the delay consequent on the construction and erection of another stand pipe, as inevitable conclusions.

Possibly no spectator in the gratified crowd of Sunday failed to acknowledge in the successful erection of the massive tube, the one and the only fact which could ensure a renewal of an adequate and customary supply. Yet, in the opinion of more than one quiet looker on, during all this delay, the very conditions of this accident made this new erection doubtful in expediency; and granting this, the Belleville engines might have been set to work in full power *within ten hours* from the fall of the stand pipe.

The stand pipe, as it has been used in this country, is borrowed from the European school, where there are important differences in the method of water supply. In London, for instance, where the supply is intermittent, being let on a given district for a certain time in each day, or at certain fixed intervals of time, overflow stand pipes are used to maintain a head on the pumps, which could not otherwise be had, as the pumping engines are operated. Here, however, in various cases, stand pipes without overflow are used, simply to regulate the condition of a constant delivery to a reservoir from which alone the water mains are supplied. At Belleville, the head on the pumping main is constant, since it rises in a reservoir to a level within three feet of the top bank, and is, therefore, independent of the fluctuations of the reservoir. The sole purpose of the vertical stand pipe near the pumps, is, therefore, to control the oscillations which may occur in the pumping main, which is also a stand pipe inclined.

When the plans for the most powerful pumping engines in use were arranged for the Brooklyn water works in 1856, where a daily capacity of 15,000,000 gallons was required from each engine, under a lift of 163 feet (the Belleville lift being 156 feet, for engines with a usual capacity of 3,300,000 gallons per day), this question of government for the pumping main was very carefully examined, and it was decided not to use stand pipes, from the various objections as to cost, exposure to gales, liability to decay, risk of freezing, but more particularly because properly proportioned air chambers attached to the pump mains, in obviating these objections, also furnished a more perfect system of government to the mains, in smoothness and elasticity of action. The air chamber provided for the No. 1 engine was 6½ feet in diameter and 25 feet high, and under trial it fully settled any doubts as to its superior advantages.

At the Belleville engine house, in the stand-pipe pedestal, there was an uninjured cylinder, six feet in diameter, attached to the pump main, and about twice the hight of the Brooklyn air chamber. If this had been capped and connected with a small auxiliary air pump, which could have been done in a few hours, the inhabitants of Jersey City and suburbs could have been spared all the expenses and losses of the delay in supply, the action of the engines would have been improved, and the annual coal account reduced. This is not said as a criticism on the engineer department, the chief of which, probably, would not have felt authorized to adopt a radical change of this kind, but rather as a comment on the conflicting practice in hydraulic design and construction.

If the history of these works be examined, it appears that from 1854 to 1859 the pumping main itself was used as the stand pipe, and in the report of Feb. 26, 1856, a singular experiment on air cushions is thus recorded:

"About 300 feet north of the reservoir there is a summit in the rising main, from which the pipe descends on one side towards the engine house, and on the other it falls regularly about 18 inches to the level of the bottom of the reservoir. At this high point a tap was inserted for the purpose of discharging the air, and the engine was worked at first with the air drawn out of the summit, and the pipe filled with water. But a difference in the discharge was soon observed by retaining the air in the pipe, which, being compressed whilst the pump is forcing water, acts on the return stroke by its elasticity, like a flat, extended air chamber, producing a constant discharge; and at times, when the pipe is well charged with air, with scarcely any variation.

"The effect of this accidental air chamber, although within 15 feet of the level of the discharge of the reservoir, is visible in the improved working of the pump; since by means of it, it is relieved of about one eighth of the recoil."

It is to be regretted that the experience of 1856 was not developed in 1859 in such a way as to obviate the disaster of 1871.

SAMUEL MCELROY,
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Spurious Champagne.

MESSRS. EDITORS:—An article in the New York *Times*, of December 17th, in regard to spurious champagne making, induces me to submit to your judgment some remarks relative to the merits of different modes of making sparkling wines. Not taking into consideration artificial wine, made of substances composing wine, there are, to my knowledge, three methods of producing sparkling wines. First, the "old method," in which the wine is allowed to ferment and to clear in bottles, and is afterwards separated from the sediment. This process requires from five to six months. The second way is the "new method," which consists in charging pure carbonic acid gas into already cleared wine. The third method alone is entitled the term "spurious champagne making," and consists in filling bottles with clear wine, and corking the same instantly, after administering salts containing carbonic acid, and also adding tartaric acid in solution. This method is cheap, simple, and quick, and wine so made may be sold at a low price.

My remarks will refer to the relative value of the two first methods. It is known that by both ways, the new and the old method, an "artificial sparkling wine" is produced. Neither is natural. The *Times* says that the "genuine wine" obtains its carbonic acid gas "by the decomposition of vegetable matters remaining in the wine." This statement is incorrect, as the saccharine matter in the wine is far too insufficient for the production of the required quantity of carbonic acid, and to retain, also, enough unchanged to give the wine a sweet taste. For this reason, it is a condition of the "old method" to administer a certain amount of sugar sirup. Consequently, the material for the generation of carbonic acid is artificially supplied, even in the old way. Besides the sirup, some cognac is added to the wine, and generally a few drops of some extract, to impart an agreeable flavor. These additions would be termed "doctoring," if they were not a part of the "old method." All these facts show that the "old method" is an artificial way of making champagne, as well as the "new method."

The manufacture of sparkling wines in the new way requires good wines. The best sort is selected for this purpose in California. This is subjected first to the clearing process, in the usual way, as done with all wines, till it appears of a brilliant clearness, the process requiring from three to five months. The wine is now ready to be charged with carbonic acid gas; but here, as in the old method, a certain amount of sugar sirup must be added, in order to counteract the sour taste of the carbonic acid. No cognac is used in this process; but, if used, it would be for exactly the same reason, and to produce the same effect as in the old method.

Now I think that carbonic acid gas, if pure, must be always the same compound, possessing the same properties, no matter how or wherefrom it is obtained; whether by fermentation, by combustion of fuel, or from limestone, just as silver is always the same metal, whether it is extracted from a sulphuret, from a chloride, or some other compound. Taking further into consideration the facts that champagne, or sparkling wine, made in both ways, has the same amount of carbonic acid dissolved in the wine, under the same pressure, exactly in the same chemical condition, and that the wine is equally pure in both cases, what specific difference is there between sparkling wines produced in the old and in the new way?

Not all champagne made after the old fashion must be necessarily pure on that account. There are factories which find it in their interest to go on with this process, in order to deceive the public, combining, however, with it the admixture of bicarbonates, shortening thereby the usual time of five or six months to so many weeks, or less.

Why is the new method in this country considered an "imitation," or artificial product, if it be exactly the same product, only produced in a different way? People who write about champagne ought to know that the new method, impregnating the wine with carbonic acid, is a legitimate business in France, Germany, and all Europe; that more than three fourths of the whole production of champagne is manufactured in the new way; and that wines of this kind received premiums in the great Paris Exposition. The question is there, not "How is it made?" but "What quality is it?" Nobody in Europe would start at this time a champagne establishment on the old plan.

The *Times* evidently considers the impregnation of carbonic acid as producing "imitation wine." It says, also, "Large quantities of white wine are purchased and mixed with California hock, or other native still wines, the fermentation of which has been artificially arrested, or has naturally ceased." As to mixing of different wines, it is never done by those employing the new method, but it is usually the case in the "old way," and is known under the name of "marriage." A wine with suppressed fermentation would give, if charged with carbonic acid gas, a muddy, horrible liquid, of no service to human beings.

It is not at all my intention to defend "spurious champagne making." I wish only to draw a line between a method recognized by the scientific world in Europe as correct and legitimate, and the really spurious process, and to correct the blunders of the *Times* article.

If the imitation of sparkling wines create so much attention as to raise the question of imposing a tax of six dollars per dozen, with the purpose of suppressing a legitimate branch of industry, as well as petty humbug factories, how is it, then, that, excluding the innocent carbonic acid gas, all other imitations made "from native wines" are considered to be all right? There are Port, Sherry, Malaga, and other imitations, made in very different ways from our own wines. There seems to be just as good a prospect for internal revenue in this line as in the former. H.

Ballooning.

MESSRS. EDITORS:—You must excuse my intrusion at this time on the subject of ballooning, as it is one of some moment in the present European war. Ballooning has been attended with considerable success, but there seems to be a point or two in which it fails. I think I can suggest a few ideas that would in a great measure overcome the difficulties.

We see by the papers that balloonists are unable to maintain a desired hight, and sometimes fall among the enemy. To overcome this difficulty I would suggest a reservoir composed of a number of folds of silk or paper (as is proposed for reservoirs in compressed air engines, which no doubt you have noticed in print), able to resist the pressure of a sufficient number of atmospheres, and provided with a pump, by means of which the balloonists could draw from the balloon the gas and concentrate it in the reservoirs, which would cause the balloon to be compressed and lose some of its buoyancy; at the same time throwing some weight into the reservoir when the balloon was desired to be lowered; and conversely, the gas could be let out of the reservoir into the balloon, which would cause it to ascend at will.

I believe it is an established fact that the atmosphere flows in currents or strata, in different directions at the same time. By means of the above contrivance advantages could be taken of these currents to go in a desired direction. In order to find these currents I would suggest the idea of providing little balloons or bags, some filled with hydrogen gas, which could be sent up and their direction watched, and others made somewhat heavier than the atmospheric air, and let down and also watched. This would enable the balloonists to take advantage of these currents.

Another idea suggests itself, but I fear it would not be practicable; that is, the upward and downward motion of the balloon could be taken advantage of to propel it forward by using a helm or rudder horizontally. Probably, however, the gas could not be withdrawn from the balloon sufficiently fast to give it any considerable downward motion. This forward motion of course would be similar to the progression of a sea vessel, being a mean direction between the force and resistance. WM. M. COWLEY.

Salt Lake City.

Poisonous Stings of Insects.

MESSRS. EDITORS:—A correspondent of the SCIENTIFIC AMERICAN refers on page 20, present series, to pressure made with the pipe of an ordinary lock key in relieving the pain resulting from a bee sting, and explains the effect by declaring that the annular compression, close to the puncture, forces out the poison.

I remember that, when a youth, a similar effect was produced by making firm pressure upon the seat of injur[illegible] short time with the flat surface of a silver [illegible]y for a [illegible]on; the effect was invariably to diminish or prevent [illegible] pain, and reduce the subsequent swelling. This eff[illegible] the youthful imagination was wont to class among [illegible] things magical and unexplainable, but as Paget in [illegible] his "Pathology" affirms that continued pressure [illegible]ves rise to absorption, I have since then understood that the prevention of pain by this means was due to the fact that pressure caused absorption of the poison into the general circulation, and thus prevented it from acting as a local irritant.

If by annular compression the virus be actually drawn from the wound, the cupping glass would, in the graver forms of poisoned wounds, be a most simple, speedy, and effectual remedy. But if I do not mistake, general experience upon this point will convince us that such is not the fact. G. W.

Baltimore, Md.

Steam Plowing.

MESSRS. EDITORS:—In looking over a recent copy of the Report of the Agricultural Department for the year 1869, we were painfully struck with the following paragraph in an article entitled "The American Steam Plow", page 305.

"As a people we are wont to boast of our great strides in the field of progress. In one hand we hold up the certificate of the infancy of our years, and in the other, with becoming pride, we unroll to the gaze of the world a voluminous scroll, setting forth our wonderful achievements in all that makes a nation great and powerful; and yet, with all our amazing progress, there is no such implement known as a practical American steam plow. American sod is successfully turned by a steam plow, but that plow is of foreign origin. We are compelled, at an immense outlay, *even after Congress remits the duties*, to send our orders three thousand miles across the ocean to procure a steam apparatus which will do all that is claimed for it. True, we may say that this same apparatus was first invented and patented in the United States, by E. C. Bellinger, of South Carolina, November 19, 1833, and was *improved* upon by John Fowler, of England, in 1854—twenty-one years after Bellinger had created the infant Hercules. So Columbus showed others how to discover unknown worlds; and as the Spaniard lost foothold in territory of his own discovery, so have we, by like supineness, lost the glory of successfully introducing to the admiration of the world what should have been known as the American steam plow."

We confess that the above is quite a damper to our American pride, and "pity 'tis, 'tis true." But it is fact, and therefore stubborn. Verily it looks as though a hidden sarcasm lurked under this act of Congress evincing so much liberality in remitting the duties upon foreign steam plows imported by wealthy planters who can even afford to purchase several sets of these expensive foreign tackle, while it ignores the duty it owes to the men of genius of our own country, men who, in the majority of instances, are too cramped in resources to develop and prove the source of wealth, either locked up in their brain or lying upon paper.

What hope can our own inventors have of ever successfully introducing an American steam plow, while the misplaced liberality of Congress invites the foreigner to bring in his engines free of duty? Does the Government doubt that there is sufficient inventive talent at home to produce a practical machine? Let the challenge be proclaimed only, and we have faith enough in our people to believe that the American mind will develop itself in practical form and means, at least equalling, if not excelling, all foreign examples. If the attempt of Fawkes and others proved anything, it only proved that they were wanting in means to prosecute their costly experiments to the final goal of success. How different is the course of the Governor General of India, who offers a prize of $25,000 for a successful Ramie machine! Suppose our Congress puts the matter of steam tillage to the same test, and, in view of the immense national importance of the subject, makes a no less liberal appropriation than the above. Let the amount be an appropriation to the Agricultural Department; to be offered by the Hon. Commissioner of Agriculture as a premium for the most practical steam plow and farm engine of American invention. Let a time be appointed for an exhibition of steam plows and all other agricultural implements, to be held at some suitable locality; and thus, if steam tillage is to be an institution in America, as it certainly ought to be, let us give it a fair trial.

It may be objected that reapers, etc., have worked their way to public favor, and why not steam plows? Simply because a steam plow, like an ocean steamer, is a "big thing" in its way; and if Congress have a right to develop ocean travel, by liberally subsidizing ocean steamers, for the same reason it ought to exert a similar right to develop the highest form of agriculture. This is to be accomplished only by promoting steam tillage, which is acknowledged, by the use of 3,000 of these machines abroad, to be the highest form of agriculture, increasing the productiveness of the soil at least one fourth, and rendering the country at large a substantial benefit, shared in by all; even the barbarous (?) Arab cultivates the banks of the Nile by steam tillage!

We apprehend, unless some such encouragement be offered, that the day of the birth of the American steam plow is yet far in the future. It is quite possible that Bellinger [illegible] with his great wealth of brain, which could origin[illegible] the steam tackle, was poor in purse, which m[illegible]y very reasonably account for the still birth of hi[illegible] great invention. And it is also more than probabl[illegible] that had John Fowler enjoyed the privilege of bein[illegible] one of the American sovereigns, instead of having be[illegible]en the humble subject of her Majesty the Queen, hi[illegible] "improvement," like Bellinger's, might doubtless have been to-day nothing more than a curious toy lying idly upon the shelves of the Patent Office in equal obscurity with its less fortunate predecessor,

"Where many a flower is born to blush unseen."

But living as he did in a kingdom where almost boundless agricultural wealth is constantly looking out for the opportunity of still further augmenting fabulous incomes, he was thus able, gradually to improve, by numerous and costly experiments, and finally reduce to practice, a system which, under different circumstances, would inevitably have been assigned to the tomb of the Capulets.

We repeat, then, let Congress lend a fostering hand to what may be justly called a national enterprise, and thus develop this mighty agent of agricultural prosperity, in which every true American must naturally feel the deepest interest. If left to individual effort, we have all the experience of the past to convince us that the present generation will, more than likely, not see its realization. For, as we have said, the inventors, as a class, are too poor to undertake more than mere spasmodic attempts, and the wealthy manufacturers are too timid to touch anything, however promising, that is not already fully developed and an assured success. TRIPTOLEMUS.

An Appeal from Russia.

MESSRS. EDITORS:—Can any of the numerous readers in your well-known journal give us the names and addresses of the principal engineering, architectural, scientific societies, etc., in America? We have received so many communications from Russian Societies and their members respecting copies of the reports and proceedings of the American institutions, that we feel compelled on behalf of our Russian friends to make public appeal, trusting that the lovers of science and art in America will not refuse to help in disseminating a little of their knowledge. We shall be only too glad to act as a humble medium in translating such proceedings for the benefit of our friends, and, we trust, by mutual exchanges, to guarantee and bind that friendship, at present so cordially and lovingly existing between Russia and America. We feel assured that to all lovers of science and art, Modern Russia has a kindred scientific relation to America in the endeavors now being made to develop its hidden resources, and in its laudable desire to secure for itself a future prosperity and greatness. It is, therefore, with feelings of more than ordinary interest that we request America and her scientific circles to help in a great work. We shall be most happy to aid by all means in our power, and shall feel flattered, and spare no pains to transmit the kind desires and good wishes of the American scientific interest to the anxious lovers of science and art in Russia; and we have every faith that the greatest and most energetic nation in the world will not turn a deaf ear to our call. The result of such a generous diffusion of ideas and facts as is daily developing in the fatherland of invention, will, we are sure, tend to mutual exchanges that cannot but help to assist in the future welfare of either nation. Any communications or reports from secretaries or others, addressed to Mr. James V. R. Swann, Senr. of this firm, will be gratefully received, and Mr. S. will at all times be happy to act as correspondent to the best of his ability, and forward mutual exchanges in copies and translations of the proceedings of such Russian societies as may interest his correspondents.

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The Plains of Kansas.

MESSRS. EDITORS:—In the SCIENTIFIC AMERICAN of Nov. 26, 1870, you say: "There are probably 50,000,000 acres of sterile plains between the Mississippi River and the Rocky Mountains. Some of them are too barren to produce anything, while some could be made productive by irrigation." Permit me to state—

1. Flourishing settlements in Kansas now extend 225 miles west of Kansas City, along the line of the Kansas Pacific Railway; say 98° 30' west longitude.

2. Wheat sown in April, 1870, matured in July, at Carlyle Station, 376 miles west of Kansas City, and 2,948 feet above the level of the sea; near or west of the meridian 101°.

3. Wheat, rye, and barley are sown, with prospect of success, at Pond Creek, 422 miles west, 3,200 feet above the sea, and near meridian 102.

4. The great plains are arid in climate, and sterile in soil; but no part between the Canadian and the Platte is barren. Natural grasses and herbage sustain ponderous animal life in the buffalo herds.

5. Given irrigation, and there is no region of our country with a less proportion of unproductive lands than the great plains.

6. The plains differ greatly from the alkali deserts of the great basin between the Rocky and Sierra Nevada Mountains; but even the latter are found to be unexpectedly productive in many places.

7. The extension of settlements over the plains is only a matter of time, and of necessity. As fast as needed for homes of increasing population, and to supply food, they will be brought into use. R. S. ELLIOTT.

St. Louis, Mo.

The Opinion of a Veteran Inventor.

MESSRS. EDITORS:—I am in receipt of my patent for sewing machine. It is but just that I bear testimony to your uniform promptness and thoroughness in all your extended transactions with me.

Some seven or eight patents have been secured for me by your agency, including all my knitting machine patents, and in every case you have given most perfect satisfaction. I shall continue, as in the past, to recommend your agency to all inventors. ISAAC W. LAMB.

Novi, Mich.

THE recently published statements of statistics for the year ending June 30, 1870, exhibit $408,000,000 as the amount of our exports. Cotton furnishes more than half this amount, and tobacco a sum of about $21,000,000.

Improvement in Car Brakes.

Perhaps no one field of mechanical invention has attracted greater attention than that of car brakes. The safety of human life, depending as it does upon the perfection of the car brake, renders this problem one of great importance. The promise of profit which successful invention in this field offers, has also been powerful in attracting to it the first inventive talent of the age. That so many devices have proved worthless does not seem to deter inventors from further attempts, and every year produces a greater or less number of inventions designed to approach that ultimatum of perfection in car brakes which is the ideal of every inventor.

Our engravings illustrate a new device, which, as it may be combined with the ordinary hand-brake, is not open to an objection which lies against many inventions of this kind. It also is not open to the objection that it offers inconvenience in the making up of trains.

That it is simple, and can easily be applied to the present style of brake, is apparent.

Through its use great power can be brought to bear upon every wheel in the train, dead-locking them, it is claimed, if desired, in a single revolution. It can be worked with ease and certainty, the power coming directly from the speed of the train, so that it is really self-acting, each car being acted upon alike, thus obviating the unpleasant jamming together of cars; and finally, that it is entirely under the control of the engineer, who can brake as light or as heavily as he wishes, and can check the speed of the train in the time it takes now to signal the brakemen.

Fig. 1

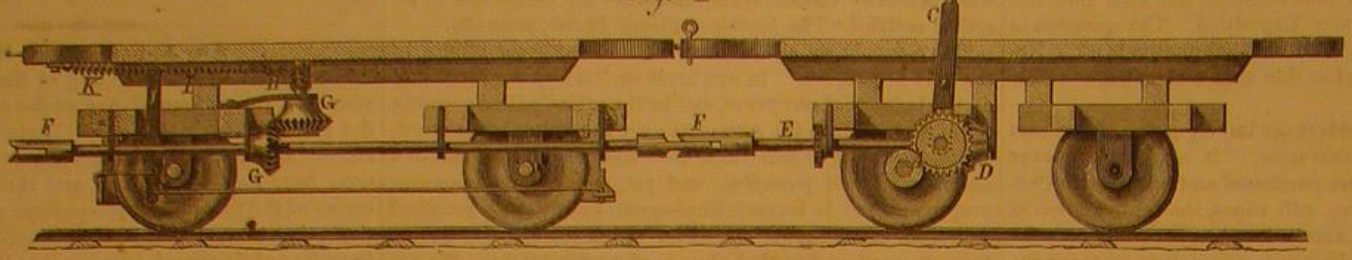
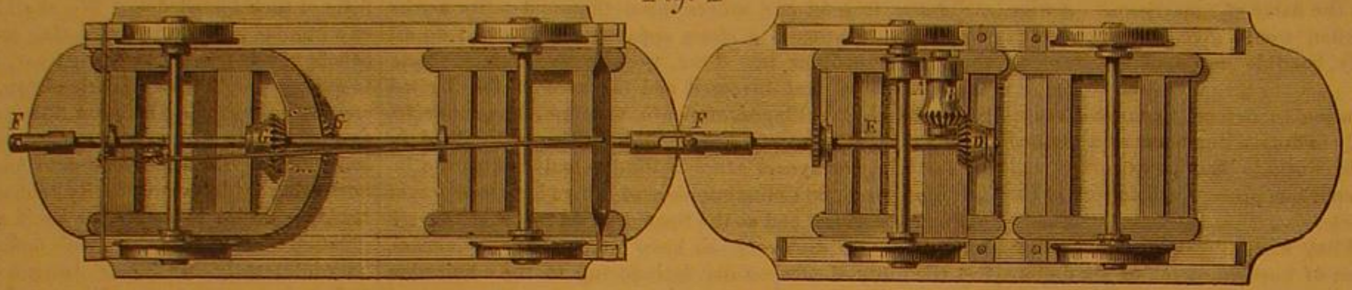


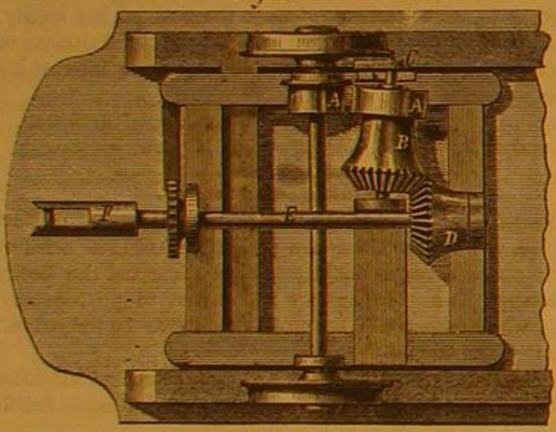
Fig. 2



FOSTER'S IMPROVED CAR BRAKE.

The operation of the brake will be readily understood by reference to the engravings. Fig. 1 is a side elevation and partial section. Fig. 2 is a bottom view, and Fig. 3, a detail showing more plainly the operation of the friction gearing, A.

Fig. 3



This friction gearing consists of a friction wheel keyed to the axle of the truck-wheels, and another keyed to the axle of the bevel wheel, B. The short axle of the bevel wheel has its inner journal either loosely fitted in a bearing attached to the truck frame, or it may have instead a spherical bearing, to allow the opposite end which rests in a bearing at the bottom of the pivoted lever, C, to swing laterally, so as to bring the friction wheels, A, into contact or to separate them according as the lever, C, is moved one way or the other.

The friction wheels being thus brought together, the bevel wheel, B, revolves the pinion, D, which is keyed to the shaft, E. Each car is provided with one of these shafts connected with the shafts of the cars next to it by universal joints, F.

All the cars, except the one on which the lever is placed—which, in ordinary cases, would be the tender of the locomotive—are provided with bevel gears, G, one of which is keyed to the shaft above described. Its fellow revolving on a vertical axis, as shown, winds up the chain, H, which chain is connected by the spring, I, to the brake lever, J, the latter operating the brakes through a system of rods or links in the usual manner. This action takes place whenever the friction wheels, A, are brought in contact with each other while the train is in motion, the spring, K, drawing back the brake-lever, J, and releasing the brakes as soon as the friction wheels, A, are separated by the action of the lever, C, which lever is under the control of the engineer.

Patented February 1, 1870, by W. G. Foster. For further information, or for the purchase of a portion or the whole of the patent, address the patentee at Dansville, N. Y.

How to Make Coffee.

A correspondent traveling in Sweden was immensely delighted with the coffee served on the steamboats and in the hotels. "At Upsala," he writes, "we determined to find out just how they made such perfect coffee as we had just drank, and stepped into the neat kitchen of the little hotel; and this was the report: Take any kind of coffee-pot or urn, and suspend a bag made of felt or heavy flannel, so long that it reaches the bottom, bound on a wire just fitting the top; put in the fresh-ground pure coffee, and pour on freshly boiled water. The fluid filters through the bag, and may be used at once; needs no settling, and retains all its aroma. The advantage of this over the ordinary filter is its economy, as the coffee stands and soaks out its strength, instead of merely letting the water pass through it. 'Do you boil it?' inquired the learner. 'Na-a-a-a-y,' said the maid, in simple astonishment that any one should be so wasteful as to send away the precious aroma in steam; should rob that prince of food of that evanescent something which constitutes his nobility, and reduce him to mere aliment. As soon would one think of throwing away that drop of sunshine, charged with all the summer's gold, which lies at the throat of a bottle of Johannisberger."

Combined Section Roller and Marker.

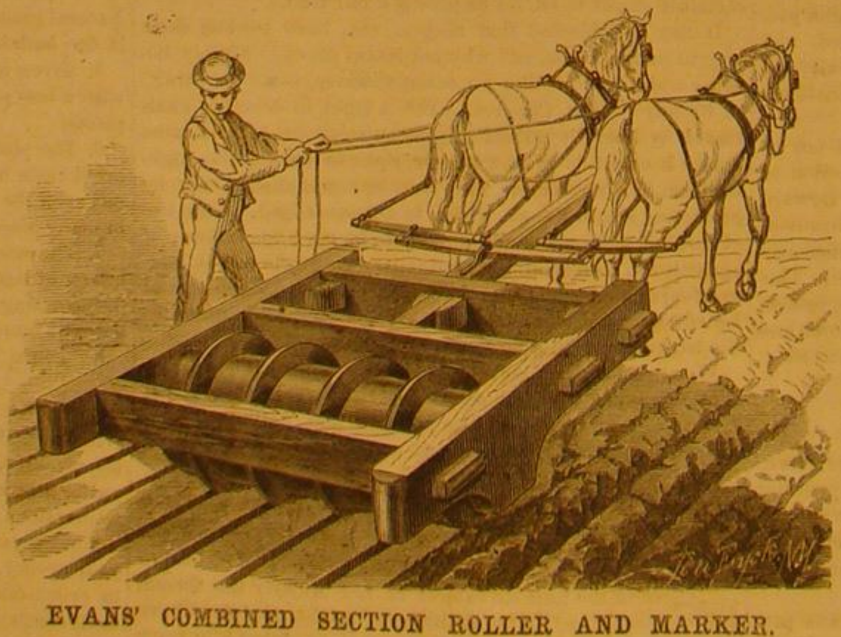
The object of this invention is to provide a farm implement, by the use of which land may be prepared for irrigation more rapidly and perfectly, so that the water may be more uniformly and effectively distributed than heretofore.

The implement is designed for, and specially adapted to, use in lands lying along the eastern slope of the Rocky Mountains. the Cordilleras in Colorado and New Mexico, and lands similarly situated, which require irrigation nearly every season.

The device consists of sectional rollers with section markers interposed, as shown in the annexed engraving. The markers project beyond the section rollers, having cuneiform edges, which, when the machine is drawn over the ground, are pressed into the soil, imprinting thereon well-defined drills or channels for the flow of the water in the subsequent irrigation.

The distance between adjacent channels may be varied by using longer or shorter rollers.

The land, in the regions of country referred to, is slightly inclined. By making the channels so that they lie parallel to each other—as is done by this machine—and inclining with the slope of the land, the water, when introduced at the upper end of the channels from a canal or small trench, may be made to flow uniformly over the field, all parts of which will be thoroughly irrigated.



EVANS' COMBINED SECTION ROLLER AND MARKER.

The rollers and markers move independently on their common axis, which renders turning at the ends of the channels easy, and, if desired, the markers may be taken out, and the implement can then be used for all purposes to which the ordinary farm roller is applied.

Patented September 14, 1869, by Elihu Evans, of Denver City, Colorado Territory, through the Scientific American Patent Agency. Address as above for further information.

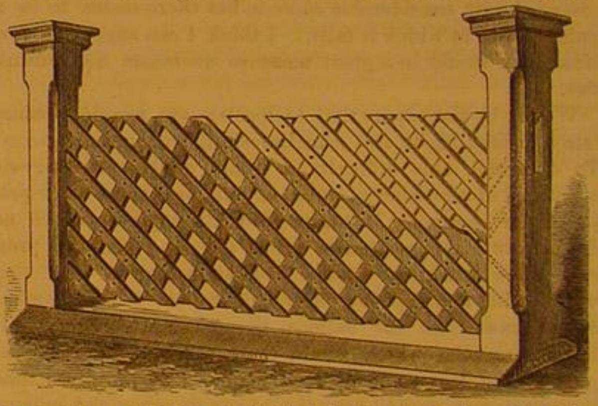
Most Delicate Color Test for the Detection of Strychnia.

Mr. W. T. Wenzell, after referring at some length to the great variation of the precise limit of the sensibility of the color tests usually applied for the detection of strychnia, and also discussing the best form of using and manner of applying these tests, says: "In testing for minute portions of the alkaloid, it is a desideratum to use a reagent the proportionate relations and superior sensitiveness of which will admit of the successful demonstration of traces of the poison. In experimenting towards that end, I have found that a solution of one grain of permanganate of potassa in 2,000 grms. of sulphuric acid, is, *par excellence*, the test for that purpose."

The author gives, further, a lengthy account of a series of experiments, instituted with various reagents, for the purpose of testing the delicacy of each of these for the detection of strychnia, the result being that the limit of positive recognition, by the bichromate of potassa and sulphuric acid test, may be placed at 1-100,000th, that of the chromic acid test at 1-600,000th, and that of the permanganate at 1-900,000th. As regards the use of the permanganate, the author distinctly states that the honor of its discovery belongs to Dr. Wm. A. Guy, of London.

IMPROVED GATE.

Swinging gates are not only liable to sag on their hinges, and render them difficult to latch and unlatch, but they are also often impeded by snow. The gate shown in the accompanying engraving is constructed on the lazy tongs principle,



and opening endwise on pivoted bars attached to the gate-post, is not interfered with by sagging, or by accumulations of snow. It is the invention of J. R. Breese, of Middletown N. Y.

Why Lace is Costly.

Many people wonder why what is termed real lace—as lace made by hand is called, to distinguish it from that made by machine, which is called imitation—is so costly. The following paragraphs from a foreign exchange explain the reason:

The manufacture of lace is carried to its highest perfection in Belgium. The finest specimen of Brussels lace is so complicated as to require the labor of seven persons on one piece, and each operative is employed at distinct features of the work. The thread used is of exquisite fineness, which is spun in dark underground rooms, where it is sufficiently moist to prevent the thread from separating.

It is so delicate as scarcely to be seen, and the room is so arranged that all the light shall fall upon the work. It is such material that renders the genuine Brussels so costly. On a piece of Valenciennes not two inches wide, from two to three hundred bobbins are sometimes used, and for the larger width as many as eight hundred on the same pillow. The most valuable Valenciennes is determined by the number of times the bobbins have been twisted in making the ground; the more frequent the twists the clearer and more beautiful will be the lace. Belgium annually sells off this lace alone to the value of over $4,000,000. Chantilly lace is always black, and is chiefly used for veils and flounces. It is very fine, and extensively worn. Mechlin lace is made at Mechlin, Antwerp, and other localities.

PHILADELPHIA consumes 2,000,000 tuns of coal annually, and the demand constantly increases.

Scientific American,

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Contents:

(Illustrated articles are marked with an asterisk.)

NARROW AND WIDE GAGES.

This subject, which in its scientific bearings belongs exclusively to the domain of railroad engineering, has still some points of general interest, and the purpose of the present writing is to place in review such bearings of the question as are important to the public at large. The railroad interest now exerts a very wide influence upon all branches of industry, both directly and indirectly, and the discussions which have been in progress for some time past, in journals specially devoted to railroading, have shown that the question of narrow gages as opposed to wide gages is one of fundamental import.

We have in this country a conspicuous example of a wide gage railway—the Erie. The fact that this road has never been a paying investment to its stockholders cannot, under existing circumstances, fairly be saddled upon its wide gage. Its notorious mismanagement has never permitted it to be a fair experiment in so far as it relates to the "battle of the gages."

So far as the comfort of the traveling public is concerned, there can be no question as to the superiority of the wide gage. The question narrows down to one of economy to the owners and lessees of roads, and if narrow gages shall be decided to pay best, the public will have to put up with them.

Which, then, will pay best under general and ordinary circumstances? The trials of extremely narrow gages have all been made under exceptional conditions. The success of such experiments cannot, therefore, be conclusive in deciding the question. The extra wide gages have also been tried under exceptional conditions. It is clear therefore that the decision of this question must be based upon general principles rather than on the results of experiments.

Now in examining into the elements of cost and expense which enter into and attend the working of railways we find so many of them depending upon the fundamental one of gage that it has been even maintained that the decrease in these items is nearly in proportion to the narrowing of the gage; but a closer examination shows this to be a very erroneous conclusion. The right of way costs nearly as much for a narrow gage road as for a wide one. The expenses of survey, grading, ties, and construction would not be reduced one half; nor anything approaching it, by reducing the grade one half, and between the three feet six inch gage and the two feet six inch gage, *Engineering* has shown that the difference in cost of construction is only £104 per mile in England. The difference in cost of construction between the gages is therefore seen to be utterly out of proportion to the difference in carrying capacity. In the comparison of current expenses with carrying capacity, or more properly speaking, with the earnings of a road supposed to be worked to its full capacity, we find a similar disproportion in favor of the wide gage.

If, however, a narrow gage be ample to do the carrying trade of the section through which it runs, the interest on the difference in first cost and in current expenses will be saved to its owners, and it is therefore more economical for that particular route. The construction of two narrow gage railways to do the work of one wide gage road would be, however, absurd in the extreme as a measure of economy.

The whole matter appears to us to lie in a nutshell. The gage of a road should be adjusted within practicable limits to the estimated traffic, so far as is consistent with the necessities of running upon other roads the gages of which are already established. We do not believe any standard width can be selected that will be found adapted to produce maximum economy in all roads alike; and so, though the gage is a fundamental element in the question of economy, it must always be considered in relation to the attendant circumstances under which the road must be constructed and operated.

HINTS TO MECHANICS.

Civility costs nothing, but is worth a great deal. We sometimes meet with persons who are either unaware of this aphorism, or put very little value upon it. Mechanics have it in their power to make themselves very disagreeable to their employers, and they may rest assured that no departure from the established rules of politeness, on their part, can be made with impunity. Many good contracts have been forfeited, and profitable jobs lost, by derelictions of this character. We are led to make some remarks on this topic, on account of occasional complaints of correspondents, who assert that manners have changed as well as moons, and that certain good customs have strangely gone out of fashion. They assert that mechanics come to their houses to do odd jobs, and sometimes by their behavior frighten the ladies and insult the servants, and thus do discredit to their occupations. They go thundering through a private residence as if it were a barrack; they never take off their hats; they neglect to clean their boots; they dirty up the floor or coal scuttle with their tobacco juice; they litter up the whole place with their tools, and make themselves so disagreeable that they are certain never to have a second job from the same person.

We are aware that our correspondents put the case pretty strongly, and do not believe that any of the enlightened readers of the SCIENTIFIC AMERICAN are ever guilty of such misdemeanors; but as they may some of them be acquainted with mechanics upon whom the coat will fit, they would do well to give such persons a hint that they make nothing by rudeness, but, on the contrary, risk the loss of their situations and of their support. It is just as easy to take off one's hat in the presence of the ladies of the household as it is to rudely keep it on. Tobacco chewing is a dirty habit, under any circumstances; but if a mechanic, in an evil moment, have acquired the appetite for tobacco, let him practice a little self-denial and leave his quid at home. It is a great feather in the cap of a mechanic to establish such a good reputation that the family will be particular to say, when they leave an order at the shop, "Please send the same young man who did the last job, he was so neat and civil!" The employer is much more apt to keep such a hand than he would be if an opposite request were to be made.

Some correspondents also complain that in repairing a piece of work the mechanic occasionally does more harm than good. He brings with him an ignorant, boorish apprentice, and the patching and mending is so bunglingly made that it has to be taken out and done over again, often at no inconsiderable expense. Now this is simple dishonesty. It is stealing the money of the person who has the job done, and is hardly less reprehensible than it would be to take money out of the till. No person ever has more than one job of this character, so that he is sure to lose in the long run more than he can gain by a little temporary dishonesty.

It is sometimes asserted that there are no longer apprentices, but that even the beginner claims to be a journeyman workman before he is out of his teens. This may account for the bad work that is sometimes charged to the account of the mechanic, when, in fact, it is due to the bungling of persons who claim to be what they are not. "There is cheating in all trades but ours," which accounts for false representations on the part of a few mechanics, who would be condemned by their mates if they could be found out. We recommend the example of George Washington as worthy of imitation, who, when he took off his hat to a negro who saluted him on the street, on being asked why he did so, replied, "You would not have me outdone in politeness by a negro!"—and the honesty of the father of his country is quite as worthy of imitation as his politeness.

We therefore repeat: Civility costs nothing, but is worth a great deal, and honesty is notoriously the best policy.

THE CONVEYANCE OF VARIOUS FLUIDS THROUGH PIPES.

For a long time pipes have been employed to distribute water and gas to dwellers in cities and villages, steam from boilers to engines, and smoke from stoves to chimneys; and their use for these common purposes has become so familiar that people in general have almost come to consider them as about the only legitimate uses to which pipes could, to any great extent, be put. We are, however, beginning to learn that they are capable of other applications. The Mont Cenis and the Hoosac tunnels, and the use of the caisson in bridge building have shown that pipes can be used for transmitting power to great advantage under certain circumstances, where it is desirable to place machinery at long distances from prime motors. It is demonstrated that compressed air may be passed through tubes, and employed to drive engines miles away from the primary compressing power without the loss from friction which the hitherto accepted formulæ led engineers to expect; not that the results obtained are necessarily irreconcilable with the accepted formulæ, but they show that there is yet something to learn practically in regard to the transmission of air through tubes.

We are in receipt of a statement of experiments made by Mr. Horace H. Day, of Passaic, N. J., in compressing air and transmitting it through tubes for the purpose of driving machinery, the statement being an account of observations of these experiments, made by Mr. Wm. S. Henson, Mechanical and Consulting Engineer, of Newark, N. J.

The length of the tubes (of which there were two) was one mile each. The pipes were of lead, one and one-quarter inches in diameter. Both pipes ran over very uneven ground, and were full of crooks, bends, and angles in each case conforming to the profile of the ground, their extremities being brought together so as to form circuits.

Each pipe had an air compressor and receiver, the compressors being horizontal cylinders five inches in diameter provided with suitable valves, and pistons driven by cranks and pulleys. Each receiver was made of boiler iron, strongly riveted, and was thirty feet long and sixteen inches in diameter.

The compressed air was employed to drive a vertical cut-off engine of A. K. Ryder's patent, illustrated and described on page 363, Vol. XXII., of the SCIENTIFIC AMERICAN. The cylinder of this engine was 8″×10″. The pipes were so arranged that either could be used separately, or both simultaneously; or the air could be transmitted throughout the entire length of both combined.

Mr. Henson states that "the theoretical power required to drive one of these compressors 100 revolutions per minute, when compressing to 75 pounds above the atmosphere, or six atmospheres altogether, is estimated at 5·87-horse power, plus the friction. This calculation is based on the well-known law of Mariotte; namely, that with equal temperatures the pressure is inversely as the volume, as although there is generally a considerable increase of temperature in the act of compressing air, yet with good compressors this heat can be so nearly all absorbed that Mariotte's law will practically hold true."

From the results of preliminary experiments, made by order of the Italian Government previous to the commencement of the Mont Cenis Tunnel, the following laws governing the resistance to the passage of air through tubes were established:

1. The resistance is directly as the length of the tube.
2. It is directly as the square of the velocity of the flow.
3. It is inversely as the diameter of the tube.

The experiments of Mr. Day give results coinciding with the two first laws, and seem to show, that in the practical transmission of, and the application of the power of compressed air through long pipes, the loss per cent of the whole power resulting from friction in transmitting a given *weight* of air diminishes inversely in a geometrical progression, having 2 as its ratio, for every increase of ten pounds in the pressure.

We append the following table of results. The water power employed to drive the compressor was regulated to deliver the same weight of air at each experiment, and the velocities were calculated from the volumes due to the pressures, according to Mariotte's law. The pressures were determined by approved steam pressure gages, placed at the ends of each circuit mile section of pipe, these ends being brought together in the same room so that the gages could be readily compared. The second table was obtained from the first by calculation.

FIRST TABLE.

No. of strokes of compressor per minute.	First gage. Pressure in pounds.	Second gage. Pressure in pounds.	Velocity at beginning of pipe in feet per second.	Velocity at end of pipe in feet per second.	Mean velocity per second.	Loss from friction in pounds.	Loss per cent. of the whole power delivered by compressor.	Percentage of loss calculated from last column.
120	22	10	21	32	26	12	51·50	54·30
120	28	20	18·06	22·6	20·6	8	28·57	27·25
120	35·25	30	16	17·8	16·9	5·25	14·89	13·67
120	43·25	40	13·66	14·33	13·99	3·25	7·31	6·83
120	51·75	50	13	12·26	13·13	1·75	3·38	3·41

SECOND TABLE.

	61·03	60		10·66		1·03		1·70
	79·396	70		9·38		·396		·852
	80·341	80		8·46		·341		·426
	80·192	90		7·62		·192		·213
	100·000	100		6·93		100		·106

These results show that, in transmitting air through long pipes, the greater the pressure under which it is transmitted the less will be the loss from friction, the latter becoming so much reduced at high pressures that great economy of power is secured.

Mr. Day now proposes to transmit through a large pipe five thousand-horse power from Niagara Falls to the city of Buffalo, the experiments under consideration having been made to test the feasibility of the project.

Another use for pipes was proposed by Mr. Silber in a paper read before the Society of Arts in London at a recent meeting; namely, the distribution of illuminating oils through towns, factories, public and private buildings, as water is now distributed.

In this system the flow is regulated by little cisterns provided with a novel and well-constructed tap, regulated by a ball-cock or self-acting float, the lights being as nearly as possible on a level with the distributing cisterns. When the lamp is lighted, the oil is, by the ball-cock movement supplied automatically as fast to the wick as it is consumed, and a very perfect combustion is effected. During the evening practical experiments were made with lights supplied in the manner described, and there seemed a general concurrence in the opinions of those present, that the system was a great improvement on the present method of burning the light petroleum oils. It is said that this system also entirely obviates the unpleasant odor of portable lamps, but we hardly see how this can be possible.

Still another use for pipes has been found by our enterprising friend, Mr. Robert Rennie, of the Lodi Chemical Works, Lodi, N. J. This gentleman is about erecting a mammoth acid and alkali manufactory at Titusville, Pa. We understand it is his intention to supply, through leaden conduits, acid and alkali, to all the oil refineries now in operation at Titusville, or which may hereafter be erected there; thus saving the loss, labor, and expense attending the transportation of those substances in the ordinary way. A description of this establishment will be found in another column of this issue.

INTERNATIONAL INDUSTRIAL COMPETITION.

In a paper read before the American Social Science Association at its general meeting in Philadelphia, October 27, 1870, Mr. Joseph Wharton discussed the above subject. The paper has now been issued in pamphlet form by Henry Carey Baird, and has found its way to our table for notice. We propose in the present article to briefly review this essay, which is far above the average character of the harangues usually delivered at the meetings of so called Social Science Associations.

Mr. Wharton starts out with the fundamental proposition that all trade is in its character essentially antagonistic. Nations are regarded by him as "competing organisms," which is undoubtedly the correct view. When the interests of nations cease to conflict, and the interests of all become common, the plural of the word nation will be superfluous except in historical records; there will be but one nation, which will comprise the entire human race.

Much, remarks Mr. Wharton, is said, upon the one hand, of the higher wages which the protective system affords to the producer; and, upon the other hand, much concerning the cheaper goods offered to the consumer by unshackled commerce; but if either the free trader or the protectionist could prove to demonstration that his policy insured to either class a large allotment of personal comforts during the current year, with a larger surplus at its end, than under the opposite policy it could enjoy, the question as to which course is most expedient for the state would still not be exhausted. The statesman must look beyond individuals or classes, and beyond the immediate present; not content with noticing that certain parts of the body politic are properly nourished, he must see that the body as a whole possesses vigor and symmetry; that development and robustness attend upon nutrition; that the whole organism enjoys fair play and good guidance in its strife with similar artificial bodies, and above all, that its present course is leading on to future health and power.

The advocates of unrestricted commerce, are, in Mr. Wharton's opinion, prone "to disregard the existence of nations" and "to look upon men merely as individuals." The "Manchester school of political economists persistently entreats mankind to regulate their commercial affairs upon the assumption that the entire race is but a band of brothers," ignoring the fact that since the race is grouped into nationalities, the interest of each group demands that it should produce that which it can best produce, and, if possible, render itself independent of commerce with other groups. And here the pertinent question is asked: Would universal and unrestricted trading and division of labor among the nations be founded upon the deepest instincts and interests of our race, or are they so contravened by ineradicable human characteristics as to be merely sentimental and illusory?

Sentimental and illusory they are most undoubtedly. And beautiful as appears the time in the distant future when "there shall be neither wars nor rumors of wars," when all men shall be banded together in one common brotherhood, if that period shall ever bless the world, it will be when a state of things,very different from that existing at present, prevails.

If then this grouping into nations be considered as permissible, and as a necessary consequence of the present character of the race, such nations must also of necessity constantly struggle for commercial independence. Good policy will dictate that governments should seek to encourage and foster, by all authorized means, home production, and to develop national resources.

On this point it is remarked that a broad distinction is, however, presently apparent between large and small nations as to the degree of completeness and independence attainable, and among the smaller nations, between those which are contentedly small, and those which have the intention of becoming large. The small nation, such as Switzerland or Denmark, which has but a slight range of habitable climate, and consequently slight range of organic products; from whose territory nature has withheld many of the minerals that, like coal and salt, are themselves indispensable, or, like the metallic ores, yield indispensable substances; and which is surrounded by nations so great and powerful that expansion is not to be thought of—such nations may perforce be obliged to content themselves with an imperfect development, and with perpetual reliance upon foreigners for very many of the necessaries of life. It may at last be true, as was said by Gortschakoff, that "Russia and America are the only nations whose grand internal life is sufficient for them," but if these two really great nations stand in such lofty isolation, the less excuse has either of them for relying upon the mercenary and precarious support of a competitor.

We cannot however extend this review to a length which would do justice to all the points made in the able paper of Mr. Wharton. Its general drift is that trade between nations is in the aggregate exhaustive, and should be as limited as possible, while each nation should as much as possible become self-centered and reliant upon its own resources.

In other words, transportation adds to the cost of every article transported, increases the burden of living to all, and is hence to be avoided as much as the natural resources of a nation will admit. Now without denying the truth of much that is urged in this pamphlet, we think too great stress is and has been laid by the advocates of protection upon the advantages of limited trade with foreign countries. There is in this, no doubt, as in all other things, a golden mean, to go above or below which is to affect disastrously the interests of the country at large. There is no doubt this country has suffered and is still suffering from excessive importation, but, if we understand Mr. Wharton aright, he would deal a death blow to commerce and trade.

These are views of an extremist, and though they are con fessedly strongly backed by argument, yet we fail to be convinced that commerce is *per se* "piracy," or anything approaching it. On the contrary, we believe a healthy commerce will greatly benefit any nation who can cultivate and sustain it. While we advocate a protective policy our views are moderate. Nothing prohibitive enters into our views of a proper tariff, which should in its operation only so far regulate trade as to enable our labor to compete at good wages with cheap foreign labor.

But we are digressing into a discussion which is foreign to our present purpose, and will close by recommending both the advocates of free trade and protection to read the pamphlet in question, as it certainly contains much worthy of careful consideration.

NAPHTHALINE AND ITS USES.

On page 40, Vol. XXIII, we gave a short account of this interesting compound, and predicted for it many useful applications. Since that time, although six months have barely elapsed, we observe that our predictions have been fulfilled in a very remarkable manner; and this substance that very few persons have ever seen, and that manufacturers of coal-tar products were in the habit of neglecting, has now obtained the front rank of important chemical preparations. It may be well, therefore, to give the present state of our knowledge of the subject.

Naphthaline has been known since 1820, in which year it was discovered by Garden. It is produced by the dry distillation of a large number of organic bodies, such as bituminous coal, fatty oils, resins, and animal substances; also, when the vapors of acetic acid, alcohol, ether, volatile oils, camphor, paraffine, carbolic acid, olefiant gas, marsh gas, hydrocarbon gases generally, mixtures of benzole, sulphuretted hydrogen, bisulphide of carbon and hydrogen, and chloride of carbon, etc., are transmitted slowly through red-hot tubes.

In the process of gas manufacture it sometimes clogs the pipes in consequence of this decomposing action of the red-hot retorts upon the gaseous products of distillation. It can be stated in general terms that naphthaline is the product of the decomposition of organic substances at a red heat in the same way that oxalic acid is derived from the oxidation of this class of bodies.

Messrs. Warren and Storer have detected naphthaline in specimens of petroleum from Burmah, but this is the only instance of its occurrence ready formed in nature; it appears to be always an artificial product.

The crude material for the manufacture of naphthaline is usually coal tar, but it is also to be met with in wood tar. The best method for its manufacture is the one proposed by Vohl. That portion of coal tar which solidifies in the cold is left six or eight days in a cool place, and the liquid portion is then decanted and drained off, and the cakes entirely freed from adhering oil by centrifugal filters, and finally by a hydraulic press. The mass is next melted by steam in a retort provided with a stirrer, treated with soda lye, and well mixed; the lye drawn off and added a second time, and finally the liquid naphthaline is rinsed and washed with hot water until there is no longer any reaction. In this way many impurities, such as carbolic acid, creosote, etc., are removed.

The still fluid material is intimately mixed with a few per cent sulphuric acid, well stirred, washed with hot water for the removal of the acid, and finally digested at 212° Fah. for two or three hours with strong soda lye, and allowed to settle.

The naphthaline mass thus obtained is distilled in cast-iron retorts of a capacity of 2,200 to 2,500 pounds. At first small portions of water go over mixed with naphthaline, but at 410° Fah. there is a continual stream of naphthaline, and in such quantity that 110 pounds of the pure material can be obtained in 20 minutes.

The condensation of the naphthaline vapor is produced by water at 176° Fah., and the closed receiver also stands in a water bath of the same temperature.

The naphthaline obtained in this way is poured into conical cylinders of glass, or moistened wood, in which it rapidly sets, and from which it can be readily removed, as it contracts on cooling, and separates from the walls of the mold. It is sold in commerce in the same form as brimstone, and has a pure white crystalline appearance.

Vohl also gives a method of testing a liquid to determine whether any naphthaline is present, which may be of value to refiners; a ready method for determining the amount of naphthaline, however, has not been published.

The qualitative test may be made made as follows: The liquid to be examined is treated with fuming nitric acid, the nitro product washed to remove the acid and then introduced into a boiling mixture of one part sulphide of potassium and one part caustic alkali; if naphthline be present be present, even in traces, the solution will exhibit a beautiful violet-blue color.

Napthalind forms white, flaky crystals, consisting of rhombic plates of peculiar odor and aromatic taste. Its specific gravity is variously stated at 1·04 to 1·15, and its melting point at 174° Fah.; it boils at 428° Fah. It is insoluble in cold water, slightly soluble in hot water, rapidly dissolved in warm alcohol, ether, benzole, and the volatile and fixed oils and hydrated acetic acid. The alkalies are fortunately without action upon it, otherwise they could not be employed in its purification.

Melted naphthline absorbs air copiously (the same is fused silver) and becomes richer in oxygen than the atmosphere, and gives it off on solidification. The solvent properties of naphthaline are considerable. It dissolves indigo, phosphorus, sulphur, the sulphides of arsenic, tin, antimony, etc., and separates them on cooling, usually in crystalline forms, also dissolves oxalic, succinic, and benzoic acids, iodine and iodide of mercury.

Chlorine, bromine, nitric acid, and concentrated sulphuric acid readily attack naphthaline, and it enters into composition with picric acid. Upon the lower forms of life the action of naphthaline appears to be analogous to camphor and carbolic acid, and it has been successfully employed as a remedy against moths. It is probable that it would keep meat from putrifying, and if its smell and bitter taste were not an objection it could be used as a flesh preserver. By combining it with wax, spermaceti, or stearine, so as to raise its melting point, it could probably be molded into candles and burnt without smoke. In its pure state it gives rise to copious clouds of lamp-black.

There is sometimes associated with naphthaline another body, to which the name of anthracene has been given—it usually goes over in the last stages of the distillation of coal tar. By treating naphthaline with alcohol the greater part of it is dissolved while the anthracene remains untouched, and can thus be separated.

The uses of anthracene have hitherto been too few to admit of its economical separation from the tar, but of late years hopes have been expressed that artificial colors could be made from it, and it is now proposed to save it for that purpose.

The number of colors made from naphthaline is nearly as great as that of the better known derivatives of aniline. It would extend our article too far to enter into full details of them, and we may recur to the subject hereafter. We can only mention a beautiful yellow, a fine brown, a variety of nitrogen and china colors, many of them much used and preferred to aniline pigments. There are manifestly other and important uses to which naphthaline and its compounds can be applied, and we shall probably some day become as familiar with it as we now are with paraffine.

RAILROAD LITIGATION.

If any oommentary were needed on the evils of an elective judiciary it would be found in the history of railroad litigation in the State of New York, in which courts of co-ordinate jurisdiction now stand arrayed against each other, on the one hand to protect stockholders in their rights, and on the other to protect those who seek by high-handed fraud to enrich themselves at the expense of honest men. Never before in the history of this country have the rights of property been so utterly disregarded as in these litigations.

In a single year the directors of the Erie Railroad have expended over three hundred thousand dollars in the defense of actions brought against them by aggrieved stockholders. By this enormous expenditure they have been enabled to retain the best legal talent throughout the State, and by the facility with which they have been enabled to obtain injunctions to defeat that justice, which, if properly administered, would long ago have brought upon them the humiliation and punishment their conduct has richly merited.

The legal agents of foreign stockholders sent to this country to watch these proceedings, and, if possible, to guard the interests of their clients, find themselves not only unable to obtain redress at the hands of the courts, but are publicly subjected to insult; while the organization of mobs, to seize and hold possession of property under pretense of legal authority, has been inaugurated as the readiest means to avoid delay in the furtherance of the nefarious purposes of unscrupulous men.

There is certainly something radically wrong in a system under which such a state of things can exist as renders the tenure of all property uncertain. Following the precedents furnished by the Erie litigations any unscrupulous scoundrel may, upon some trumped up complaint, obtain authority to interrupt honest business, and to seize and hold property of any kind. In short, a premium is offered to roguery, and honesty is browbeaten and bullied with impunity.

In such a state of things the wonder grows that men can be found willing to invest money in the stock of railroad corporations, where the big fish eat the little ones with as little compunction as a pickerel swallows minnows.

The recent upright and manly decisions of Judges Rosekrans and Brady avail nothing against the counter action of coordinate courts of infamous notoriety, the judges of which would, under the old system of appointments, long ago have been impeached and removed from the seats they have disgraced.

The condemnation of the course of the trustees, managers, and counsel of the Erie railroad administered by Judge Rosekranz is one which finds its echo in the heart of every honest and intelligent man in the country, yet from this scathing rebuke they march into another court, and unblushingly ask and are unblushingly granted what they knew they would get beforehand—a stay of proceedings. A *final* stay of the proceedings of this corrupt clique must come soon or late, and we hope it may not long be delayed.

NEW YORK PHOTOGRAPH GALLERIES.

According to the *Photographers' Friend*, the formulas and processes used in the best photographic galleries in this city are about as follows:

Cleaning the Glass.—Immerse for several hours in a strong solution of common washing soda, rinse, and rub with alcohol and Joseph paper. Kurz varies from this a little. After the soda bath, he puts the glass into a nitric acid and water, equal parts, for 2 hours. Then wash under tap, and rub with a sponge, rinse, and coat with filtered albumen (white of one egg to 24 ounces of water, well beaten).

Negative Bath.—Forty grains of silver to the ounce of water, iodize slightly with iodide of silver; slightly acidulate with nitric acid.

TO RESTORE THE BATH.—Add fresh silver if required. Boil down one half. Add as much water as necessary, filter, and it is ready for use.

COLLODION.—All use ether and alcohol, equal parts. Fredricks uses iodide of ammonium, $4\frac{1}{2}$ grains to the ounce; bromide of potassium, 2 grains; cotton, 6 to 7 grains, washed in ammonia. Gurney uses 5 grains iodide of ammonium, $1\frac{1}{2}$ grains bromide of cadmium, $1\frac{1}{4}$ grains bromide of ammonium. Sarony uses $4\frac{1}{2}$ grains iodide of ammonium, 2 grains bromide of potassium, 5 to 7 grains cotton. Iodize the ether and alcohol, then add cotton. Kurz uses iodide of ammonium, 4 grains; iodide of cadmium, 2 grains; bromide of potassium, 2 grains.

DEVELOPER.—One ounce protosulphate of iron to 1 quart of water, to which add only enough acetic acid to make it flow well.

FIXING THE NEGATIVE.—Use a saturated solution of hyposulphate of soda. In some of the galleries they add 1 ounce of cyanide of potassium to 4 quarts of the hypo solution.

SENSITIZING THE PAPER.—Fredericks uses 35 grains silver to the ounce of water; to each $\frac{1}{2}$ gallon add $\frac{1}{4}$ ounce muriatic acid; neutralize with liquid ammonia; filter to remove chloride, float 30 seconds, fume 10 minutes. Gurney uses 40 grains silver, slightly alkaline, or with 1 drop ammonia added; float 40 seconds, fume 10 minutes. Sarony uses 50 to 55 grains silver, slightly acidulated with nitric acid; float 1 minute, fume 15 minutes. Kurz uses 60 grains silver, slightly acidulated with nitric acid; float 1 to 2 minutes, fume 15 to 20 minutes.

TONING BATH.—To $\frac{1}{2}$ gallon water add $\frac{1}{4}$ ounce solution of common washing soda saturated, or enough to make it feel slippery to the fingers, then add a suitable quantity of chloride of gold.

FIXING BATH.—Water, $\frac{1}{2}$ gallon; hyposulphite of soda, 12 ounces.

THE PRESENT AND THE PAST.

I. INTRODUCTORY.

"To paint the Past, yet in the Past portray
Such shapes as seem dim prophets of to-day,"

is the task of the geologist as well as of the historian. The latter depicts the steps of man's intellectual advancement; the former, the gradual development of that part of creation which has brought this earth and its inhabitants to their present physical condition. Did we not find in the records of nature everywhere evidences of a design infinitely more foreseeing, and endowed with means to accomplish itself infinitely more powerful than are to be discovered in the highest efforts of the human race, we might indeed admit the claims of history upon our attention as superior to those of geology. As it is, however, the least we can claim is, that the latter science is essential to the completeness of human history, and to the liberal training of the human intellect. If the study of man be man, that study cannot be accomplished by one who is ignorant of the long chain of antecedent circumstances that have slowly and inevitably, because by law, placed man amidst the conditions in which he finds himself, and which control him to an extent that he but slightly realizes. History in the future must acknowledge this influence of the distant past; it will recognize how physical geography in its widest sense has influenced political boundaries, and how the advancement or retardation of races in civilization has been the certain results of geological causes.

A chain of geological events culminated in the Anglo-Saxon power, physical and moral in the Old World; a similar chain of geological events has laid down the path that the same power must follow in the New; and whatever the future destiny of this country, that destiny was part of the plan that laid the foundations of this continent in Eozoic seas; that built it up stratum by stratum; that enriched it now with metalliferous deposits, and now with stored-up fuel; that slowly raised mountains on it to give variety to its climate, and, atom by atom, denuded valleys on its surface to furnish rich soil to the agriculturist, and to mark out lines of travel for commerce.

History thus inspired will be very different from much that has hitherto been written. The same age that has swept from its pages the mythical legends of ancient Rome, and that has reconstructed by induction the dim outline of a lost Aryan race, has given us, by the same process of thought, differently applied, the restorations of Playfair and of Lyell and of Cuvier, filling up unoccupied spaces of the past, and has led us unexpectedly to altogether new interpretations of old and familiar words. Creation now no longer means but a single act of unstinted power, taking up time, it is true, but time to be measured by the units of the created, and reaching but the few years of his supposed existence. Geology gives us a far nobler reading—æons of the Creator figured by the days of man, and a creation that has been continuous and still endures, unfolding a design which is as undefinable in its origin as its ultimate object is utterly inconceivable. A science so young and yet promulgating ideas so sublime, and, at the same time, so subversive of those hitherto received may well have met with opposition from minds of the same caliber as those that persecuted Galileo; minds "of little faith," who regard geology as an intellectual snare of the evil one, and its professors as little better than atheists. This was to be expected, but it needs some inquiry to account for the general apathy that prevails amongst less prejudiced minds regarding the great and elevating truths that this science makes known; and still more to explain the persistent disregard of it, as a part of our general educational system, by those who, of all others, boast of being practical men. It is acknowledged to be essential in he education of a mining engineer; surely it should be a complementary portion of that of a civil engineer, and certainly the political economist, who has all his life to deal with questions regarding the raw products of various regions, ought to know something of that science which gives us an insight into the conditions to which these products are due. And should not every intelligent member of the community have some knowledge of such elements of political economy? Nevertheless it is safe to affirm that geology is a subject practically ignored by the mass of the community. Not merely is its economic importance overlooked, but the elevating influence on the human mind of the truths it enunciates is utterly unrealized. We may well ask why is this? We believe that it is because the popularization of geology has been in many instances conducted on a wrong basis either by well-meant but premature and crude attempts to reconcile its truths with a literal interpretation of the Sacred Writings, or by an investment of its facts with a web of impossible theories.

Popular interpretations of geology have often about as much relation to the true science as historical novels have to history. A few striking facts are strung together upon fictitious hypotheses. As romances such geological writings have not succeeded, because they necessarily want a human element to attract our sympathies; as histories they fail to gain credence, because in this practical age past events must not merely be stated to be believed, but they must also be accounted for, not by mythical causes, but by such controlling circumstances as bring about similar events in our own times.

It would seem that comparatively few geologists have grasped in its entirety the spirit in which Lyell's "Principles of Geology" was written. There is still a hankering after violent, sudden, and universal catastrophes and cataclysms. It was all very well for the first observers of fossil shells on mountain summits to believe them to have been sports of nature or relics of a universal deluge; they had then no inkling that causes still in operation were sufficient to account for such phenomena; but now that we have learned this truth we ought also to have learned the folly of calling in unknown agencies to explain away our own temporary ignorance. Fortunately geology is a very progressive science, and within the last few years many fresh facts have come to light, and many new ideas have been broached, in elucidation and support of what has been derisively termed the Uniformitarian system of geology, a system that simply claims that the laws which control matter have always been the same, uniform, and unceasing in their action. It teaches that the geological scheme has been perfectly designed, and that in it, therefore, there never has been any necessity for, or in fact any possibility of, its laws being temporarily suspended, and that consequently if we wish to understand past effects and events, we must read them by the causes we see in operation around us at present. Such a system as this has consistency in it, and gives a charm of reality to the science far more impressive to the reasoning mind than all the semi-miraculous agencies invoked by its opponents.

OBITUARY---HENRY BURDEN OF TROY, N. Y.

As we go to press we are in receipt of the news of the death of Henry Burden, inventor and mechanic, who was born at Dunblane, Scotland, April 20, 1791. His father was a farmer, and it was when a youth engaged on the farm that the son gave evidence of inventive genius, by making with his own hands labor-saving machinery from the roughest materials, and with but few tools and no models. The first marked success was in constructing a thrashing machine. He afterwards engaged in erecting grist mills and making various farm implements. During this period he attended the school of William Hawley, an accomplished arithmetician; and afterwards, having resolved to try his fortunes in America as a machinist and inventor, he went to Edinburgh and entered upon a course of studies, embracing mathematics, engineering, and drawing. Arriving in this country in 1819, he devoted himself to the improvement of agricultural implements. His first effort was in making an improved plow, which took the first premium at three county fairs. In 1820 he invented the first cultivator in the country. In 1825 he received a patent for his machine for making the wrought spike, and in 1835 for a machine for making horseshoes. In 1840 he patented a machine for making the hook-headed spike, an article which is used on every railroad in the United States. In the same year he patented a self-acting machine for reducing iron into blooms after puddling. In 1843 he patented an improvement in his horseshoe machinery. In 1849 he patented a self-acting machine for rolling iron into bars. In June, 1857, he patented a new machine for making horseshoes. This may be considered his greatest triumph in mechanics; it is self-acting, and produces from the iron bars sixty shoes per minute. He has obtained patents for this machine from every prominent government in Europe. Mr. Burden's suspension waterwheel is another of his inventions. In 1833 he built a steamboat 300 feet long, with paddle-wheels 30 feet in diameter; from its shape it was called the "segar boat." It was lost through the mismanagement of the pilot. In 1836 Mr. Burden warmly advocated the construction of a line of ocean steamers, of 18,000 tuns burden. In 1845, when the steamer *Great Britain* was crippled by breaking one of her screw blades, Mr. Burden went to England for the especial purpose of inducing her owners to adopt the side wheel, but was unsuccessful. Since that time to the time of his death Mr. Burden was one of the most extensive manufacturers in the United States, and amassed a large fortune.

As our readers are aware, the portrait of this eminent inventor and manufacturer forms one of the group in our prize engraving, "Men of Progress." As death removes, one by one, of these remarkable men, this collection of lifelike portraits will become more and more valuable.

Acid and Alkali Works at Titusville, Pa.

The arrangements for building chemical works at Titusville, have lately been completed, and as the magnitude of the scheme renders it one of natural importance, we feel sure that the following particulars will interest most of our readers:

It is intended to build, at a cost of a quarter of a million dollars, a manufactory of acids, alkalies and other chemicals. The works will cover three acres of ground, and the extent of the operations to be carried on may be judged from the fact that two of the chambers, for the production of sulphuric acid, measure each 216 feet × 48 × 56. Two hundred tuns of sheet lead will be used in the linings of these rooms. Seven tuns of sulphur will be used here daily. The concentrating room for reducing the volume of the acid till it reaches 66 gravity, is nearly as large as the others. A neutralizing alkali, to supply the place of caustic soda, will also be made here.

The credit of the enterprise is due to Mr. Robert Rennie, proprietor of the Lodi Chimical Works, N. J. Mr. Rennie intends to fix supply pipes for acid and alkali to all the oil refineries in the town, that both chemicals may be constantly on service: the fluids will be measured by accurate meters. In addition to the two large factories mentioned above, Mr. Rennie has a recently-erected establishment at Charleston, S. C.

The Titusville Works will probably commence running in May next, under the guidance of Mr. Rennie's chief chemist, Mr. Butterworth. When complete, the factory will furnish employment to a large number of hands, and will add to the manufacturing reputation of Pennsylvania. We wish Mr. Rennie every success.

The Scientific Goes Everywhere.

In a recent business letter from Moscow, a correspondent writes as follows:

"Believing it will interest you, we state the following facts; they, however, only prove the interest felt by all parties in your really useful journal, the SCIENTIFIC AMERICAN. In 1869, we had occasion to forward several small parcels by overland route to the Amoor, and to the borders of Chinese Tartary; such parcels we wrapped in numbers of the SCIENTIFIC AMERICAN, knowing full well that our clients would read every scrap of English in those out of the way parts. Having done this once or twice, we were rather surprised to receive instructions from one of the gentlemen to forward him weekly, by letter postage, two copies; and from one other client we are now in receipt of positive instructions to wrap all parcels in your sheets, one client paying for one copy (in Moscow). In 1868, we sent a parcel of small wares to a merchant (an Affghan) in Bokhara, enclosed in one or two advertisement sheets of the SCIENTIFIC AMERICAN. The merchant had the same translated (feeling an interest in one or two small wood cuts), and through that simple agency we have received several good orders for American goods. (Why are American goods altogether out of the Russian market? Shame!) Our country clients find the SCIENTIFIC AMERICAN so suited to their wants that we find it very difficult to keep our office copy. We consider that to be without the SCIENTIFIC AMERICAN would be a positive and serious loss, and this in the face of the leading English, French, and German scientific journals. Accept our thanks, and we shall be only too happy to assist you, if we can by any means do so."

Production of Coal-Tar Colors.

One hundred pounds of tar will yield, on the average, 3 pounds of commercial, or $1\frac{1}{2}$ pounds of refined benzole, from which 3 pounds of commercial nitro-benzole can be made; this in turn will yield $2\frac{1}{4}$ pounds rosaline, which will produce $3\frac{1}{2}$ pounds rosaniline red, from which $1\frac{1}{8}$ pounds fuchsine can be manufactured.

As it takes 100 pounds of coal, on the average, to produce 3 pounds of tar, there are necessary to the production of 2 pounds of pure fuchsine 6,000 pounds of coal. The entire gas manufactories of Europe consume annually 16,000,000,000 tuns of coal from which 5,300,000 pounds of fuchsin could be made—enough color to dye a brilliant red nearly every object on the face of the globe.

There does not appear to be any immediate danger of a dearth of aniline colors, but, on the contrary, the temptation to deck ourselves in gay colors is greater than ever before.

A Cheap Breakfast for Eight Persons.

"A good breakfast for eight persons for about a dime. Put half a pound of rice and half a pound of Scotch barley into one gallon of soft water; stew them gently for four hours. Then add four ounces of molasses and a little cinnamon; boil another half hour. This will produce eigh pounds of good food."

The above quotation, clipped from a journal ostensibly devoted to the promotion of health, is a fair sample of the teaching of many of these pseudo-medical publications. The entire amount of solid matter contained in this "mess" is twenty ounces, which gives each person of the eight two ounces of farinaceous food and one half an ounce of molasses for a breakfast. The writer of this recipe ought to be made to take three meals per diem of his "pap" for three weeks. If at the end of that time he should retain strength to write another, we will concede that six ounces of mixed rice and barley, and an ounce and one half of molasses are a liberal day's rations for an adult.

The New Commissioner of Patents.

The New Commissioner of Patents, Gen. Leggett, visited Washington on the 19th inst. He had an interview with Secretary Delano, and afterward, in company with the acting Commissioner, Gen. Duncan, and Chief Clerk Grinnell, visited all the rooms of the office. He expressed himself pleased with the condition and service of the office, and left a very favorable impression with the gentlemen now in the office. He will return shortly to Ohio, where he will be detained some time in closing up his private business. Meantime the administration of the office will continue, as at present, with Gen. Duncan, who has conducted its affairs with ability and general acceptance.

THE PRESENT AND THE PAST.—We this week commence the publication of an interesting series of popular articles on geology, under the above caption. These articles have been prepared especially for the SCIENTIFIC AMERICAN, by the author of the exceedingly popular, interesting, and useful illustrated articles on various insects, which appeared during the past year. Professor Day's happy style of treating the subjects upon which he occupies his pen, will render these articles interesting and attractive to both old and young. The first article is introductory in character, and we trust its perusal will induce our readers to follow the entire series with that attention which the importance of the subject demands.

THE Assay office, New York city, recently received a piece of gold ore, which, on trial, assayed nineteen and a half dollars of gold to the tun. It was from Nelson Ledge, Ohio, and the discovery created some agitation among the farmers and lumbermen of Portage and the adjacent counties.

Queries.

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

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

2.—HARDENING SHEET BRASS.—How can I harden sheet brass without hammering or rolling?—W. E. A.

3.—SPEED OF CIRCULAR SAW WITH MORTISED GEARING.—would be pleased to get the opinion of some of your readers as to whether I could run a circular saw 400 revolutions per minute with cog gear direct from the engine shaft by using a mortised gear on shaft and polished pinion on mandrel; engine portable.—E. O. T.

4.—PAINTING WHITEWASHED WALLS.—What is the best substance for filling the cracks of a whitewashed wall preparatory to painting it? Can such a wall be successfully painted to look well permanently, and if so, what is the best method?—H. P. T.

5.—STRAIGHTENING AND TEMPERING CIRCULAR SAW.—How may I temper and straighten a 30-inch circular saw gage 8 or 9 inches? It has been burnt and slightly warped.

6.—SOLDER FOR ZINC AND PLATINUM, AND IRON AND PLATINUM.—What kind of solder is necessary, and how should it be applied, in attaching the thin slip of platinum to the zinc in Grove's galvanic battery? Soft solder is inadmissible, as the lead therein alloys with, and eats, as it were, holes through the platinum. What solder will serve to unite iron and platinum?—J. Q.

7.—WOODEN TRAMWAYS.—Will some of the numerous readers of your valuable paper who have had experience please tell me what difficulties there are to be overcome in laying and running cars on a wooden tramway—no iron—say a narrow gage, thirty inches or so?—C. O. P.

8.—MARBLE SAWING.—There are many marble and hard stone sawyers (myself amongst the number) who are anxious to know the kind of sand which is best to use in sawing hard and brittle stone. Some old stone sawyers say large sand is best; others that sharp small sand cuts best. Please enlist the experience of your correspondents to give the desired information through your columns; and while they are about it, it would be very desirable for them to give a description of the best kind of stone saws suitable for sawing very hard stone; and other information respecting sawing slabs from hard stone blocks.—A. P.

9.—BORING PUMP LOGS.—Having formed the intention of trying to supersede iron pumps in a mine where the water destroys the metal, by wooden ones of the same size, say ten inches caliber, and having some difficulty in boring out the logs, I would like to get the best method of boring wood to the size of ten inches.—B. A.

10.—SMALL ELECTRICAL MACHINES.—Can any of your readers inform me if an electrical machine or a Leyden jar can be constructed so small as to be conveniently carried in the pocket, and yet exhibit the electrical spark about the size of a pin head? If so, I desire the directions for constructing such an apparatus.—J. T. P.

11.—LITHOGRAPHY.—Will some of your numerous correspondents give me information on the following points relative to the art of lithography? I wish to know the kind of ink used to transfer the acid, and its proper dilution for etching, the kind of pencil used in drawing upon the stone, how to use the gum, etc.—T. P.

[Our correspondent may find some information on these points in an article published on page 15, current volume.—EDS.

12.—OILING LOOSE PULLEYS.—What is the best plan for oiling loose pulleys running at high speed?

13.—I wish a remedy to cure the itching and inflammation caused from frost bites on the feet.—S. F. C.

We will let the following correspondent speak for himself, and leave generous readers to give him the desired information:—I was serving our common country at Malvern Hill, Va., July, 1862, when I received an injury to my spine and hips which has confined me to my bed all the time in a sitting position night and day, causing me constant pains, at times severe. I use my hands and brains to make different kinds of fancy work in wood, ivory, beads, shells, etc. I have a most precious wife, who at every chance she gets, helps me about my work. Fret sawing by hand is what she does the most of. This leads me to my first question. Do you know of any foot power portable gig or fret saw, and its cost? Again, do you know of any power besides our feet to run a small saw or sewing machine suitable to use in any dwelling house or chamber? If a saw frame or a sewing machine were arranged before me on the bed near enough, I could use it. The work is now done by my dear wife by means of a little hand fret saw. It is only fine work; the stuff only one eighth of an inch thick. A good fret saw machine ought to saw three or four inches thick to as fine a pattern as could be done by hand.—FRANK L. KEYES 12 Tahanto street, Concord, N. H.

Business and Personal.

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

Answers to Correspondents.

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

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

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

RENDERING BRICK FLOORS IMPERVIOUS TO MOISTURE.—In answer to J. M. K.'s query, I would advise him to have the cement removed, be it under the brick or on the same (which he does not state); and use a one-inch layer of good asphalt instead. The asphalt should be used as a bed for the brick or tile, and the outside bricks, along the walls of the rooms which are to be floored, must also have a coat of asphalt between them and said walls. If the asphalt be used as a covering coat only of flooring, the bricks under it will, nevertheless, attract moisture from the soil, rot in time, and, in consequence of their crumbling, the asphalt cover will also go to pieces, as its support is yielding. In point of expense, asphalt is indeed more costly than cement, but it will amply repay the outlay by its durability and perfect dryness. I have seen it used in a building where moisture ran up the walls to the third story, thus making the dwelling almost uninhabitable; in that case one row of brick was cut out throughout the building, at the hight of two feet above ground and a layer of asphalt inserted therein. A short time afterwards the house became perfectly dry and has remained so ever since.—C. M.

STEAM PUMP FOR HIGH PRESSURE ENGINE.—I herewith give you my plan for P. D. to fix his pump so as to give a variable supply of water to the boiler, which I think will be cheaper than his, and just as good. Let him connect his delivery (to boiler) pipe with the suction pipe, by a pipe of nearly the same capacity, midway on which, he should place a "relief valve," loaded with weight or spring just above his boiler pressure. Then he should fit his check valve at the boiler with a screw stem and hand wheel, which he can set to admit any quantity of water, large or small, and his weighted relief valve will work in proportion and automatically. The pipe with the weighted valve on it can be passed overboard if not convenient to get at the suction. Or, if his pump be double acting he can connect each end with a small pipe, and a simple globe valve in the middle, which can be opened or shut to vary the boiler supply. I give this for what it is worth, and as a form of pump I have seen and used a good deal. He may object to the first on account of working his pump all the time full capacity. But I think that is the way to work a pump that supplies a boiler.—M. H. K.

WIRE OF SOLDER.—I have made wire of solder for my own use for many years by the following simple process. Take a sheet of stiff writing or drawing paper, and roll it in a conical form, exactly like the cornucopias sold by confectioners, but broader in proportion to its length. Make a ring of stiff wire to hold it in, attaching a suitable handle to the ring. The point of the cone may be cut off to leave an orifice of the proper dimensions. When filled with molten solder, it is held just above the surface of a pail of cold water, the stream of solder flowing from it will congeal in the shape of a wire. If held a little higher, so that the stream breaks into drops before striking the water, it will form elongated "tears" of metal. By holding it still higher, each drop forms a thin concave cup or shell. As each of these forms has its peculiar use in my business, I found this simple instrument invaluable. A few experiments will convince any one that he can prepare solder in any convenient form by the aid of a sheet of paper and a bucket of cold water.—C. E. T.

SPEED OF MILLSTONES.—In answer to query No. 13, in the SCIENTIFIC AMERICAN of January 7th, I would say: Use a 36-inch burr. After thirty years' experience I have found nothing to equal a French burr. Let your correspondent buy an under runner; drive with belt, and have the pulley on the mill spindle as large as the mill burr. Let him run the skirt of the burr 2,700 feet per minute, and he will be surprised at the amount of work it will do.—C. C. E.

CHEAP MAGNETIC BATTERY.—Take a gallon stone jar, and place a sheet-zinc cylinder therein, and inside that a porous cup (a porous flower-pot will answer after a fashion). Inside the porous cup place a piece of sheet copper. Use a solution of common salt next the zinc; and a solution of sulphate of copper next the copper, if a strong current be desired. Dilute sulphuric acid (1 part of acid to 10 of water) makes a very constant, but weaker current.—A. G.

RECHARGING METAL CARTRIDGES.—C. W. H., on page 9, Vol. XXIV., wishes to know how to recharge old shells—breech loaders. I have done as follows: Use either fulminate of silver, mercury, or any of the chlorate of potash mixtures, and a little shellac varnish mixed to thin paste, then dry and fill with powder, and insert the bullet carefully. But *he* will find it cheaper, if labor is worth anything, to saw cord-wood, and buy cartridges.—A. G.

O. W. D., of Mass.—Your theory of solar emission is not very intelligible to us. So far as we can gather from your letter we infer that in your opinion there is a compensating principle in the correlation of forces, which maintains the heat of the sun, and will continue to maintain it. We think it probable this would be found true, provided we could see at once the whole of one of the tremendous cycles of existence. As it is, we only see dimly a small portion of a cycle, and all such theories as you propound are speculations, the truth or error of which is incapable, in the present state of science, of being determined.

D. D., of Mass., says: "I send you some specimens of stone taken from a ledge near here, will you inform me what they contain?" The minerals sent contain plumbago, sulphuret of iron, and copper. It is possible that considerable copper may be found in the vicinity. In North Carolina the same species of quartz yields gold; and we believe that in your own neighborhood gold, in small quantities, has been found.

J. L. N., of Ky., writes: "There is in your last issue an extract from the *Builder*, on diamonds, that has called my attention to a lot of crystals that I have in my possession, that I think are real gems, but not being posted in *gemology*, I send you a small sample, hoping you will favor me with your opinion. Diamond or not diamond, you can retain the sample. If they are gems they will benefit me, as I am only a working man; if they are not I have philosophy sufficient to smile on misfortune." Our correspondent will have to wear the philosophic smile. The gem sent is only quartz. Diamonds have been found in Georgia, South and North Carolina, but we are not advised as to Kentucky.

C. H. C., of Pa.—We cannot say without analysis of the water in your well whether you could safely continue the use of a galvanized iron pump to raise water for culinary purposes. The probability is that by always pumping off the water which has been standing in the pump before drawing for use, you would run little risk. Many writers attack galvanized iron pipes with great energy. In such cases there is great danger of more or less injury from their use. The oxide and salts of zinc are irritant poisons.

F. S. C., of Mass.—Your plan of boring out a segment of a hollow cylindrical ring by a bent bar with a screw thread cut upon it, the screw to carry a cutter, is wholly impracticable. No perfect job could ever be done in this way.

N. D., of Me.—Valves often leak slightly under slight pressure, and become tight under increasing pressure, which springs them home to their seats. This is probably the case with the safety-valve of your steam-heating apparatus.

J. C. B., of Pa.—The Cornell University, at Ithaca, N. Y., is an institution of the kind you inquire about. By addressing the President of that institution, you will probably receive a catalogue with full particulars.

NEW BOOKS AND PUBLICATIONS.

LOCOMOTIVE ENGINEERING AND THE MECHANISM OF RAILWAYS. A Treatise on the Principles and Construction of the Locomotive Engine, Railway Carriages, and Railway Plant. With Examples Selected from the International Exhibition of 1862. Illustrated with Sixty Large Page Engravings and Woodcuts. By Zerah Colburn, Esq., Civil Engineer. New York: John Wiley & Son, No. 15 Astor Place.

As our readers are many of them aware, this is a work published in numbers. The numbers (15 and 16) now received bring the treatise up to the sixteenth number of the twenty, which were originally embraced in the design. When completed, it will be one of the most comprehensive as well as one of the most elegant works ever published. Its form (large quarto) gives ample scope for illustration, and the engraving, as well as the typographical execution, is really superb. The acknowledged genius of its gifted author has enriched its pages by a mass of facts which, perhaps, no other author could have so skillfully collated, and so ably condensed, into an exhaustive treatise. The work is sold only by subscription.

HAND-BOOK OF MINERAL ANALYSIS. By Friedrich Wöhler, Professor of Chemistry in the University of Gottingen. Edited by Henry B. Nason, Professor of Chemistry in the Rensselaer Polytechnic Institute, Troy, N. Y. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut street. Price, by mail, free of postage, $3·00.

This is a translation of Wöhler's "Hand-book of Mineral Analysis," with some changes and additions. The editing of this work has fallen into able hands. Of the character of the original treatise it is unnecessary that we should speak, since it is a standard work in every chemical library. As a guide in mineral analysis it is one of the very best, easily understood, and in every way reliable in its methods. The work is specially adapted to the wants of mining engineers, and metallurgists in general; and will be found a valuable addition to those of Fresenius, and other standard authors, for the use of students of chemistry in the laboratory.

THE YOUNG MEN OF THE WEST; or, A Few Practical Words of Advice to those Born in Poverty, and Destined to be Reared in Orphanage. By L. U. Revais, St. Louis, Mo. New York: S. R. Wells, Publisher, No. 389 Broadway.

This is a little pamphlet full of sound advice to young men, and should be widely read.

MAN AND WOMAN, Considered in their Relations to Each Other and the World. By Henry C. Pidder. New York: S. R. Wells, Publisher, No. 389 Broadway.

In the present state of the public mind on the "woman question," this work is timely, and will be read with interest.

THE medical and surgical literature of this country is enriched by "Bostwick's Medical and Surgical Journal," intended to be a companion for the physician, and a family guide. The first number of this new monthly is on our table, and we find its contents interesting and instructive. Its editor and publisher, Homer Bostwick, M.D., is a physician and surgeon of thirty years' practice, and has given renewed evidence in this number of his magazine that his ability as an editor is equal to his admitted skill in the art of healing.

THE PHOTOGRAPHERS' FRIEND is the title of a new quarterly magazine, published by R. Walzl, Baltimore, Md. $1·50 a year. Devoted to the photographic art. It is a very handsome and excellent periodical. In another column we give some extracts from its columns.

THE AMERICAN JOURNAL OF MICROSCOPY is the name of a new monthly quarto, published at Chicago, by George Mead & Co. $1·00 a year.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

APPLICATIONS FOR LETTERS PATENT.

3,332.—MACHINERY FOR SHEARING METALS.—Robert Briggs, Philadelphia, Pa. December 21, 1870.

3,344.—APPARATUS FOR PREVENTING NUTS WORKING LOOSE IN REAPING AND MOWING MACHINES.—Walter A. Wood, Hoosick Falls, N. Y. December 21, 1870.

3,345.—WEATHER STRIP.—William Cook, Chicago, Ill. December 21, 1870.

3,366.—ENGRAVING BLOCKS.—Claus Van Haugen, Philadelphia, Pa. December 21, 1870.

3,375.—TREADLE MECHANISM.—George Willey, Cleveland, Ohio. December 24, 1870.

3,376.—BREECH-LOADING FIRE-ARMS.—Charles E. Sneider, Baltimore, Md. December 24, 1870.

3,378.—PRESERVING FRUIT.—S. E. Sewell, of Melrose, and J. G. Loring, of Boston, Mass. December 27, 1870.

3,381.—WOOD SCREWS.—George C. Davies, Dayton, Ohio. December 28, 1870.

3,390.—STEAM GENERATOR.—S. Lloyd Wiegand, Philadelphia, Pa. December 29, 1870.

3,391.—MACHINERY FOR MANUFACTURING METAL TUBES.—S. P. M. Tasker Philadelphia, Pa. December 29, 1870.

3,392.—PAPER-MAKING STOCK AND PULP.—M. L. Keen, Jersey City, N. J. December 29, 1870.

3,019.—METALLIC CARTRIDGE CASES.—Hiram Berdan, New York, now residing at St. Petersburgh, Russia. November 18, 1870.

3,260.—WIRE BANDS, OR FASTENERS, FOR FASTENING BALES, ETC.—E. S. Lenox, New York city. Dec. 13, 1870.

3,290.—RAILWAY CAR SPRINGS.—Patrick S. Devlan, Jersey City, N. J., and Isaac P. Wendell, and S. P. M. Tasker, Philadelphia, Pa. December 15, 1870.

3,376.—BREECH-LOADING FIRE-ARMS.—C. E. Sneider, Baltimore, Md. December 31, 1870.

3,215.—CARTRIDGE BOX.—Henry D. Cooke, Washington, D. C. December 31, 1870.

3,294.—DEVICE FOR SECURING CLOTHES ON A LINE.—Henry A. Tweed, New York city.

3,401.—FELTED FABRICS.—Robert Spencer, New York city. December 31, 1870.

5.—CARPET BEATER.—W. H. Hankinson, New York city. January 2, 1871.

6.—SEWING MACHINE.—B. P. Howe, New York city. January 2, 1871.

7.—HARVESTER.—D. M. Osborne, Auburn, N. Y. January 2, 1871.

APPLICATIONS FOR EXTENSION OF PATENTS.

AUTOMATIC LATHES FOR TURNING IRREGULAR FORMS.—William D. Sloan New York city, has petitioned for an extension of the above patent. Day of hearing, March 15, 1871.

FLUID METERS.—James Cochrane, New York city, has petitioned for an extension of the above patent. Day of hearing, March 15, 1871.

MACHINE FOR CUTTING SLOTS IN CLOTHES PINS.—John Humphrey, Keene, N. H., has petitioned for an extension of the above patent. Day of hearing, March 15, 1871.

MILLS FOR CLEANING CASTINGS.—Henry R. Remson, Albany, N. Y., has petitioned for an extension of the above patent. Day of hearing, March 22, 1871.

BLIND FASTENINGS.—Horace Vansands, Middletown, Conn., has petitioned or an extension of the above patent. Day of hearing, April 19, 1871.

Recent American and Foreign Patents.

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

AUGER.—Blase Walch, Frederick, Md.—The object of this invention is to improve the construction of augers, so that the cutters and center screw, besides being rendered adjustable, can be readily detached and sharpened when necessary; and the center screw or point, and cutters only, need be made of steel, all the rest of the augur being of iron.

STEAM BOILER.—Adolph Brase and Lemuel Salladay, Sciotoville, Ohio.—This invention consists in combining with a steam boiler, a perforated tube with scrapers attached thereto, to which a longitudinal motion is given, and which perforated tube distributes the feed water, and through which the sediment is blown off.

CENTRAL DISCHARGE WATER WHEEL.—Albert L. Moore and Norman S. Parker, El Dorado, Oregon.—This invention has for its object to furnish a simple and effective water wheel which shall be so constructed as to give fully one-half power at half gate, and which will receive and discharge the water in a smooth solid column.

MOWING AND REAPING MACHINES.—Thomas J. Barnes, Corry, Penn.—This invention has for its object to furnish a simple, convenient and effective device for operating the cutter bar of a mowing or reaping machine by a direct motion in both directions.

WAGON JACK.—George H. Tule, Haddenfield, N. J.—This invention relates to a new wagon jack, which is of extremely simple construction, and readily adjusted to any desired hight. The invention consists in the application to the lifting lever of an elbow, pendant, which sustains the adjustable rest or slide whereon the axle or weight is to be held.

FOUNTAIN PAINT BRUSH.—D. J. Kellogg, Toledo, Ohio.—This invention has for its object to furnish an improved paint brush, which shall be so constructed as to retain the paint in such a way that it will not incrust and become useless, and which will prevent the brush from drying, so that it will not need to be washed, thus saving much time and annoyance to the artist.

MACHINERY FOR BURRING OR CLEANING WOOL, COTTON, AND OTHER FIBROUS MATERIALS.—Wm. Richardson, Oldham, England.—This invention relates to improvements in burring or cleaning machines, of that class in which a fine comb cylinder is employed, and from which burrs, seeds, and other impurities are stripped, while the cleaned material is carried forward to be removed by a revolving brush or similar apparatus.

SEWER BASIN TRAP.—Matthew K. Couzens, Yonkers, N. Y.—The object of this invention is to provide means for preventing the clogging of pipes which lead from basins or receptacles to sewers, and for consequently obtaining a constant outlet for such basins. The invention consists in the application to the end of the pipe within each basin, of a float valve, which is closed as long as the ordinary outlet is open, but will be raised off its seat to provide another outlet, if the former be clogged.

COKE FURNACE.—Thomas Price, Steubenville, Ohio.—This invention relates to a new furnace for producing coke free from sulphur or other impurities, so that it may be used for the production of pure iron.

CLAMP FOR ANTI-RATTLING SHAFT CONNECTIONS.—John J. Dominic, Gallupville, N. Y.—This invention relates to a new and useful device to facilitate the operation of putting the shafts to buggies or other vehicles where rubber or other elastic material is used to prevent rattling or looseness in the connecting joints.

CHURN.—A. & J. A. Gifford, West Somerset, N. Y.—This invention has for s object to improve the construction of churns, whereby it is enabled to furnish the public a cheaper and more convenient and efficient machine than those heretofore known, and one also adapted to operate as a butter worker; and the invention consists in so arranging three or more dashers in connection with a double-armed frame or socket, that when the latter is oscillated the dashers shall move alternately in opposite directions.

SEED DRILL, MANURER, AND POTATO DIGGER.—Eugene C. Hopping and Eugene A. Ely, Madison, N. J.—This invention relates to a new and useful improvement in a combined seed drill and potato digger.

CUTTER.—Joseph H. Bradley, Hillsboro, Ohio.—This invention relates to improvements in feed cutters, by the operation of which the degree of fineness to which feed is cut may be regulated at pleasure, the blade being one of the spokes of a fly wheel, and so arranged that the cutting begins at the outer extremity of the knife, where the speed is highest and the power least and draws inward toward the center, the power increasing as the speed diminishes, so that the two forces may operate complementarily.

TILE MACHINE.—Albert Moorhous, Indianapolis, Ind.—This invention consists in arranging screens and dies in connection with the doors of the plunger-box, so that the clay will be screened or freed from stones, or other unsuitable foreign material, and the latter may be readily and easily removed at suitable intervals of time without causing other than a momentary halt in the operation of the machine.

FIRE TONGS.—Alfred M. George, Sand Fly, Texas.—This invention has for its object to prevent the legs of fire-tongs from lapping or crossing each other, as they incline to do soon as the joint is worn; and consists in a slotted guide attached at one end to the stationary leg, and extending beyond and inclosing the movable leg.

SEED DRILL AND COCKLE SEPARATOR COMBINED.—J. Fletcher, Rectortown Va.—This invention consists of two parallel shafts, provided with rollers—those on the front shaft being covered with rubber—said shafts being placed beneath the seed-box, the rollers coming directly under the discharge orifices in the bottom of the box, and operated by gearing, arranged in such a manner that it can be thrown in or out of gear at pleasure; the object being to sedarate the cockle from the wheat and deposit it in a trough beneath the seed-box, and to permit the grain only to pass through the seed conductor into the ground.

MATTING MACHINE.—James H. Reilly, Brooklyn, N. Y.—This invention has for its object to produce in metal ware of any sort an ornamental indented or "matted" surface, and consists in the use of jointed metallic needles articulated at one end to the periphery of a chuck whose rapid revolution causes the needles to stand out radially, so that the article of ware receives blows from their points, and its surface is thereby suitably "matted."

RUNNING GEAR OF WAGONS.—G. Doan, Wallis, and Morland, Fleming, N. Y.—This invention consists in forming both hounds and the sway bar of vehicles of one solid piece of wood bent into the desired shape; and also in forming the tongue-braces and cross-bar of vehicles in a single piece, on the same principle.

OIL-TANK DISCHARGING APPARATUS.—W. J. Brunded, Oil City, Pa.—The object of this invention is to provide convenient and ready means for discharging oil from tanks, more especially designed for tanks on railroad cars or trucks, but applicable to tanks or oil reservoirs in other situations.

CAR VENTILATOR.—William C. Betts, Brooklyn, N. Y.—This invention has for its object to furnish an improved ventilator for cars, which shall be so constructed as to introduce the fresh air freely, withdraw the foul air from the car, and, at the same time, prevent the entrance of dust.

SINKING SCREW PILES.—W. S. Smith and William Reuschel, Chicago, Ill.—This invention relates to improvements in machines for turning screw piles for sinking them into the earth, and consists in an arrangement with the hub of the wheel or other device used for turning the shaft of the pile to screw it down, of friction rollers acting against a clamp made fast to the shaft, to impart the rotary motion and to turn on their axes by the downward motion of the pile, in a manner to avoid the great friction which exists between the pile and the part which imparts the rotary motion where the one has to slide on the other. The invention also comprises an improved mode of attaching the clamp on which the turning force is deliver

PAPER-BED BOTTOM.—James B. Crane, Dalton, Mass.—This invention has for its object to furnish an improved paper-bed bottom, which shall be simple in construction, neat, clean, strong, and durable.

CHURN AND BUTTER WORKER.—A. and J. A. Gifford, West Somerset N. Y.—This invention consists in a novel arrangement of oscillating paddles within a suitable box, whereby the machine is adapted to alternately perform both the functions of a churn and butter worker with equal efficiency

WATER WHEEL.—J. W. Truax, Essex Junction, Vt.—This invention relates to new and useful improvements in water wheels (constructed upon the turbine principle), whereby they are rendered more efficient, durable, simple, and less expensive than such wheels have hitherto been.

SIDING GAGE.—W. E. Lewis, Princeton, Iowa.—This invention has for its object to furnish an improved instrument for gaging and holding siding, weather, or clap boards while being scribed and nailed, which shall be simple in construction, reliable in operation, and convenient in use.

PLOW.—Elias Halman, Columbus, Ga.—This invention has for its object to furnish a simple, convenient, strong, and durable plow, which shall be so constructed that the operating parts can be detached to allow of the attachment of a subsoil plow.

CONNECTING ROD.—W. G. Freeman, Richmond, Va.—This invention relates to improvements in apparatus for adjusting and tightening the brasses of connecting rods, such as are commonly known as "stub ends," and it consists in a broad wedge, the width of the bearing surface of the back of the brass arranged behind one of the braces, in a wedge-shaped cavity, and a screw connected therewith and secured through the cap, on the side of the "stub end," to work the wedge back and forth in, place of the gib and key now used, said screw being provided with a jamb nut to prevent it from turning.

Official List of Patents.

ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING JAN. 17, 1871.

Reported Officially for the Scientific American.

SCHEDULE OF PATENT FEES

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MUNN & CO.,
Patent Solicitors, 37 Park Row, New York.

110,948.—PADLOCK.—John H. Ames, Stamford, Conn. Antedated December 31, 1870.

110,949.—HARVESTER.—Thomas James Barnes, Corry, Pa.

110,950.—RAILROAD-CAR VENTILATOR.—William C. Betts Brooklyn, N. Y. Antedated January 7, 1871.

110,951.—BACK CENTER FOR MILLING MACHINES.—Amos H. Brainard, Hyde Park, Mass.

110,952.—CLOTHES DRIER.—Joseph L. Brigham, St. Paul, Minn.

110,953.—DEVICE FOR DISCHARGING OIL FROM TANKS.—Wm. J. Brundred, Oil City, Pa.

110,954.—WOOD PAVEMENT.—William Bushnell, Elizabeth, N. J.

110,955.—BELT GEARING.—James H. Butler, Hampden, Me.

110,956.—FILE-CUTTING MACHINE.—Pehr Johan Carlsson, Andover, Mass.

110,957.—GATE LATCH.—Calvin Cole (assignor to Moses Gilmor), Dayton, Ohio.

110,958.—PAPER BED BOTTOM.—James B. Crane, Dalton, Mass.

110,959.—PEN CLEANER.—Samuel Darling, Providence, R. I.

110,960.—BIT-BRACE.—William P. Dolan, Charlottesville, Va. Antedated January 14, 1871.

110,961.—CLAMP.—John J. Dominic, Gallupville, N. Y.

110,962.—STAMP CANCELER.—Charles C. Egerton (assignor to Samuel E. Middleton and Daniel W. Middleton, Jr.), Washington, D. C.

110,963.—ELECTRO-MAGNETIC WEIGHING MACHINE.—Henry Fairbanks, St. Johnsbury, Vt.

110,964.—COMPRESSION-COCK FOR FLEXIBLE TUBES.—Henry Fairbanks, Boston, Mass.

110,965.—AUTOMATIC WEIGHING AND DISTRIBUTING SCALES—Henry Fairbanks, St. Johnsbury, Vt.

110,966—SAW.—Walter Lafayette Gage, St. Louis, Mo.

110,967.—PORTABLE CAMP GRATE.—Lorenzo D. Gavitt, Los Angeles, Cal. Antedated January 7, 1871.

110,968.—CHURN.—Alden Gifford and Zenas A Gifford, Somerset, N. Y.

110,969.—HARNESS SADDLE.—Algernon Gilliam, Pittsburgh Pa.

110,970.—MECHANISM FOR OPENING AND CLOSING TELEGRAPHIC STATION CIRCUITS.—Elisha Gray, Chicago, Ill.

110,971.—ENDLESS-WIRE ROPEWAY.—Andrew Smith Hallidie, San Francisco, Cal.

110,972.—MACHINE FOR MIXING AND BLEACHING SUGARS. Melancthon Hanford, Lexington, Mass.

110,973.—ANIMAL TRAP.—George L. Hart, New Britain, Conn.

110,974.—WEDGE FOR SPLITTING WOOD.—Albert Heusser, Ellington, Conn.

110,975.—STAIR-ROD FASTENING.—Robert Hutchison (assignor to William B. Gould), Newark, N. J.

110,976.—PUMP.—Edward T. Jenkins, Brooklyn, N. Y. Antedated January 7, 1871.

110,977.—ATTACHING DOOR KNOBS TO THEIR SPINDLES.—James N. Karr, Buffalo, N. Y.

110,978.—FOUNTAIN PAINT BRUSH.—D. J. Kellogg, Toledo Ohio.

110,979.—MANUFACTURE OF EYELET-BLANKS.—William R. Landfear, Hartford, Conn. Antedated January 5, 1871.

110,980.—MODE OF FORMING BALLS OF TWINE AND CORD.—Hamilton B. Lawton, Cropseyville, N. Y.

110,981.—MACHINE FOR MOLDING CHAIR BOTTOMS.—John Lemman, Cincinnati, Ohio.

110,982.—SIDING GAGE.—William E. Lewis, Princeton, Iowa.

110,983.—MACHINE FOR MANUFACTURING HINGES.—William E. Lewis (assignor to Benedict & Burnham Manufacturing Company), Waterbury, Conn.

110,984.—BURIAL CASE.—Ivory Lorde, Moline, Ill.

110,985.—DOOR CHECK.—Horatio Nelson Hicks Lugrin, Chelsea, Mass.

110,986.—CUTLERY.—Myron W. Lyman, Chicago, Ill.

110,987.—SHOEMAKERS' TOOL.—Myron W. Lyman and Franklin C. Wyman, Chicago, Ill. Antedated January 14, 1871.

110,988.—COTTON SCRAPER AND HARROW.—John M. P. Lyon Bellefonte, Ala. Antedated January 9, 1871.

110,989.—EARTH CLOSET.—Patrick Malone (assignor to himself and Charles C. Landry), New Orleans, La.

110,990.—Producing Refined Cast Iron, Steel, and Malleable Iron.—John W. Middleton, Philadelphia, Pa. Antedated January 8, 1871.
110,991.—Lunch Box.—David Miller, Allegheny City, Pa.
110,992.—Attaching Knobs to their Spindles.—Charles Morrill (assignor to George H. Bidwell), New York city.
110,993.—Hoisting Apparatus.—Charles R. Otis and Norton P. Otis, Yonkers, N. Y.
110,994.—Material called "Ole-izerine," for Dyeing and Printing.—Alfred Paraf (assignor to Edward S. Renwick, trustee), New York city.
110,995.—Process of Extracting the Coloring Matter of Madder.—Alfred Paraf (assignor to Edward S. Renwick, trustee), New York city.
110,996.—Tree Protector.—Caroline Parks, Milan, Ohio.
110,997.—Apparatus for Distilling and Concentrating Liquids.—C. Chauncy Parsons, New York city.
110,998.—Apparatus for Extracting Essential Oils.—George Gilman Percival (assignor to Isabel B. Percival), Waterville, Me.
110,999.—Oil Paint for Coating Oil Cloth.—Thomas Potter, Philadelphia, Pa.
111,000.—Machine for Mixing Concrete, etc.—Silas Putnam and Thomas Burt, Rockville, Conn. Antedated January 5, 1871.
111,001.—Filter.—Louis Raecke, New York city. Antedated January 7, 1871.
111,002.—Let-off Mechanism for Looms.—Horatio A. Remington, Anthony, R. I.
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REISSUES.

4,232.—Horse Hay Rake.—N. M. Barnes, Tiffin, Ohio. Patent No. 105,542, July 19, 1870.
4,233.—Treadle for Sewing Machines.—J. A. Bradshaw, W. H. Brown, and Darius Whithed, Lowell, Mass.—Patent No. 92,786, dated July 20, 1869.
4,234.—Curtain or Shade Fixture.—William Campbell, New York city, assignor to Nathan Campbell.—Patent No. 44,602, dated October 11, 1864.
4,235.—Machine for Forming the Brims of Felt Hats.—W. A. Fenn, Rochester, N. Y.—Patent No. 17,033, dated April 14, 1857.
4,236.—Apparatus for Suspending Gas-oilers and Drop-Eights.—S. B. H. Vance (assignor to Mitchell, Vance & Co), New York city.—Patent No. 70,635, dated November 5, 1867.

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Arrangement of Railroad Platform Scales.—S. G. Lewis, of Philadelphia, Pa., executor of Lea Pusey, deceased.—Letters Patent No. 16,286 dated October 28, 1856.
Horse Rake.—J. J. Squire, of De Soto, Mo.—Letters Patent No. 16,318, dated Dec. 16, 1856; reissue No. 3,303, dated Feb. 16, 1869.
Loom.—B. G. Dawley, of North Providence, R. I.—Letters Patent No. 16,306, dated Dec. 23, 1856.
Crib for Horses.—Henry Eddy, of North Bridgewater, Mass. —Letters Patent No. 16,357, dated Jan. 6, 1857; reissue No. 1,300, dated April 8, 1862.

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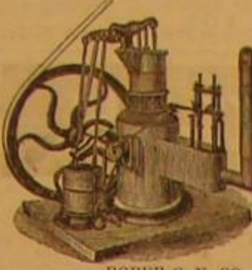

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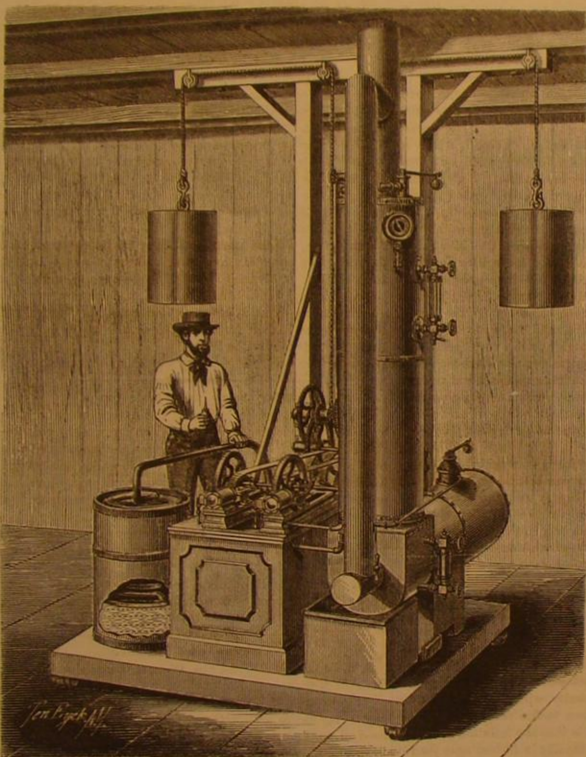
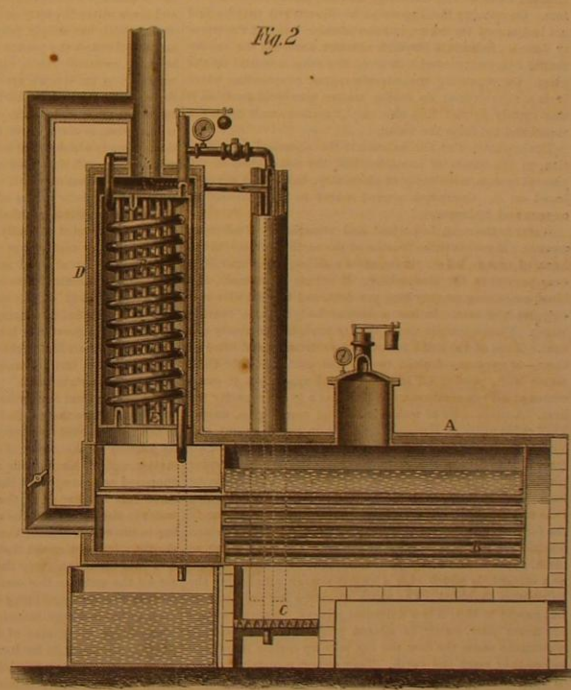
UTILIZING WASTE HEAT FROM STEAM ENGINES AND BOILERS.

Mr. J. H. Ellis of Springfield, Vt., has recently made some interesting experiments in utilizing the heat that escapes in the exhaust steam from engines, and in the smoke from steam boiler furnaces. The apparatus used, and the results produced, are illustrated by the annexed engravings, of which Fig. 1 is a perspective view, and Fig. 2 a vertical section of the arch boilers and chimney flues. He used for the purpose the horizontal tubular steam boiler, A, Fig. 2, twelve inches in diameter and three feet long, with thirteen copper flues, B, one inch in diameter; the fire box, C, being under the boiler, and the smoke returning through the flues. He connected with this boiler an engine, with cylinder $1\frac{3}{4}''\times2\frac{1}{4}''$, running 350 revolutions a minute. This engine was geared to a derrick, so that it raised a weight of five hundred pounds five feet in one minute.





ELLIS' METHOD OF UTILIZING WASTE HEAT FROM STEAM ENGINES AND BOILERS.

For the purpose of using the escaping heat from this engine and boiler, he placed another upright tubular boiler, D, in the flue of the chimney, the base of the flue being enlarged sufficiently for the purpose. This boiler was four feet long and nine inches in diameter, and had seven copper flues, E, 1" in diameter. A spiral coil of copper pipe, F, was placed inside this boiler, of sufficient length to extend from one end to the other; one end of the coil passing out at the top, and the other end at the bottom of the boiler. The diameter of this coil was 8", and the diameter of the pipe of which it was made was $\frac{3}{8}''$. The upper end of this coil was connected with the exhaust pipe of the engine, so that the exhaust steam was compelled to pass through the coil to escape into the atmosphere.

The boiler, D, was filled with the bisulphide of carbon (which boils at about 110° Fah.) and it was connected with another engine, of the same size and style as the one used with the steam boiler, and geared to a derrick in the same manner.

Having raised the pressure in the steam boiler to 45 pounds, the steam engine was started, raising with the derrick a weight of 500 pounds, the exhaust steam passing through the coil of pipe in the bisulphide boiler in the manner described.

In five minutes after the steam engine commenced running, the pressure in the bisulphide boiler went from 0 to 30 pounds to the inch. At this time the second or bisulphide engine was started, geared to a derrick, and commenced raising a weight of 500 pounds in the same manner that the steam engine was doing. The two engines were kept running simultaneously two hours, and during this time the steam engine made 38,000 revolutions, and raised 500 pounds 456 feet, while the bisulphide engine made 44,000 revolutions, and raised 500 pounds 528 feet. The pressure in the steam boiler ranged from 30 to 70 pounds to the inch, averaging about 45 pounds, and the pressure in the bisulphide boiler ranged from 30 to 60 pounds, averaging about the same as that of the steam boiler. The temperature of the smoke on leaving the flues of the steam boiler did not exceed 360 degrees during the trial.

The exhaust steam was perfectly condensed in the coil, and all its latent heat imparted to the fluid that surrounded it; and the temperature of the water discharged from the coil did not exceed 108 degrees, being reduced to that point by the cold bi-sulphide constantly pumped in at the bottom of the boiler around the lower end of the coil. The heat of the exhaust steam being applied at the top of the boiler, a pressure of 60 pounds to the inch was obtained, before the temperature at the bottom of the boiler was raised a single degree. The vapor of the bisulphide of carbon was condensed in a short coil of copper pipe, immersed in a tank of water, and pumped back into the boiler continuously during the trial, with no perceptible loss of the material.

The amount of fuel consumed in getting up steam from cold water and running the engine during the trial, was 5 pounds of wood and shavings, 6 pounds of charcoal, and 12 pounds of anthracite coal; and 60 pounds of water were condensed from the exhaust of the steam engine, in the coil of the bisulphide boiler.

It will be seen by the above statement of facts, made from data furnished us by Mr. Ellis, that the increase of power obtained from a given amount of fuel by the use of the bisulphide boiler was 115 per cent.

Mr. Ellis states that owing to the fact that the engines used had no cut-off valves, and had ports too much contracted to exhaust freely, and also because the amount of friction in the derrick gearing, which was new, was very great, the amount of power developed and useful work performed, was not as much as it would have been with more perfect engines. But as the bisulphide engine labored under precisely the same disadvantages that the steam engine did, the power gained by the use of the former was not affected thereby.

These engines can be seen running, or further particulars in regard to them obtained by applying to Joel A. H. Ellis, Springfield, Vt.

This invention has been secured through the Scientific American Patent Agency by four distinct letters patent. It has also been patented in foreign countries through the same medium.

Lumber Trade.

Some idea of the magnitude and importance of the lumber trade in the upper Mississippi and its tributaries may be formed from the following figures: The logs cut last winter measured in round numbers 100,000,000 feet, or 20 per cent less than the yield of the previous year. The stock on hand at the commencement of the season was 30,000,000 feet, about the usual quantity. The St. Anthony manufacture accounted for 110,000,000 feet, 15,000,000 were sent to market by river, and the balance not stacked was sold in Minnesota and Iowa. On the St. Croix and its tributaries, 73,700,000 feet were cut, and this large figure is 40 per cent below the production of 1868–69. With stock on hand 75,000,000 feet old logs, the total at the commencement of the manufacturing season was nearly 150,000,000 feet. Of this amount 40,000,000 was unattainable in the pineries; 75,000,000 was manufactured on the St. Croix, and at Hastings, Redwing, and Lake City, and the balance, 33,000,000, left for exportation. At Black River the logs scaled exceed those of the Upper Mississippi and its tributaries by more than 30,000,000 feet. The Black river is thus at the head of all the districts on the Mississippi river.

HAILSTONES.—A writer in *Nature* says: "Hailstones are frozen raindrops, and a raindrop falling through a vacuum would of necessity be spherical; but in falling through the air it must tend to assume the form of least resistance, what ever that may be. I was told many years ago of hailstones which had been picked up and found to be of the form of Minié bullets. I do not vouch for the truth of this, but I think it likely; the Minié bullet was, I believe, the nearest approach to the form of least resistance that the inventor was able to arrive at."

THE WATER WE DRINK.

LECTURE BY PROF. CHANDLER, BEFORE THE AMERICAN INSTITUTE.

Water is the sole product of the combustion of hydrogen. The Hindoos and the Egyptians considered water the element from which all bodies are formed. Among the Greeks, six hundred years before Christ, the opinion was defended that water was the first and fontal element of all matter. Aristotle regarded it as one of the four primal elements, and this idea prevailed for more than a thousand years, and the four elements—fire, air, earth, and water—were supposed to be materials from which all matter was formed. It was supposed, however, that these four elements were, to a certain extent, mutually convertible, and there were certain facts which made this appear very possible, at that date. Heat converted water into steam, which to the ancients was equivalent to air; and the frequent evaporation of water from glass vessels seemed to convert the water into earth; so the four elements were mutually convertible.

This idea of the conversion of water into earth prevailed until about 1770, just one hundred years ago, when Lavoisier, the French chemist, applied the balance to the solution of the problem. It had, however, been known that when water was placed in a retort, and evaporated, there remained behind a small quantity of earthy matter. If the water were poured back and distilled a second time, the quantity of earthy matter increased; so the third time, and this continued until the distillation was complete. Lavoisier provided himself with an alembic which was hermetically sealed, and into this he introduced three pounds of water. He repeated the distillation for a long time, and found that at the end of the operation he had twenty drams of mineral water; but he found that the alembic and the water had the same weight as before. On opening the apparatus he discovered that he had not lost any of the water, but the alembic had lost the twenty drams. Scheele, a Swedish chemist, analyzed the earthy matter left, and proved it to be of the same material as the glass. On repeating the experiment of evaporating water from a silver vessel no earthy matter was produced: so it was clearly proved that the earthy matter came from the vessel and not from the water.

The application of the balance to the chemical investigation, in the hands of Lavoisier, laid the foundation of the present system, not simply of chemistry, but of the sciences based on it. Cavendish proved water to be composed of oxygen and hydrogen.

Water is the most important and remarkable of all compounds. It covers three fourths of the earth's surface, in the form of oceans, lakes, rivers, snow and ice. As vapor, it is ever present in the atmosphere. It occurs in animals, the blood containing seventy-nine per cent, and the muscles seventy-five per cent. In fact, a human body is three fourths water. Plants contain from twenty to eighty or ninety per cent. None of the solid rocks are free from it, and some of them—as gypsum—contain twenty per cent. At 212° Fah., water boils, passing off in the form of vapor, but it evaporates at all temperatures. Water has a great capacity for heat. A cubic mile of water, in cooling one degree, warms 3,076 cubic miles of atmospheric air to an equal extent, and a cubic yard of ice, in melting, cools 1,000 cubic yards of air from fifty to fifty-two degrees Fahrenheit. We have water playing the part of an acid, in combination with a strong base. It is in the condition of acid that it attacks the quick lime and slakes it. We have the water again occurring in the form of watery crystallization, in solid substances, which assume a crystalline form when separating from water, as alum, gypsum, and many other materials. We have it again as a solvent, in which case it exerts a weak affinity for the substances involved. The water dissolves not only waters, but gases; in fact, it is a universal solvent. Natural waters are never pure, owing to solvent properties. Atmospheric waters, the snow, the dew, the fog, take up certain impurities before they reach the earth. They absorb a certain portion of oxygen and nitrogen; they wash out the dust floating in the atmosphere, and near the seashore the waters contain common salt. In some cases we find sulphuric acid, and in others ammonia.

WELLS.

Terrestrial waters are still more impure. When the water reaches the surface it is absorbed by the porous strata. The character of a spring will depend upon the strata through which the water has percolated. Our common wells are simply holes dug down through the strata. Water takes the character of the earth through which it has passed. The earth's crust consists of strata, different kinds of rock, sandstone, limestone, and slate. Some of these are porous, others are impervious to water, so that we may have in different points many different kinds of water occurring in as many different layers. In boring an artesian well, we may come across water characterized by salt. At a still greater depth, we may meet water which is quite pure. The artesian well is simply a boring made down through those different strata to reach water of a desired quality. One of the most celebrated of these wells is at Grenelle, Paris, 1,800 feet, or one third of a mile, in depth. As the water which rises in this well has its source at a remote distance, where the porous strata which bring it are more elevated, the water rises eighty feet above the surface. The yield in that well is ninety cubic feet per minute. The temperature is eighty-two degrees Fahrenheit. The deepest well in Europe—at Rochefort—has a depth of 2,776 feet, or more than one half mile. At Louisville, Ky., a well has been bored 2,086 feet deep, and another at Charleston, S. C., 1,250 feet deep—both of these wells being mineral water.

Attempts have been made to obtain fresh water by boring in some of our Western States. In Columbus, Ohio, a well was bored 2,275 feet deep, but no water would come to the surface. At St. Louis, the deepest artesian well that has ever been bored was 3,881 feet, or nearly two thirds of a mile. It was a failure, however, as the water obtained would not rise to the surface. In many other localities these wells have been exceedingly successful. In oases on the desert they have added greatly to the fertility. In Algiers and other localities, they have been bored with great success, sometimes producing natural and at other medicinal waters. At Tours, in France, the artesian well is sometimes closed by leaves which, when finally brought to the surface, are found to come from a region 150 miles distant, the water having come through subterranean channels.

Owing to the solvent power of water, spring and well waters always contain more or less mineral matter. Where the rocks are chiefly composed of silicious minerals, we have very little impurity. In New England, the waters generally contain nearly three or four grains of impurity to the gallon.

WHAT WATER CONTAINS.

We sometimes find in water organic matter derived from the decay of vegetables, and certain gases, oxygen and nitrogen—in other words, air; but the air which is dissolved in water is richer in oxygen than the atmosphere. This seems to be a wonderful provision of nature for the support of those animals that breathe by the means of gills. Fishes derive their oxygen from this gas, which is dissolved in water; and, although its volume is only one twenty-fifth the volume of the water, still the supply is sufficient to support this animal life. In wells we have also nitrates, and ammonia salts, produced by the decomposition of animal matter in the soil round our dwellings.

We get an approximate idea of the quality of spring water by the density of the precipitates contained in it. Pond, lake, and river water is partly supplied by springs, and partly by water which has simply passed over the surface of the earth, and not through the porous strata. Consequently, this water is purer, generally, than spring water. Some of the purest waters that are known are lake waters. There is a lake in Sweden the water of which is found to contain only one twentieth of a grain of impurity in a gallon. Water which is in motion, as river water, often contains suspended impurities, or mud, which it has no opportunity of depositing; but when the stream becomes quiet, the mud is deposited, and the water becomes clear. The waters of the Mississippi river contain forty grains of suspended impurities in a gallon, and it is estimated that 400,000,000 tuns are carried to the Gulf of Mexico annually. By the Ganges, 3,668,000 cubic feet of earthy matter are carried annually to the ocean. In fact, it is by alluvial matter—mud transported in this way—that the entire State of Louisiana has been formed, by the encroachment of this earthy matter upon the waters of the gulf. We find also living organisms—plants and animals—occurring in greater or less quantities. There is a popular idea that you can find these animals in a drop of any water. This is untrue; but by causing the water to pass through a filter we can obtain them.

The waters from our rivers and lakes, on reaching the ocean, evaporate, leave their saline matters behind, and come back in the form of rain or snow; and every time the water makes its journey to the ocean, it carries with it its little cargo of matter, and in this way the ocean becomes salt. It might be supposed on this account that the ocean would become much more salt in time; but the ratio between the quantity of water in the rivers and the quantity of water which is existing in the ocean, is such that the change must proceed very slowly. It is estimated that thirty-six cubic miles of water flow into the ocean every day, but it would take 30,000 years for all the water in the ocean to make the round once, to go back to the land, and bring its cargo of saline matter. Supposing that each gallon of river water which comes to the ocean bring six grains of impurity with it, it would take 36,000 years for it to be increased in the ratio of six grains to the gallon. The probability is that the solution of saline matter took place much more rapidly in former ages than it does now. It is pretty nearly washed out of its dust now, and carried to the ocean. Inland seas which receive rivers of a considerable size, and at the same time have no outlet, become much more concentrated than sea water, owing to the evaporation. We have saline waters in which common salt predominates, some of the most remarkable of which occur in this State at Syracuse, and in the Onondaga salt reservations we have brine from which enormous quantities of salt are manufactured. Nine million bushels have been manufactured in a single year, the impurity consisting, in this case, almost entirely of salt.

At St. Catherine's, in Canada, we have a water which contains large quantities of chloride of calcium and magnesium. There is through the valley of Saratoga a break in the strata. Below the surface of the earth, many hundred feet, is a porous layer of sandstone. This comes to the surface further north, where it receives pure atmospheric air, and this, passing down through the sandstone, dissolves the saline matter, takes up the carbonic acid, and comes up through the earth.

PURIFICATION.

Where water is used for washing, as in woolen mills, in dyeing, etc., it is extremely important that it should be comparatively pure. Various methods have been resorted to for its purification. [The speaker here exhibited a filter, which he said was now coming into use, in which a sponge is made to do the work.] For domestic purposes, the water of hillsides is always the best. Wells are objectionable, as they serve to collect what soaks from the soil, and in these waters nitric acid and decomposed animal substances are almost always found. It is found that the waters of artesian wells contain no oxygen. To make these waters useful they must be brought into contact with the air. River and lake waters are preferable for city supplies. As to the characteristics of good water, first, it should be of low temperature, not over forty-eight or fifty degrees; it should be free from taste, except, perhaps, a slight saline taste, and a slight pungency from the presence of carbonic acid. Transparency is not so important, as water may be considerably colored, and yet be free from injurious ingredients. It is not so much in the quantity of impurity as the quality. Five or six grains of lime or magnesia in water renders it unfit for cooking. For tea and coffee, however, it is found to be an advantage to have a small quantity of lime in the water. A person of delicate taste can detect the presence of lime salts in water when it exists in the proportion of only two grains to the gallon. Certain waters in almost every region acquire a special reputation as tea waters. Old inhabitants in New York remember the famous tea pumps, one of which was situated in Franklin street, where a boy was kept pumping tea water for the neighboring inhabitants. Another was at the corner of Reade and Center streets.

ORGANIC IMPURITIES.

It is the animal organic matter in water which is objectionable, not the vegetable. In many cases living vegetables are our great safeguards. Many lives have been saved by the action of vegetation destroying decomposing animal substances. Soakage from the neighboring dwellings adds organic matter to the water, which has germs of disease. Analysis hardly detects it. Sudden outbreaks of dysentery are produced by this cause. Before New York was supplied with Croton water, it was visited by epidemics believed to have been caused by defilement of the wells then in use. Cholera, although it does not originate from this cause, is chiefly disseminated by impure supplies of water. During times of its prevalence it has been noticed that where fresh water is abundant, no deaths of any consequence occur.

The evil from which we are most likely to suffer is from impregnation of the water from lead. There is hardly any kind of water but has some effect upon lead. Pure distilled water attacks it rapidly; water containing some lime salts attack it less rapidly. When Croton was first introduced, owing to the aqueducts being freshly built, the water was much more impure than at present, and it was then noticed that it had but little effect upon lead, but as the water becomes purer, we are in more danger of its contamination. Several other materials have been suggested as a substitute for lead pipe. Galvanized iron pipes are open to some objections. Glass pipe has been suggested, but the inconvenience of introducing it is a serious objection. The best pipe is that made of tin, surrounded by lead, the water being entirely protected from the lead.

The lecture was illustrated by numerous experiments.

Why Soup is Wholesome.

Physiologically, soup has great value for those who hurry to and from their meals, as it allows an interval of comparative rest to the fainting stomach before the more substantial beef and mutton is attacked, rest before solid food being as important as rest after it. Let a hungry and weary merchant or lawyer rush *in medias res*—plunge boldly into roast beef, and what is the result? The defeat is often as precipitate as was the attack. When the body is weary the stomach must be identified with it, and cannot therefore stand the shock of some ill-masticated, half-pound weight of beef. But if a small plateful of light soup be gently insinuated into the system, nourishment will soon be introduced, and strength will follow to receive more substantial material.

Burns and Scalds.

S. B. Judkin, M. D., of Cuba, Ohio, writes to the *Journal of Materia Medica*:

"I have treated a good many cases of burns and scalds, and to my entire satisfaction. I dissolve white lead in flax seed oil, to the consistency of milk, and apply over the entire burn or scald every five minutes. I have been in the habit of using a soft feather to apply the liniment. I have used this preparation a great many times in the fifteen years of my practice, and have never been disappointed; it gives relief sooner and is more permanent in its effects than any preparation I am acquainted with.

I think that any one testing it will be satisfied. It should be applied often, and a full dose of an opiate will be advantageous if the burn is deep."

Singular Mode of Detecting Fraud.

A lawyer in Providence, R. I., was recently, on behalf of the heirs of an estate, contesting a will which he believed to have been forged. His clients were confident of the justice of their claims; but the instrument was apparently all correct, and the prospect of setting it aside looked very dubious. The pretended will was written under the date of 1855, and bore the stamp, "A. P. Co.—Superfine." No paper but that of the Agawam Company of Mittineague bears this mark. The lawyer conceived the idea of writing to the officials of the Agawam Company for information in regard to the paper, and had the satisfaction of learning that their first paper with that stamp was made and sold in 1860, which proved that the fraudulent will must have been written at least five years after its date. Of course this discovery settled the matter.

THE curious fact, that a needle or other steel wire inserted in a living body will immediately become oxidized, while, if the body be dead, no oxidation will take place, was recently brought to light by Dr. Laborde, of Paris. This is a simple test as to whether death has taken place, and will be available in cases of trance or catalepsy.

THE YEAR AND THE DAY.

Our satellite the moon has this remarkable property, that it turns on its own axis in precisely the same time that it takes in completing a revolution round the earth. The result of this is that men have been known to state, with an air of scientific research, that it does not turn on its own axis at all. But *fiat experimentum in corpore vili*, for, as Herschel remarks, if a man will only walk several times round a stick, with his face always towards it, he will find from the unpleasant sensation of giddiness that he has been rotating on his own axis also.

Now, the earth moves in a most confusing manner round the sun. It rotates on its axis about 365 times while it revolves about the sun; if it were exactly 365 times, the year would be difficult to manage, on account of its not being readily divisible into months or other periods. But it is about 365¼ times, and, to make the confusion worse, it is less than this number by an insignificant fraction, which *will* make itself known in course of years.

If we were to go back to the earliest correct, or moderately correct, notion of the length of the solar year, we should probably find it among the Chinese. But in their case it is impossible to tell what is false and what true. If, however, we are to believe their historians at all, we shall have to allow that in knowledge of this sort they anticipated Europeans by about two thousand years. The Chaldeans and the Egyptians were very early in the pursuit of astronomy, yet quite modern in comparison with the Chinese. In Europe, the Greeks, at an early period of their history, were aware that the revolution, called the solar year, occupied about 365¼ days, but for a long time could not arrive at a more exact determination, and it was not till 140 B.C., that any accurate idea was formed. At that time lived Hipparchus, otherwise "the Father of Astronomy." He pursued the science in Rhodes; and by comparing his own observations of the summer solstice with those taken by Aristarchus about 140 years before, he arrived at a fairly correct result; in fact, whatever inaccuracy there was lay chiefly with Aristarchus. Modern investigations give as the exact time occupied by the earth in moving from a point in the ecliptic to the same point again, 365 days, 5 hours, 48 minutes, 49·62 seconds.

The Romans seem not to have had the advantage of even the imperfect knowledge possessed by the early Greeks; and as our calendar has come down to us directly from them, it will be our object to examine the development of their system. At first the moon was their guide.

Romulus instituted an arbitrary year of 304 days, containing ten months, and commencing with March. Numa, finding that this was so far from the length of the solar year, and that consequently the seasons occurred at different times in different years, added two months, January at the beginning, and February at the end. Here, by the way, we may mention that in 452 B.C. the Decemvirs altered the order, putting February between January and March. Numa's year contained 354 days; and the superstition of the times caused the addition of a day to make it an odd number, which was considered more lucky.

Thus the year became 355 days. This was known to be too short. Numa therefore ordered that every other year a month should be inserted between two days near the end of February, which month should consist alternately of twenty-two and twenty-three days. But notwithstanding this clumsy arrangement, the year was still nearly a day too long, for it was brought up to an average length of 366¼ days. Lastly, this inaccuracy was to be overcome by the omission of one intercalary month in twenty-four years. This was pretty accurate, and might have worked well, but it was left in the hands of the pontifices. Some say that they abused their power over the length of the year to serve political or personal objects. It may have been from ignorance or carelessness; but certainly when Julius Cæsar, as pontifex maximus, examined the state of the calendar, he found that winter months had crept back into autumn, and the heat of summer was raging in the months of spring.

At this period he called to his aid the astronomer Sosigenes, by whose advice the so-called Julian Calendar was framed. The lunar year was abolished, and with it the confusing arrangement of intercalary months. Cæsar ordered that the average length of the year should be 365¼ days; and, to effect this, decreed that every fourth year should contain 366 days, the others 365, so that there would at first seem to have been very little change from that time till now. But again the pontiffs interfered with the working of it. The Romans had a peculiarity in computing intervals of time which may have caused a mistake in the arrangement of the leap years. They always counted intervals as including the extreme limits; that is to say, they would call the 5th day of a month the 3d before the 7th; we should call it the 2d before it. At all events, the pontiffs, instead of making every fourth year, made every third consist of 366 days. The error thus introduced was gradually corrected by Augustus; it was not large, and therefore he had not to resort to the violent measures of his predecessor Julius, who made the year of his reformation consist of 445 days, which truly was a "year of confusion."

Our months are necessarily of different lengths, but they might be more evenly arranged. They seem to follow no law except that of the little rhyme, which every one is supposed to know. Had we received the Julian system unaltered, this little poem about the thirty and the thirty-one days would never have been needed. The original distribution was such that the months were alternately composed of thirty-one and thirty days in the leap years, and in the other years a day was taken from February, which was always regarded with spite as an unlucky month. Thus, July consisted of thirty-one days, August of thirty. Accordingly, in the time of Augustus, gross adulation caused a day to be taken from February, the poor, unlucky, but ill-used month, and added to the one which bore the emperor's name, merely that his month might not be shorter than July, his predecessor's. The emperor *may* have been gratified by the attention, but it is hard that we should suffer for it.

The Julian method was nearly complete; the year thus established was only 11 minutes 10·35 seconds too long, which amounts to a day in 129 years.

When the Julian Calendar was instituted, the vernal equinox was fixed at the 25th of March; and had it not been for the slight error in the length of the solar year which resulted from the arrangement of Sosigenes, we should probably still have it on that day. As it was, however, the equinox receded; and at the Council of Nice, in 325 A.D., it was settled that the 21st should be distinguished as the day of its occurrence. And here it is remarkable that no correction was made which would prevent further recession, and absolutely fix the equinox on the 21st. The existing calendar was very convenient, simple, and accurate, as far as temporary results; but the error induced must have been manifest; and it must also have been clear that in every four centuries the seasons would be one day out of place.

The necessity of reformation was felt by the Venerable Bede as early as the eighth century; it was subsequently recommended to the pope by the philosopher Roger Bacon; but the first attempt at correction was made in the fifteenth century by Pope Sixtus IV. To assist in this he invited the great astronomer of that time, Regiomontanus; but by the death of the latter, the project was not carried into execution until the accession of Gregory XIII. to the papacy. His system was as follows: The Julian plan of intercalation was adopted, with the exception that the first year of a century should not be a leap year unless it were divisible by 400. Thus the length of the year was brought so nearly to exactitude that in a period of three thousand years the error amounts to less than a day, which is certainly of no great importance. This reformation was made in 1582; and it is a curious coincidence that whereas the Julian Calendar was finally drawn and fully written out by a scribe named Flavius, the Gregorian was published and explained by Clavius.

The reformed or Gregorian Calendar was almost immediately adopted in all Roman Catholic countries, and the seasons were brought back to their original places in the year by the omission of the ten days which had accumulated since the Council of Nice. In Scotland it was adopted in 1600, and in the Protestant States of Germany in 1700. In England the *vox populi* was so strongly opposed to change that no alteration was made until the year 1752; and, indeed, when the change eventually came, it brought with it a most ridiculous outburst of popular ignorance. The 2d of September of that year was followed by the 14th; so that the eleven days, which was the amount of difference between the old style and the new, were omitted in that month; and the lower orders of the nation, under the impression that they had been unwarrantably deprived of something, clamored vehemently but fruitlessly for the restoration of these days. At the present time Russia is the only European country which adheres to the old style.

All things considered, our calendar seems remarkably simple, and, for all human purposes, sufficiently exact; but, in conclusion, we will quote a passage from Herschel's "Astronomy" with reference to the system adopted in Persia;

"A rule proposed by Omar, a Persian astronomer of the court of Gelaleddin Melek Schah, in 1079 A.D. (or more than five centuries before the reformation of Gregory), deserves notice. It consists in interpolating a day, as in the Julian system, every fourth year, only postponing to the thirty-third year the intercalation, which on that system would be made in the thirty-second. This is equivalent to omitting the Julian intercalation altogether in each one hundred and twenty-eighth year (retaining all the others). To produce an accumulated error of a day on this system would require a lapse of five thousand years; so that the Persian astronomer's rule is not only far more simple but materially more exact than the Gregorian."—*Chambers' Journal.*

Spontaneous Combustion.

Instances of spontaneous combustion are so common now-a-days that we cannot help thinking that people are becoming more careless than they used to be, or else they are ignorant of the nature and the causes of this kind of combustion. The latter, we doubt not, is more frequently the case, and this is our reason for taking up the subject here.

Our readers are aware that ordinary burning is nothing but rapid oxidation, or the union of the combustible substance with the oxygen of the air. But they may not all be equally familiar with the philosophy of slow combustion, which is a more gradual oxidation of a substance. The decay of animal and vegetable substances is a process of this sort. When a log of wood rots in the forest, it is as really burned up as when it blazes on the hearth of an old-fashioned fireplace. The carbon and hydrogen which make up the greater part of its bulk are oxidized in the former case, as in the latter, and the products of the combustion—carbonic acid and water—are the same. And it has been proved that the heat generated in both forms of burning is precisely the same; the only difference being, that in ordinary burning it is all set free in a short time, while in decay it is developed so slowly that we do not perceive it.

The rusting of metals is another instance of this slow combustion, the rust being the metal after it is burnt, or oxidized. Heat is generated in this process, as in that of decay; and if the rusting can be made sufficiently rapid (as when a large pile of iron filings is moistened and exposed to the air), the rise of temperature is readily detected. A remarkable case of heat developed in this way occurred in England during the manufacture of a submarine cable, and is described in Rolfe and Gillett's "Natural Philosophy:"

"The copper wire of the cable was covered with gutta-percha, tar, and hemp, and the whole inclosed in a casing of iron wire. The cable, as it was finished, was coiled in tanks filled with water; these tanks leaked, and the water was therefore drawn off, leaving about 163 nautical miles of cable coiled in a mass 30 feet in diameter (with a space in the center 6 feet in diameter) and 8 feet high. It rusted so rapidly that the temperature in the center of the coil rose in four days from 66° to 79°, though the temperature of the air did not rise above 66° during the period, and was as low as 59° part of the time. The mass would have become even hotter, had it not been cooled by pouring on water."

In this case the heat set free caused the oxidation to go on faster and faster; and this is what occurs in spontaneous combustion, which is simply "rapid combustion developed gradually from slow combustion." There is no more common source of such combustion than the oily rags used by painters in their work, or the cotton waste used for wiping machinery. When such substances have become saturated with oil, if they happen to be thrown into a heap, the oil begins to oxidize slowly; but the heat produced makes the oxidation more and more rapid until the mass bursts into a flame. Oils that oxidize readily, like cotton-seed oil, are especially liable to take fire. Oil spilt on dry sawdust has been known to ignite in the same way.

It sometimes happens that hay, cotton, and many forms of woody fiber—as tow, flax, hemp, rags, leaves, spent tan, straw in manure heaps, etc.—when stacked in large quantities in a damp state, take fire spontaneously. Here the oxidation is merely that of incipient decay or fermentation, which is promoted by the dampness. The confined heat accumulates, as in the case of the oily rags or cotton, until it is sufficient to cause rapid combustion. According to M. Chevalier and others, pulverized charcoal, prepared for making gunpowder and stored in heaps, has been known to ignite, when neither oily nor damp; the very slow action of the oxygen of the air upon the charcoal itself being gradually accelerated by the heat produced until it set it on fire.

Whether grain or seeds of any kind be liable to spontaneous combustion is doubtful; though several French savants came to the conclusion that a barn had caught fire from the spontaneous ignition of damp oats stored in it. But, however, that may be, it will be evident from the facts we have given that many fires, involving great destruction of property, have been the result of spontaneous combustion; and it is probable that many conflagrations ascribed to incendiarism have really owed their origin to the same cause.—*Boston Journal of Chemistry.*

Prof. Huxley's Plan of Education.

I conceive the proper course to be somewhat as follows: To begin with, let every child be instructed in those general views of the phenomenon of nature for which we have no exact English name. The nearest approximation to a name for what I mean, which we possess, is "physical geography." The Germans have a better—*Erdkunde* (earth-knowledge, or "geology" in its etymological sense), that is to say, a general knowledge of the earth, and what is on it, in it, and about it. If any one who has had experience of the ways of young children will call to mind their questions, he will find that, so far as they can be put into the category, they come under the head of *Erdkunde*. The child asks: What is the moon, and why does it shine? What is this water, and where does it run? What is the wind? What makes the waves in the sea? Where does this animal live? and what is the use of this plant? And if not snubbed and stunted by being told not to ask foolish questions, there is no limit to the intellectual craving of a young child, nor any bounds to the slow but solid accretion of knowledge and development of the thinking quality in this way. To all such questions, answers which are necessarily incomplete, but true as far as they go, may be given by any teacher whose ideas represent real knowledge, and not mere book-learning; and a panoramic view of nature, accompanied by a strong infusion of the scientific habit of mind, may thus be placed within the reach of every child of nine or ten.

After this preliminary opening of the eyes to the great spectacle of the daily progress of nature, as the reasoning faculties of the child grow, and he becomes familiar with the use of the tools of knowledge—reading, writing, and elementary mathematics—he should pass on to what is in th more strict sense physical science. Now there are two kinds of physical science: the one regards form, and the relation of forms to one another; the other deals with causes and effects. In many of what we term our sciences, those two kinds are mixed up together; but systematic botany is a pure example of the former kind, and physics of the latter kind of science. Every educational advantage which training in physical science can give is obtainable from the proper study of these two; and I should be contented for the present if they, added to our *Erdkunde*, furnished the whole of the scientific curriculum of schools.

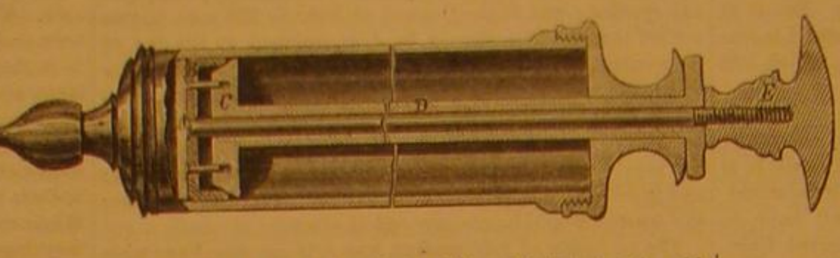
BLACK ink, possessing fluidity, depth of color, and permanency, is still a *desideratum*. The pale inks of the present day, when pure, turn black in time, and are lasting. But the blackness, due to the action of tannic acid in the galls on the iron in the copperas, is inferior in color to the carbon inks of the ancients. A carbon ink of the present day always turns mouldy. What is the secret of making a carbon fluid, free from any disintegrating or perishing ingredient?

IMPROVED EXTERNALLY ADJUSTABLE PACKING FOR PISTONS.

The great difficulty which has always attended the use of pistons is that of keeping them tight. Exposed to constant friction the wear is great, and in addition to this, if soft packing be employed, the result of the friction is to condense its texture and impair its elasticity. Hence the piston which fits the cylinder accurately to-day, must, unless re-adjusted, fit it less accurately to-morrow.

In the use of pumps, syringes, etc., it has been necessary to rearrange frequently the packing, for which purpose it was necessary to take off the head of the cylinder, and often to remove the piston.

By means of the invention, shown in the accompanying engraving, this necessity is avoided, the expansion of the packing being effected without opening the cylinder, by simply turning a nut at the outer end of the piston rod.



The engraving represents the invention as applied to a common syringe, but, with slight modifications in the details, it is applicable to all classes of pistons.

The piston, A, is provided with a cup leather packing, B. This cup leather is expanded by a conical head, C, attached to a sleeve, D. The turning of the knob, E, presses the head, D, down into the cup leather, or relieves it from pressure, according as the knob is turned to the right or left. We need not dwell on the means necessary to adapt this principle to pumps, steam engines, etc., as they will readily suggest themselves to all mechanics.

Under the present system when the leakage of the piston becomes too great to be tolerated any longer, the cylinder is opened and the packing re-adjusted. This requires a considerable outlay of time and labor, and to avoid the necessity for its immediate repetition the piston is packed about as tightly as possible. This results in considerable loss of power by friction, which gradually diminishes until it is succeeded by gradually increasing loss by leakage. Thus friction and leakage alternately operate against economy of power.

By means of this device it is easy to expand the packing from day to day precisely to the extent required without causing any unnecessary pressure upon the interior of the cylinder. There need therefore be no loss by leakage on the one hand or by unnecessary friction on the other, to say nothing of the time involved in removing the head of the cylinder.

In syringes and pumps in which soft packing is employed an interval of a few days without use is almost certain to be followed by such a shrinking of the packing as to require considerable trouble to get the piston to work. By means of the improved piston this annoyance is entirely overcome. A single turn of the nut renders the packing, however dry and shrunken, perfectly tight.

Patent allowed through the Scientific American Patent Agency, and will issue next week to A. H. Smith. For particulars apply to W. H. Wells, 948 Broadway, New York.

SCRUBBING MACHINE.

Mr. Andrew Irion, of Femme, Mo., has invented a scrubbing machine, of which our engraving is a representation. A tank containing the water made alkaline by soda or soap, is arranged on wheels, as shown. The wheels have teeth on the interior of their rims, which gear with a pinion on a crank shaft, from which motion is communicated through a connecting rod to a large scrubbing brush. The water is sprinkled upon the floor in advance of the brush, the flow being controled by a valve actuated by a hand lever. In use, the hands grasp a horizontal bar, attached to the tank by brackets, and the machine is rolled over the floor or sidewalk to be scrubbed, which imparts a rapid reciprocating movement to the brush. The substitution of the erect posture for the awkward position on the hands and knees, in scrubbing by

hand, renders the work far more easy and cleanly to the operator; and, as a consequence, the work may proceed with greater rapidity. In the cleansing of large open floors, this machine may be used to advantage.

THE disastrous war in Europe has given great impetus to some of our fancy manufactures, as we are now prevented from obtaining French goods. The change is especially noticeable in the artificial flower trade. The annual consumption of these apparently trifling articles is estimated to reach $16,000,000, and the employment to women and girls it affords is a most important consideration.

Spurious Metallic Filling for Teeth.

One of the refinements of the art of deception is described in the following passage, for which we are indebted to the *Dental Cosmos*, of Philadelphia:

"A man called upon the doctor to have a tooth extracted, as he had pain all over the right side of his face, which he located in one of the molar teeth, that had apparently a very nice gold filling. The patient was dismissed without extracting the tooth, as the doctor thought that the pain was due to neuralgia, caused by something else, and treated him accordingly. The patient called again the next day, saying the tooth must come out, as it pained intensely. It was extracted, but no relief was afforded. He called on the following day, and desired to have other teeth removed. The molar tooth that had been extracted was broken open, and found to have been half filled with tin foil and finished with gold. The other fillings were then taken out of the remaining teeth, and found to have been in the same condition, thus making a galvanic battery. The patient was sent to a good dentist to have these fillings renewed with gold. Immediate and permanent relief was obtained."

The name of the ingenious dentist is withheld; had it not been we would have given him and his deeds a most undesirable publicity.

PERPETUAL MOTION.

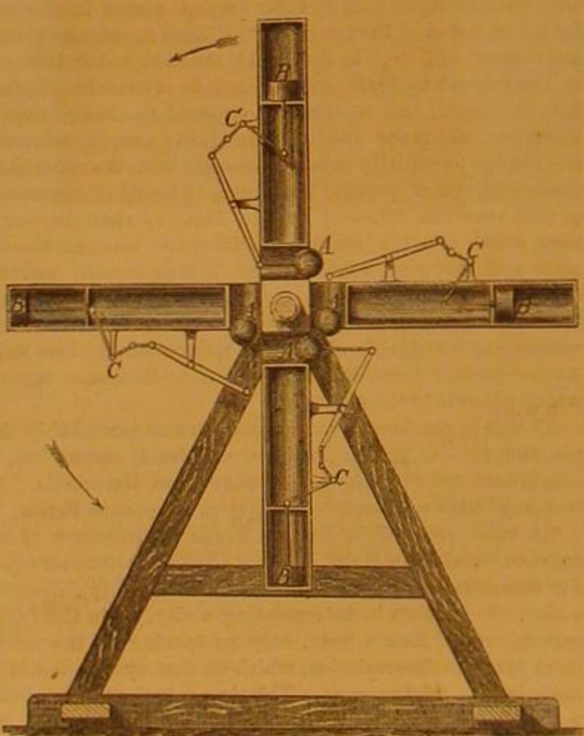
NUMBER X.

CARNOT'S OPINION OF PERPETUAL MOTION.

The celebrated physicist and mathematician, Carnot, has given his opinion on "perpetual motion," as follows:

From what we have observed regarding friction and other passive forces, it may be inferred that perpetual motion is a thing absolutely impossible, when only such bodies are employed as are not acted on by motive power, or any heavy body; for, as these passive forces, which cannot be avoided, are constantly resisting, it is evident that the movement must continually abate; and, from what has been said, it will be seen that, when bodies are not acted on by any motive power, the sum of active force will be reduced to nothing; that is to say, that the machine will be brought to rest when the amount of activity absorbed by friction, since the commencement of the movement, will have become equal to one half of the initial active force; and when the bodies are weights, the movement will terminate when the amount of activity absorbed by the friction equals one half of the initial active force; moreover, one half of the active force existing, if all the parts of the system have a common speed, equals that which is due to the hight of the point where, in the first instance of the movement, was the center of gravity above the lowest point to which it can descend.

FIG. 22.



It is easy to apply the same reasoning to constructions where springs are used, and generally to all such constructions where, abstracting from friction, the moving force, in order to bring the machine from one position to another, must consume an amount of activity as great as that which is absorbed by the resisting forces when the machine returns from the last to the previous position.

The movement will terminate still sooner, if any percussion takes place, as the sum of active force is always diminished in such cases.

It is therefore evident, that one must altogether despair of producing what is called the perpetuum mobile, if it be true that all the motive powers existing in nature consist in nothing but attraction, and that it is a general property of this power to be always equal at equal distances between given bodies; that is to say, to be a function that only varies in cases where the distance of these bodies varies itself.

This opinion may be appropriately followed by that of Dr. Lardner, given in the following extract:

There is no mechanical problem on which a greater amount of intellectual ingenuity has been wasted, than that which has for its object the discovery of the perpetual motion. Since this term, however, is not always rightly understood, it will be useful here to explain what the perpetual motion is not, as well as what it is.

The perpetual motion, then, which has been the subject of such anxious and laborious research, is not a mere motion which is continued indefinitely. If it were, the diurnal and annual motion of the earth, and the corresponding motions of the other planets and satellites of the solar system, as well as the rotations of the sun upon its axis, would be all perpetual motions.

To understand the object of this celebrated problem, it is necessary to remember that, in considering the construction and performance of a machine, there are three things involved: 1st, the object to which the machine gives motion; 2d, the construction of the mechanism; and 3d, the moving power, the effect of which is transmitted by the machine to the object to be moved. In consequence of the inertia of matter, the machine cannot transmit to the object more force than it receives from the moving power; strictly speaking, indeed, it must transmit less force, since more or less of the moving force must be intercepted by friction and atmospheric resistance. If, therefore, it were proposed to invent a machine which would transmit to the object to be moved the whole amount of force imparted by the moving power, such a problem would be at once pronounced impossible of solution, inasmuch as it would involve two impracticable conditions: first, the absence of atmospheric resistance, which would oblige the machine to be worked in a vacuum; and second, the absence of all friction between those parts of the machine which would move in contact with one another.

But suppose that it were proposed to invent a machine which would transmit to the object to be moved a greater amount of force than that imparted by the moving power, the impossibility of the problem would in this case be still more glaring; for, even though the machine were to work in a vacuum, and all friction were removed, it could do no more than convey to the object the force it receives. To suppose that it could convey more force, it would be necessary to admit that the surplus must be produced by the machine itself, and that, consequently, the matter composing it would not be endowed with the quality of inertia. Such a supposition would be equivalent to ascribing to the machine the qualities of an animated being.

But the absurdity would be still greater, if possible, if the problem were to invent a machine which would impart a certain motion to an object without receiving any force whatever from a moving power; yet such is precisely the celebrated problem of the perpetual motion.

In short, a perpetual motion would be, for example, a watch or clock which would go as long as its mechanism would endure, without being wound up; it would be a mill which would grind corn, or work machinery, without the action upon it of water, wind, steam, animal power, or any other moving force external to it.

It is not only true that such a machine never has been invented, but it is demonstrable that so long as the laws of nature remain unaltered, and so long as matters continue to possess that quality of inertia which is proved to be inseparable from it, not only in all places and under all circumstances on the earth, but throughout the vast regions of space to which the observations of astronomers have extended, the invention of such a machine is an impossibility the most absolute.

Fig. 22 is a drawing of a supposed perpetual motion, which the inventor says will not go, though he has worked at it twelve months. He has now given it up in despair, and vows he will waste no more time upon it. The central weights, A, each weigh one fourth more than the weights, B, at the extremities of the arms. The two sets of weights are connected pairs, each pair being joined by a lever, link, and bell crank, C. The action of gravity in the central weights compels the sliding weights at the ends of the arms to assume the positions shown in the engraving.

Had our correspondent, Mr. Geo. C. Phillips, of Alleghany, Cal., applied a little mathematical calculation to the verification of the truth or falsity of the principle of his device, he might easily have proved that it was a perfect balance, and saved himself twelve months of trouble and expense. The leverage of the outside is exactly counteracted by the leverage of the inside weights.

FIG. 23.

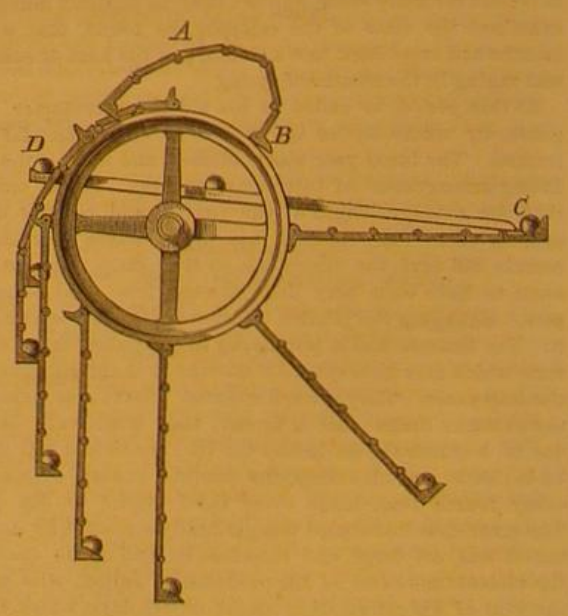


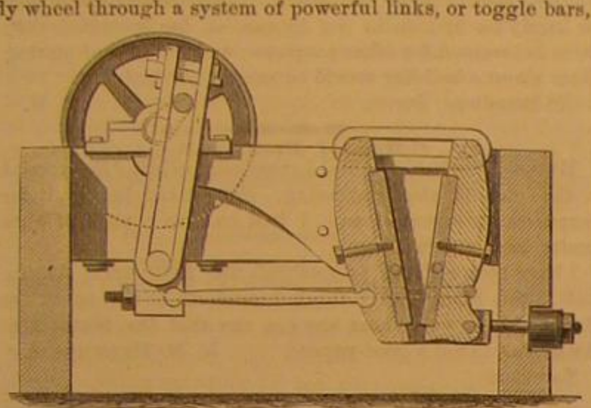
Fig. 23 is a device contrived by Mr. Geo. Linton, of Middlesex, England. The engraving is an end view of a series of vertical wheels, one only being seen. The lever, A, is represented in the act of falling from the periphery of the wheel into a right line. The lever is composed of a series of flat rods, connected by ruler joints, which said ruler joints are provided with a stop, or joggle, to prevent their collapsing at any time more than will bring any one of the rods which compose the levers at a right angle with the rod next to it. This lever is attached to the periphery of the wheel by the hinge joint, B, provided with the shoulder, to prevent its falling into any other than a right line from the center of the circumference of the wheel. The levers are furnished at their outer extremities with a bucket, or receiver, the bottom of which is sufficiently broad to retain the ball, C. The balls remain in the buckets till the buckets come into the position of the lever, D, when they are expected to roll out of the buckets on to the inclined plane, and by their own gravity roll to the other end of the inclined plane, ready to be again taken into the buckets.

QUARTZ CRUSHER.

In machines designed for breaking stones, crushing ores, etc., simplicity is absolutely essential. Pride and poverty are fully as congenial as rude work with complication in mechanism. The parts of such machines should therefore be few and massive, and be so put together that even common laborers may be able to keep them in running order.

Messrs. Varney & Rix, of San Francisco, Cal., have patented a machine which seems, so far as simplicity is concerned, to answer the requirements of the case.

Our engraving is a representation of this machine. The power is transmitted from cranks on the shaft of a heavy fly wheel through a system of powerful links, or toggle bars,



to pivoted jaws, which thus approach each other with great force at each revolution of the fly wheel, compressing the quartz and thus crushing it. The general principle of the mastication of food by the jaws of animals is very nearly approached in this machine.

ACTION OF THE RECIPROCATING PARTS OF STEAM ENGINES, AND ITS INFLUENCE ON THE PROBLEM OF HIGH PISTON-SPEED.

Read before the Polytechnic Club of the American Institute, by Chas. T. Porter.

Your attention is invited to a proposition, which, on its bare statement, will probably strike many persons as absurd. It is, that a reciprocating engine is, with respect to the line of centers, identical with a rotary engine; reciprocation is, in the line of motion, identical with rotation; the reciprocating parts of an engine, at the instant when the direction of their motion is reversed, exert a force, which is precisely the same centrifugal force that would be exerted by them continually if they were revolving with the crank; so that reciprocation may properly be defined to be rotation in a straight line.

I am well aware that the doctrine that the reciprocating parts of an engine exert a force on the dead centers where they are at rest, when their motion in one direction has ceased and that in the opposite one has not yet begun, is rank heresy; as much so as was once the assertion that the earth revolves on its axis. It is, however, equally true. The demonstration of it is quite simple, and I do not doubt that at every step I shall have your entire and cordial concurrence. If we find ourselves on ground not before trodden, we shall nevertheless be sure that it is firm and solid ground.

It may be observed here, that the action which we are to investigate has no *necessary* connection with high piston-speed. Although it is what makes rapid speed practicable, and although a correct understanding of it wholly removes any theoretical objection to the employment of such speed, still it takes place at all speeds, varying only in the amount of centrifugal force developed, according to the law of central forces, namely; directly as the mass, directly as the diameter of the circle when the number of revolutions is constant, inversely as this diameter when the velocity is constant, and as the square of the speed in a given circle.

We know that the motion of a piston controlled by a crank is not uniform, but, commencing from a state of rest, it becomes at the mid stroke slightly in excess of that of the crank-pin, and at the termination of the stroke has been reduced back to nothing. In giving the piston-speed of an engine, we always name its mean speed, found by multiplying the length of the stroke, in feet, into the number of strokes made per minute; but the speed attained at the middle of each stroke is about 57 per cent greater than this, having the same relation to it that the semi-circumference bears to the diameter of a circle.

Let us take, for illustration, the case of a horizontal engine, of 16 in. diameter of cylinder, by 30 in. stroke, the reciprocating parts of which weigh 1200 lbs., and which makes 122·3 revolutions per minute. The mean piston-speed is 611·5 feet per minute, while that reached at the middle of each stroke is 960 feet per minute, or 16 feet per second.

The first question requiring to be answered is: What is the amount of accelerating force, constantly exerted through a distance of 15 inches, that is required to impart to a body of 1200 lbs. weight a velocity of 16 feet per second? We suppose the motion to be without friction, and are inquiring only for the force required to overcome the inertia of the mass. The laws of falling bodies will furnish the answer to our question.

The motion being horizontal, gravity has no effect, either to produce or to destroy it; but a force of 1200 lbs., equal to the weight of these parts, would, by being constantly exerted horizontally through a distance of 16·083 feet, give to them a velocity of 32·166 feet per second, this being the velocity imparted by gravity to a falling body.

But what velocity would this force impart, by acting through a distance of 1·25 feet? The velocity acquired by a body accelerated by a constant force, varies as the square roots of the distances through which the force acts. Thus, a falling body, to acquire a double velocity, must fall through four times the distance, and to acquire five-fold velocity, it must fall through twenty-five times the distance; and so the force equal to their weight, acting through 1·25 feet, would impart to the reciprocating parts a velocity of 8·968 feet per second.

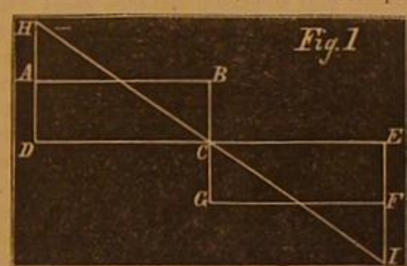
$$\frac{32{\cdot}166 \times \sqrt{1{\cdot}25}}{\sqrt{16{\cdot}083}} = 8{\cdot}968$$

But if 1200 lbs. will give a velocity of 8·968 feet per second, what force will be required to impart a velocity of 16 feet per second? The forces required to impart different velocities by acting through a given distance, must vary as the squares of the velocities imparted. Thus, to give to a body in moving through a distance of 16·083 feet, a velocity of 64·332 feet per second, or double that which gravity would impart, the accelerating force must be equal to four times its weight, and so the force required to impart to a body of 1200 lbs. weight a velocity of 16 feet per second by acting through a distance of 1·25 feet, is 3820 lbs.

$$\frac{1200 \times 16^2}{8{\cdot}968^2} = 3{\cdot}820$$

We have thus completed the first step in our demonstration. There can be no doubt that our piston, crosshead and connecting rod have attained a velocity of 16 feet per second, that this velocity has been imparted to them in moving through a distance of 15 inches, and that they must have been accelerated by a force, supposing it to have been exerted constantly, of 3820 lbs.

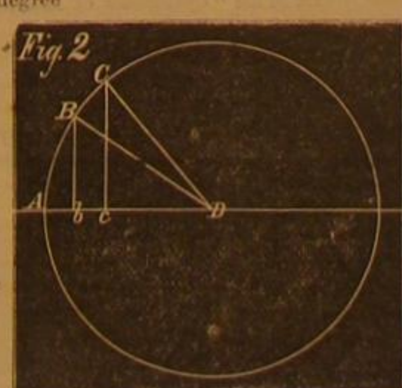
But it is obvious that the force accelerating the motion of a piston cannot be a constant force, because if it were so, then at the middle of the stroke, where acceleration ends, it must cease abruptly, and retardation must commence in the same manner, as would be illustrated by the two parallelograms, A B C D and C E F G, in the accompanying figure.



Now we know very well that, instead of this, acceleration passes at the mid-stroke into retardation, in a manner wholly insensible.

How shall this mystery be explained? There are various methods, more or less abstruse, of reaching the explanation, but there is one that is exceedingly simple, indeed so much so that it is surprising that engineers are not uniformly familiar with it. It is found by almost the mere inspection of the table of versed sines.

The motion of a piston, disregarding the effect of the angular vibration of the connecting rod, is equal to the versed sine of the angle which the crank forms with the line of centers. The versed sine of any angle shows, then, the motion of the piston from the commencement of the stroke. If we take the versed sine of any degree, and subtract from it that of the preceding degree, the remainder will represent the motion of the piston while the crank is moving through the last degree.



Thus, in the above figure, while the crank is traversing the arc, A B, the piston is moving through a distance equal to A b, the versed sine of the angle, A D B, and so on.

The following table, which any one can complete, shows, in the first column, the versed sine, or total piston motion, for the first and last five degrees which the crank passes through while the piston is making a half stroke, and in the second column, obtained by subtraction as above, shows the motion for each one of these degrees.

The motion for each succeeding degree, of course, increases all the way, but in what ratio does it increase? This is the vital question. To answer it, we subtract from the motion for each degree that for the preceding one, and the difference shows the velocity imparted while the crank was moving through the last degree. In this manner we obtain the third column, showing at a glance the velocity imparted to the piston at each degree; and how wonderful is the revelation! The acceleration, at first nearly uniform, diminishes in an increasing ratio, which for the 90th degree is less than $\frac{1}{57}$ that for the first degree, and is just equal to the diminution in the acceleration for the 89th degree, showing how at the end of this degree it ceases altogether.

Degrees.	Versed sine, or total motion.	Motion during each 1°.	Velocity imparted during each 1°.	Differences.
1	·0001523	·0001523	·0003046	
2	·0006092	·0004569	·0003046	0
3	·0013705	·0007613	·0003044	2
4	·0024359	·0010654	·0003041	3
5	,0038052	·0013693	·0003039	2
86	·9302435	·0173992	·0000265	
87	·9476640	·0174205	·0000213	52
88	·9651005	·0174365	·0000160	53
89	·9825476	·0174471	·0000106	54
90	1·0000000	·0174524	·0000053	53

The motion during the first two degrees seems to be uniformly accelerated; but if we should go to a sufficiently high place of decimals, we should find the acceleration absolutely greatest on the very dead center.

It will be interesting to compare this diminishing acceleration with the uniform acceleration of the motion of a falling body. The following table represents the latter; decimals are omitted for convenience, but this does not at all affect the table for the purpose of this comparison. The second and third columns are derived from the first by subtraction, in the same manner as above.

Seconds.	Total distance fallen through.	Distance fallen in each second.	Velocity in feet per second imparted during each second.
	ft.	ft.	
1	16	16	32
2	64	48	32
3	144	80	32
4	256	112	32
5	400	144	32
6	576	176	32

If now, at each degree, we draw an ordinate, perpendicular to the line of centers, and of a length proportionate to the acceleration at that degree, we shall find that a straight line connects all their extremities, showing the acceleration to be represented by the right-angled triangle, D C H, Fig. 1. This any one can verify.

It is thus revealed to us, that precisely on the dead center the acceleration of the force of the piston's motion is double its mean acceleration, and the force required to produce it is twice that which would be constantly required; or, in the case we are considering, is 7640 lbs., equal to a pressure of 38 lbs. on each square inch of piston area.

The fact is so important, that it may be well to exhibit it also in another manner. We have seen that the motion of the piston is, for the first two degrees, accelerated in a manner which may be regarded as uniform. The distance moved through by a body uniformly accelerated, increases as the square of the time, as shown in the last table.

If, then, we take the coefficient of the motion for the first degree, ·0001523, and multiply it by the square of the number of degrees traversed by the crank in one second, we shall have the distance which the reciprocating parts would be moved in one second, at their original rate of acceleration, supposing it to be continued uniformly during that time, if the length of the crank equaled 1. This distance is 82·05254 feet, for the crank moves in one second through 734 degrees, and $734^2 \times {\cdot}0001523 = 82{\cdot}05254$. The length of the crank is, however, 1·25 feet, so that the distance moved through would be 102·5 feet. This distance, divided by 16·083, gives the quotient 6·37, which is the accelerating force in terms of the weight of the parts. But $1200 \times 6{\cdot}37 = 7644$, the same result as before.

The second point in our demonstration is now established that on the dead center, where motion begins to be imparted to the piston, it is imparted in double the average ratio, and the force required for this purpose is just twice as great as a uniform accelerating force would have to be, to give to it the velocity that it has at the mid-stroke.

The retardation of the motion of the piston by the crank, bringing it to rest at the end of the stroke, is the reverse of the acceleration, commencing insensibly at the middle, and culminating at the termination of the stroke, and is represented by the triangle, E, C, I, Fig. 1. This, to one who has clearly apprehended the acceleration, must be sufficiently obvious.

We are arrived now at our final proposition, that the resistance offered by the reciprocating parts to this alternate acceleration and retardation is, at its culminating point, the dead center, precisely the centrifugal force that the same weight would exert continually, if it were revolving with the crank pin.

Let us examine this action in the light that has now been thrown upon it. We will suppose the steam to be suddenly shut off, so that the acceleration, as well as the retardation, is effected through the crank. We note, first, this distinction, that while at the mid-stroke acceleration passes when diminished to nothing into retardation commencing at nothing; at the centers, on the contrary, retardation passes at its maximum into acceleration at *its* maximum. A closer examination shows, however, that while, in the first case, the direction of the force changes, in the latter it does not change. This direction must be reversed twice in each revolution, and this reversal takes place at the middle of each stroke, and not on the center. The crank begins, at each mid-stroke to retard the motion of the piston, and opposes to it a continually increasing resistance, retarding it more and more rapidly up to the center line, at which point it begins *by a continuance of the same force*, to urge it in the opposite direction. The strain of the piston on the crank, in either direction alternately, begins insensibly at the mid-stroke, culminates on the center, and diminishes to nothing at the mid-stroke again, and this resistance, at its culminating point, is the centrifugal force which the mass would exert, if it were revolving instead of reciprocating; and at every other point is the horizontal component of that force.

This is readily established. First, the direction of the force is radial. Second, the coefficient of centrifugal force is the decimal, ·000341, which is the centrifugal force (in decimals of a pound), of one pound, making one revolution per minute, in a circle of one foot radius. This coefficient shows the centrifugal force of 1200 pounds, making 122·3 revolutions per minute, in a circle of 1·25 feet radius, to be 7650 pounds.* Third, this identity is practically proved by the fact that the reciprocating parts are balanced, in the horizontal direction, by an equal weight, revolving opposite to the crank, and at the same distance from the center. Fourth, an examination into the nature of the force itself shows that it *is* centrifugal. What is centrifugal force? It is the resistance which a moving body offers to being deflected from a right line, or, as it is radially at rest, its right line of motion being across the radial line at right angles, it is its resistance to being put in motion, towards the center, from a state of rest, and the amount of this motion is the versed sine of the angle, a definition which exactly describes the force under consideration.

But what is the influence of this action upon the problem of high piston-speed?

We see that it makes any engine, in effect, a rotary engine if the steam be shut off, the crank passing the centers under the strain of the centrifugal force of the reciprocating parts. But at ordinary speeds this force is developed only in a small degree, varying from 2 pounds to 10 pounds for each square inch of piston area, and of course the force of the steam is only to this extent expended in overcoming it, the excess becoming, at the instant of its admission, effective against the crank.

Nor, at more rapid speed does it become of marked value, unless considerable weight in the reciprocating parts and a short stroke be employed, since it increases directly as the mass, and inversely as the diameter of the circle, with a given piston-speed. By combining, however, rapid speed and short stroke with considerable weight in these parts, their centrifugal force may be developed to whatever extent we choose; and if this be in excess of the force of the steam, the engine with the steam turned on, becomes, in effect, a rotary engine. The crank passes the centers under a strain not wholly relieved; the force of the steam does not reach the crank at these points, but is absorbed in the mass, and is afterwards gradually imparted to the crank during the stroke.

It is certainly difficult to estimate too highly the value of this action. By means of it, the shock of the steam on the center may be avoided wholly, or in any degree; the excessively intermittent pressure caused by working steam at a high grade of expansion is transformed, as by magic, into a steady and uniform rotative pressure on the crank; the fly wheel is relieved of its most trying offices, and the shaft from the excessive torsion in alternate directions that is produced by its action; and a smooth and gliding movement is attained, with a closer approximation to uniform motion than the crank has been supposed to be capable of giving.

It is curious to observe how exactly opposite to the truth all the engineering traditions on this subject turn out to be. We have been taught that the reciprocating parts of an engine were passive on the centers, that the great difficulty encountered in the attempt to employ high speed was the necessity of reversing their motion, that they should therefore be made as light as possible, and long strokes should be employed, so that the changes in the direction of their motion might be as few as possible. Now we know that their centrifugal action on the centers is all important to a high speed engine, and that to render this most serviceable we must employ considerable weight and a short stroke.

The field is a very large one; I limit myself to the fundamental principle which I have endeavored to explain. This being established, all theoretical objection to the employment of high speed vanishes. When the dead center is stripped of its imaginary terrors, we must perceive the dawn of a new day in the history of the steam engine.

* This furnishes us a simple rule for calculating this force. Multiply together the weight of the reciprocating parts, the length of the crank in feet, and the square of the number of revolutions per minute, and multiply the product by the decimal ·000341.

Sulphuric Acid from Gypsum.

As is well known, numerous attempts have been made to procure sulphuric acid from the widely-distributed gypsum, or sulphate of lime; but hitherto without success. Some time ago it was stated that dolomite, a mineral consisting of carbonate of magnesia and lime, may be decomposed by gypsum—carbonate of lime and sulphate of magnesia (bitter salt) being produced when they are both mixed as fine powders and lixiviated with water. From the latter the sulphuric acid can be readily separated by chloride of sodium, the concentrated solution of both yielding sulphate of soda and chloride of magnesium. In the *Neue Jahrbuch für Pharmacie*, 1870, page 204, H. Reinsch denies that gypsum can be decomposed by dolomite. He prepared an intimate mixture of the powdered minerals, and treated it for three months with water, allowing the liquid to drop from a filter, but without even obtaining a trace of bitter salt. After this time he kept the mass boiling for three days, the waste of water by evaporation being constantly re-supplied. The filtered liquid, being boiled down, left a yellowish cake, consisting of two thirds gypsum and one third of other salts, as nitrate of magnesia, chloride of magnesium, nitrate of lime, and traces of bitter salt. Hereupon Reinsch made trials in another direction. He mixed two parts of powdered gypsum with one part of carbonate of ammonia, which contains one and a half equivalent of ammonia. Upon being triturated with water, a liberation of gas took place which lasted for several days, and as the liquid was ultimately heated to the boiling point, a very vivid disengagement of pure carbonic acid was produced. By this process, carbonate of lime, and sulphate of ammonia were formed, and part of the carbonic acid of the ammonia salt was disengaged as gas.

The gypsum was completely decomposed. At the ordinary temperature the decomposition takes place without interruption, but slowly, while at the boiling point it becomes very rapid. A very soft carbonate of lime is thereby obtained, which, in large quantities, might certainly be utilized. In order to separate the sulphuric acid from the ammonia salt, it would only be necessary to subject it to sublimation with common salt, and to convert the resulting chloride of ammonia with carbonate of lime into carbonate of ammonia. It is thought probable that this method of producing sulphuric acid may be carried out on a large scale, provided that the carbonate of lime formed during the first decomposition, and the chloride of calcium formed at the second one, can be utilized, of which, according to Reinsch, there cannot be any doubt.

The chloride of calcium, at least, has repeatly been recommended as a means for keeping streets free from dust. In this manner the inexhaustible sources of gypsum could be employed for the manufacture of sulphate of soda, which forms the basis of the fabrication of glass and soda.

Correspondence.

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

Beams and Girders.

MESSRS. EDITORS:—Mr. Severson, in the SCIENTIFIC AMERICAN of Dec. 10, last, criticised me freely on the subject of the strength and strain of beams, etc., which is all right; but I am sorry for the reputation of the profession to which he attaches himself, that he should make so many blunders in so short an article. He evidently does not belong to that class of engineers to which I referred in a former article, for he differs from all of them, in every point he advances.

It will be observed that, on page 307, SCIENTIFIC AMERICAN, Vol. XXIII., I assumed two positions, differing from those advanced by the *Builder*. The first, which was in relation to the strain to which a beam is subjected by a weight laid upon it at different points between the supports, is expressed by the following formula or general proportion:

$$A \text{ varies as } BC \times CD$$

in which A is the strain to which a beam is subjected, by a weight laid on it, at any point, and BC and CD are the segments of the beam between this point and the supports. For authority see "Gregory's Mathematics," art. 2, page 402; "Practical Book" of reference, by Chas. Hazlett, and Prof. Hackley, of Columbia College, page 265; "Scribner's Engineer's and Mechanic's Companion," page 129, Note 1.

The second relates to the strength of beams, and is expressed by the following general proportion:

$$S \text{ varies as } \frac{bd^2}{l}$$

in which S equals the strength of the beam, b the breadth, d the depth, and l the length. See "Scribner's Engineer's and Mechanic's Companion," page 127; "King's Notes on Steam," art. 3, page 207; "Gregory's Mathematics, art. 22, page 405; "Mahan's Engineering," first equation on page 387; reports of Du Hamet and M. de Buffon, to the French Government, as given by Robert Stuart in his "Cyclopedia of Architecture," article, "Mechanical Carpentry."

Yet, in the face of all this authority, our friend Benjamin Severson, mechanical and civil engineer, of Washington, D. C., is bold enough to tell us, with regard to the first of the above propositions, that the strain varies "inversely as the distances." And with regard to the second proposition, that "the positive statement of Mr. Pearson appears to be equally erroneous."

Again, in attempting to enlighten us upon the "strain of beams," resulting from a load laid evenly over the whole length, he says: "Under loads thus uniformly applied, the strains increase as the squares of the spans." While all the authorities above quoted unite in telling us that the strain at any point of a beam, resulting from a load thus evenly laid over its entire length, is only the half of that resulting from laying the entire load on that particular point.

Again, in relation to his hypothetical beam, it is no disparagement of the formula that the beam will not support its own weight. It will be seen that the element of weight varies directly as the length, while the element of strength varies inversely as the length, the other dimensions remaining constant, so that it is possible for a beam, having all the strength assigned to it by the formula, to fail of supporting its own weight.

Furthermore, it will be seen by reference to his article on page 372, Vol. XXIII., SCIENTIFIC AMERICAN, that all his deductions are from appearances. He does not give the result of any experiment, or any analytical investigation, or quote any author in support of his sayings. It takes something more than simple appearances to do away the results of profound research for ages.

H. C. PEARSONS.

Ferrysburgh, Mich.

Fire Escapes.

MESSRS. EDITORS:—In a late issue of your valuable paper, one who signs himself "Humanity" suggests the idea of an apparatus to save persons from the horrible death of burning alive, as was the case at the burning of the Spotswood House, at Richmond.

The idea is a good one, but instead of a rope basket, as he suggests, two baskets, made of wire, should be used, one inside of the other. The outside one must be made of wire gauze $\frac{1}{20}$-inch mesh, or sufficiently fine to prevent a flame from passing through, yet, at the same time, allowed full circulation of air. The inside basket should be made less than the size of the outside one, allowing from two to three inches space between the two, and of wire $\frac{1}{4}$-inch mesh. Both should be placed on iron frames. To this should be attached a small iron chain, sufficiently long to be used by parties outside of the building, on the ground, in hoisting and lowering. A small pulley block and hook should be attached to the chain.

About the building in several places should be placed iron brackets with rings suspended to hook the blocks to in case of need. The principle of the basket is well understood to be that of Sir H. Davy's miners' lamp. It could be lowered through any amount of flame without the least fear of a person's clothes inside taking fire. These baskets would also be handy for firemen to use in case of fire, provided they were not wanted for other purposes; and the cost of placing them about a building would be merely nominal.

376 Broadway, Boston. M. H.

"Men of Progress."

MESSRS. EDITORS:—I feel I must acknowledge the receipt of the splendid steel engraving. For art and beauty, it far surpasses my expectations. I look on it as a piece of work pretty hard to beat.

I have been striving to establish the SCIENTIFIC AMERICAN in this place; and I think, henceforth, it will speak for itself. I have yet to hear any one say that the SCIENTIFIC AMERICAN is not a good paper. R. M. HUMPHREYS.

Tarentum.

Discovery and Invention.

The genius of the inventor is frequently undisciplined by culture; he is perhaps a workman of slender means and narrow views; hence the overpowering force with which his one idea seizes him. The discoverer, on the contrary, he who enlarges the boundaries of knowledge by important truths, must be both a genius and a scholar, a man of broad views, many-sided, healthy, up to the level of science in his time. Such conditions almost presuppose pecuniary independence. Hence, in reading the lives of the great lights of science—Pythagoras, Archimedes, Copernicus, Newton, etc.—we generally find them men of standing and influence, men who have leisure enough to devote themselves to science, and education enough to bring all varieties of existence within their ken. For want of this thorough scientific training, inventors are continually forced to test every step of their work; and it may be that only after hundreds of failures any success is achieved. Though, as Mr. Smiles says, "the steam engine was nothing until it emerged from the state of theory, and was taken in hand by practical mechanics," it must be remembered, also, that without theory it could never have been thought of, and that ignorance of scientific truths is often the most serious hindrance to practical men in their inventions. If Goodyear had known that oil of vitriol contained sulphur, he might have been able to utilize india-rubber in three years, instead of ten, after he had made that the purpose of his life. He found that oil of vitriol (he did not know it by the name of sulphuric acid) would sometimes produce upon the pure gum the very effect that he wanted, and he wasted time in numerous experiments trying to render that effect permanent, when a chemist would have suspected that the sulphur in the acid was the real agent, and have taken the steps at once that Goodyear took years later.

Perhaps the greatest, the most complete and powerful mind among men, is that of the man who is at once a great discoverer and great inventor. Archimedes, Newton, and Franklin are illustrious examples. The ancients attribute to Archimedes more than forty mechanical inventions, prominent among which is the endless screw, which he thought out while traveling in Egypt, reflecting on the necessity of raising the water of the Nile to points which the river did not reach. He likewise applied it as a pump to clear water out of the holds of vessels, to launching ships, and to propelling them through the water, a use which is still retained. The precision with which he directed his thoughts to the attainment of any desired result is well shown by his detection of the fraud practised on Hiero, King of Syracuse, by a goldsmith to whom the king had intrusted a certain weight of gold to be made into a crown. The king suspected, when he received the crown, that the gold had been adulterated, and he applied to Archimedes for a test. The difficulty was to measure the bulk of the crown without melting it into a regular figure. It was of the proper weight; hence, if any alloy had been substituted for a part of the gold, the bulk would be necessarily increased. Archimedes kept the subject continually in his thoughts, and the conditions of the problem became so clear to his mind that when he stepped into a bath one day, the vessel being full and water flowing over, he comprehended in an instant that the amount of water flowing over was equal in bulk to the body immersed. It followed at once that if the crown would displace more water than an equal weight of pure gold, it had been fraudulently adulterated. Without a moment's delay he jumped from the bath and ran to his own house, crying triumphantly, "Eureka! Eureka!" Yet, notwithstanding his ability in the application of scientific principles, he regarded his inventions as contributing far less to his glory than the additions which he made to speculative truth. "He was half ashamed," says Lord Macaulay, "of those inventions which were the wonder of hostile nations, and always spoke of them slightingly, as mere amusements, as trifles in which a mathematician might be suffered to relax his mind after intense application to the higher parts of the science." He knew the superior value of his purely theoretical pursuits as mental discipline, and as indications of mental power. Hence he requested that his memory should be perpetuated as far as he could determine the manner of it, by his discovery that a sphere is exactly two thirds of its circumscribing cylinder; and, accordingly, a sphere inscribed in a cylinder was sculptured on his tomb.

Before quitting this subject, it may be well to notice the fact that inventions are largely based on the state of knowledge at the time, and are consequently often claimed by several persons who have worked independently of each other. Invention is at once the cause and the measure of civilization. When the world was ripe for printing, printing was accomplished, either by Koster, Gutenberg, Faust, or Schœffer. When the telescope was needed, the telescope must be invented, whether by Hans Lippershey or Galileo. The honors of the steamboat are disputed, and claimed by almost every civilized country under the sun. A want thoroughly felt tends to bring out its supply. It would be interesting to look over the records of the Patent Office, to find out in what year the people of the United States felt most keenly their need of improved mouse traps, and when the imperfection of their coffee mills became a burden. Even in these things, demand regulates supply, and anxiety for perfection in the merest trifles is an indispensable condition of progress.—*Am. Ex. and Review.*

Burning and Unburning.

Abstract of a lecture by Dr. William Odling at the Royal Institution, London.

Dr. Odling began by explaining the first principles of combustion, and showing the simplest methods of lighting a match. When speaking of the old method of obtaining a light by means of flint and steel, he exhibited the "steel mill" once in common use among English miners, to give them just enough light to proceed with their work. It consisted of a little steel wheel driven by multiplying gear, and made to rub against a piece of flint; by this method a continuous shower of sparks could be kept up. He then exhibited the old method of obtaining a light by means of a piece of bent steel, one part of which was allowed to hang down over the knuckles of the left hand, and this part was struck with a piece of flint held in the other hand. With each blow a few sparks were struck off, and these sparks were allowed to fall upon carbonized rags, better known as "tinder;" the tinder at once began to smoulder; this smouldering was increased by blowing; so that at last there was ignition enough to set fire to a splint of wood, the end of which had been previously coated with sulphur. The lecturer remarked that on a cold winter's morning this tedious method of obtaining a light was a very serious thing. He then showed some of the more recent methods of producing flame, and among others he lit the gas jets of the theater of the Royal Institution with sparks of electricity.

The lecturer then spoke of ordinary examples of combustion, such as is seen in gas flames, candle flames, and the household fire; he pointed out that coals, candles, and other substances gradually disappear as they burn, and he asked, "Where do they go to?" An ordinary sperm candle while burning loses in weight about two grains per minute, and it burns down at the rate of one inch per hour. All this burning, however, goes on in common air; exclude the air and the fire soon goes out, as it unites with the one fifth part by volume of oxygen gas contained in common air. To illustrate this Dr. Odling took a very large glass tube, full of air, into which he poured a small quantity of a strong solution of pyrogallic acid and a little caustic potash; thus a solution of pyrogallate of potash was formed. He then closed the end of the tube, and shook up the liquid inside it; consequently, as fresh pyrogallate of potash absorbs oxygen with very great avidity, the solution took up all the oxygen contained in the air in the tube, reduced its bulk by one fifth, and left nothing in the tube but pure nitrogen. This nitrogen, he then proved by experiment, would not support combustion.

Dr. Odling pointed out that, although mercury does not oxidize in the air at ordinary temperatures, it rusts very slowly when it is kept at a high temperature, and then it changes slowly into red oxide of mercury. Dr. Odling applied heat to red oxide of mercury contained in a tube, and thus drove off the oxygen once more; he mixed the oxygen thus made with five times its bulk of nitrogen, then proved by experiment that the resulting mixture had all the properties of common air.

In another experiment he proved that the chief products of the combustion going on in a candle flame were water and carbonic acid gas; a common sperm candle, weighing $2\frac{3}{4}$ ounces, produces in burning no less than $3\frac{1}{4}$ ounces of water, or more than its own weight. The additional weight of the product of combustion is, of course, due to the oxygen taken from the atmosphere.

At the close of this lecture Dr. Odling exhibited the ignition and combustion of the metals—silver, cadmium, zinc, and thallium. A hollow was scooped in the top of the lowermost carbon point of the electric lamp, and in this hollow a piece of silver was placed; when the upper carbon point was allowed to touch the silver, the electrical current quickly raised the silver to boiling temperature, and on separating the points, a broad brilliant arc of vapor of silver played between them. This phenomenon, magnified by the lenses of the electric lamp, was projected upon the screen, forming a beautiful green luminous arc, apparently about six feet long. Cadmium gave a more subdued bluish green light, and the solid oxide was seen to assume curious network forms upon the lower carbon point. Zinc burnt with a purple flame. Thallium gave a magnificent green arc of very considerable length.

Dr. Seyferth's Process for the Purification of Sirups and Molasses in the Manufacture of Sugar.

The juices and liquors employed in the first extraction of sugar from the raw material it is contained in, as well as the sirups resulting from the sugar refining processes, all generally contain a certain quantity of alkaline substances, varying, however, in quantity with the various conditions of the soil on which the beet roots have been grown and the mode of cultivation. The juice of the ripe sugar-cane, however, is at the moment of being squeezed out of the cane slightly acid to test paper. By treating the saccharine juices with milk of lime, several of the bases of the alkaline salts present in the juices are separated from the acids they were at first combined with, and by thus being set free and remaining mixed with the sugar, impede its crystallization. One part of alkaline matter can absorb as many as four parts of sugar; and some kinds of molasses (chiefly from beet root) contain as much as 8 per cent of alkali.

The means hitherto tried to remedy this defect; namely, neutralization of the alkalies by acids, have failed in practice, chiefly for two reasons—first, because the acids have not been applied at such a stage of the process of manufacture as to enable the acids to seize upon the whole of the alkalies; and secondly, because it has never been possible to prevent the injurious effect of even a very slight excess of acid upon the sugar itself; while, moreover, a difficulty is encountered by the very variable quantity of alkali present, whereby the proper quantity of acid to be applied varied every moment, thus rendering its application totally unsuited in any but very skilled hands. Among the acids applied, sulphuric and phosphoric have been most used, but their use could not but be very limited, since even a very slight excess of acid was far more to be dreaded, on account of its highly injurious effects upon the sugar than almost any amount, so to say, of alkalies. Sulphurous acid has been used and recommended in various forms, even as far back as 1810 (Proust), both on account of its activity as acid in saturating alkalies, as well as its power as a bleaching agent, by thus rendering the sugar more white-colored.

Dr. Auguste Seyferth, managing director of the Brunswick sugar (beet root) refinery, has hit upon a plan for the use of sulphurous acid, which (according to the unanimous and unbiased testimony of no less than one hundred proprietors of establishments wherein the processes invented and brought out by the doctor, since September, 1869, are applied) answers the purpose admirably, yielding more produce and of better quality in every respect.

The process alluded to consists essentially in the introduction of sulphurous acid, either in gaseous form, or in very weak aqueous solution, into the vacuum pans. By this arrangement it is possible to bring all particles of the sugar solution (sirup) into contact with sulphurous acid, and to eliminate, by the joint action of heat and vacuum, any excess of the acid, which, however, not only saturates free alkalies and carbonate of lime, but also sets the organic acids, which might be present as alkaline salts, free from these combinations; the sulphurous acid taking hold of the bases they were combined with, while the greater part of these organic acids are volatilized along with the steam, and thus the sulphurous acid promotes the good and ready crystallization of the sugar, while its action as a decolorizer comes also advantageously into play.

The Seyferth process embraces two main operations; namely, the manufacture of the sulphurous acid as gas, or as aqueous solution, and the application of the acid (chiefly in aqueous solution, being more readily manageable) and its introduction into the vacuum pans. The sulphurous acid is manufactured at the works (beet-root sugar manufactories or sugar refineries) by the well-known expedient of burning sulphur in suitably constructed ovens, and carrying the products of combustion, previously cooled so as to condense any vapors of sulphur, into a leaden vessel wherein the gas is met by a suitably arranged current of water so as to become entirely absorbed.

The aqueous solution thus obtained is put into casks, or other suitable vessels, and from these a tube, provided with taps, leads to the vacuum pans, wherein the liquid is sucked simultaneously with the sugar solution. The party in attendance upon the boiling in the vacuum pans, while causing the sulphurous acid to be aspired, takes care to test from time to time (this is done by means of a contrivance technically known as proof-stick) the contents of the pan by applying blue litmus paper, so as to insure the contents of the pan remaining alkaline; but if by a mishap the acid is in excess this is remedied by sucking in a fresh quantity of sugar solution, while a slight increase of the rapidity of evaporation (the turning on of more cold water to the condensers) will rapidly eliminate and volatilize any excess of sulphurous acid, which, when in quantities of 50 to 100 kilos, excess of the weak solution, does not affect the sugar.

The quantity of sulphurous acid solution applied varies from 4 to 8 or from 10 to 15 per cent of the bulk of liquid (sirup) to be evaporated, but these figures are not absolute, but only relative, since experience has already proved that the requirements differ for different localities. The process alluded to is stated to possess, besides the advantages already named (production of better quality and larger quantity of sugar) the good qualities of being applicable at very little cost; to require no inconveniently large space; to be applicable to any already existing manufactory without causing any temporary stoppage of work; and its application is readily learned by the sugar boilers.

According to communications made on this subject by the members assembled at the general meeting of German sugar manufacturers and refiners, at Berlin (last May), and a similar meeting lately held at Prague, this process is highly appreciated, and largely eulogized as an immense improvement in this branch of industry.—*From the London Artizan.*

Sewing and Cooking.

Says the *Journal of Gas-lighting*: A French lady has been calling attention to the deficiencies of the working and lower middle classes in sewing and in cooking. Cooking seems, like music, a gift of certain nations. The French have it in perfection, stimulated by poor food and dear fuel. Italian cookery is atrocious; and German, where unimproved by French contact, greasy and unsavory. It is much to be desired that some of the fervor directed towards making women fit for physicians and barristers were directed to making them good wives and mothers. There may be exceptions, but we have never come across a charity school where even the principles of cookery were taught. While a smattering of superficial knowledge is distributed, the girls never get a good lesson on "the difference between simmering and boiling!" There is no sewing in our workhouse schools to be compared with that turned out of the convents of Belgium and France. Indeed, we should say that in the female orphan asylums round London more attention is paid to a parrot-like instruction in religious phrases than to any useful knowledge. Many of the girls turn out hypocrites; most of them, from the severity with which they are treated, liars; but it is very rare to hear of the manufacture of a good governess or a good domestic servant. The model prize girls are often female samples of Uriah Heeps. There is no reason why cookery should not form part of the daily education of every girl above eight years old who has to get her own living, or whose husband has to get his living. But there is no standard school book on roasting, boiling, stewing, frying, making soups, and cooking vegetables. Mrs. Beeton or Miss Acton could have produced such a manual, if any of the book-publishing religious societies had asked for such a necessity. As to sewing, the art will be found more cultivated in the higher than in the lower middle classes. A widow lady, who had been well trained at home and abroad as a governess, and in that capacity had acted in several noble families, on the death of her husband opened a day school in a district of rich London shopkeepers. One day she received a visit from a very grand lady, the mother of a pupil, and the wife of a thriving shopkeeper. She came to protest against her daughter being taught the art of plain sewing and cutting out body linen. "We are well satisfied," she said, "with Maria Jane's progress in music and other accomplishments, but we keep four servants, and my daughters need never do plain work." The school-mistress at first employed the ordinary common-sense arguments without effect. She added, "When I lived in the family of the Duchess of Blank, my four pupils, the Ladies, &c., were all taught to cut out and sew the garments they presented to the poor. It is my system—I cannot alter it." The name of the Duchess acted like a spell, and the purse-proud dame submitted. Such are the peculiarities of a large class in rich England. It is from the influence of the intelligent women who have been returned to the School Boards, that we anticipate a better system, better teachers, and more useful books in our elementary schools. The example will speedily spread to our many ill-managed school charities, the worst managed being those for girls.

Preservation of Iron from Oxidization.

Among the many processes and preparations for preserving iron from the action of the atmosphere, the following will be found the most efficient in all cases where galvanization is impracticable; and, being unaffected by sea water, it is especially applicable to the bottoms of iron ships, and marine work generally: Sulphur, 17 lbs.; caustic potash (lye of 35° B.), 5 lbs., and copper filings, 1 lb. To be heated until the copper and sulphur dissolve. Heat, in another vessel, tallow, 750 lbs., and turpentine, 150 lbs., until the tallow is liquified. The compositions are to be mixed and stirred together while hot, and may be laid on, as paint, to the iron.

MARINE GLUE.—Mix together, gum sandaric, $\frac{1}{4}$ lb.; gum mastic, $\frac{1}{4}$ lb., and methylated spirit, 8 lbs. When the gums are dissolved, add $\frac{1}{2}$ lb. turpentine, and mix this with a thick hot solution of the best glue (to which a little isinglass has been added to clarify it), and filter through muslin. The marine glue will be impervious to moisture, and will not soften in any ordinarily hot weather.

HOW TO CHOOSE A PUPPY.—Montaigne says: "Sportsmen assure us that, in order to make choice of a puppy from among a number of others, it is better to leave the choice to the mother herself. In carrying them back to their bed, the first one she takes up will always be the best; if we pretend to set fire to the bed on all sides, then the one she will try to rescue first." We would suggest in regard to the latter paragraph, that whoever may test the accuracy of the sportsman's receipt, be careful to not set the bed-clothes on fire in trying the experiment.

THE extravagant tendencies of the present generation suggest to a clergyman the inquiry whether it would not be better to devote half of one's energies to learning to live on a very small income, than to devote all of one's energies in struggling and waiting for a large income?

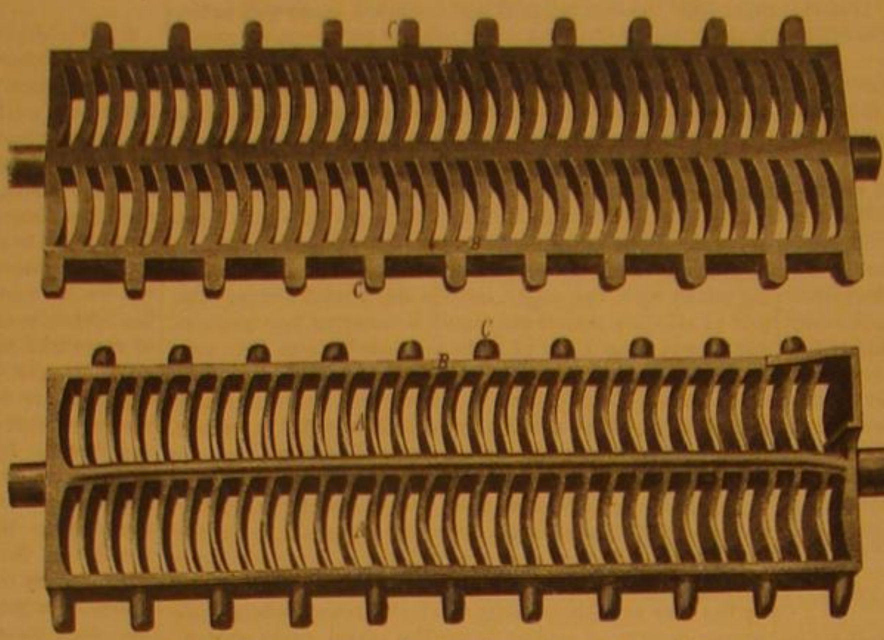
Improved Grate Bar.

Engineers have become thoroughly alive to the fact that the heating surface of boilers can never work up to its full efficiency without not only the proper amount of grate surface, but also such a construction of the grate that the fuel may be economically consumed. The combustion must not be partial, distilling off the fuel and sending it out of the mouth of the chimney in black volumes of smoke; it must be as complete as possible. Large heating surface avails nothing if the combustion of the fuel be imperfect, and the completeness of combustion depends primarily upon the grate, which must be of such a form that a full draft may be secured, yet be able to retain its form under the effects of heat, and support the fuel properly for the uniform distribution of air to the combustibles used.

A large number of patents have been issued for improvements in grate bars, and still inventions in this field increase and multiply. The demand for grate bars is so large that any bar which can fairly compete with those that have preceded it, is sure of sale, and the manufacture of such bars has grown into a large industry.

Our engravings show the form and construction of a grate bar, for which it is claimed that it effects a large saving in fuel, that it does not warp or twist, that it lasts much longer than the ordinary bar, and that it can be used in any furnace without the trouble and expense of making alterations.

The shape of the grate bar is such that a very large aggregate opening for the passage of air to the fuel is secured, resulting in more perfect combustion and greater rapidity in raising steam than is the case with many forms of grate bar in use.



GREENLEAF'S IMPROVED GRATE BAR.

Nut coal, slack, sawdust, shavings, and tan bark, can be successfully burned upon it, as is attested by those who have used it in the consumption of the combustibles named.

The bar is constructed with horizontally curved cross pieces, A, which act as braces, and in combination with the side plates, B, prevent warping or twisting, under great and unequal exposure to heat.

The grate, formed by the curved arch cross pieces, has a flat, even surface upon the top, so desirable in grate bars, and enables the weight of metal to be reduced, without increased liability of breakage from unequal expansion. The pieces also act as shears in cutting clinkers. It is claimed that actual use has shown that these bars will outlast two or three sets of ordinary bars. The bars, it is claimed, weigh less, per square foot surface measurement, than any other grate bar now in use, and the pieces are so constructed that they may be placed in any furnace without change in the bearing bars.

The exterior projections, C, on the side plates, B, form a series of apertures between the bars, when the latter are placed together in the grate, preventing the formation of blank spaces.

The under edges of the curved cross pieces are cast with a re-entrant curve, as shown in Fig. 2, which reduces their width, so that they do not readily clog up; and the ashes can readily be removed from the interspaces.

We have been shown testimonials in regard to this grate bar, which state that by its use a large saving in fuel has been secured, and also corroborating the claims made in regard to its durability.

Patented, Nov. 16, 1869, by Clements A. Greenleaf. For further particulars, address Greenleaf Machine Company, 319 South Tennessee st., Indianapolis, Ind.

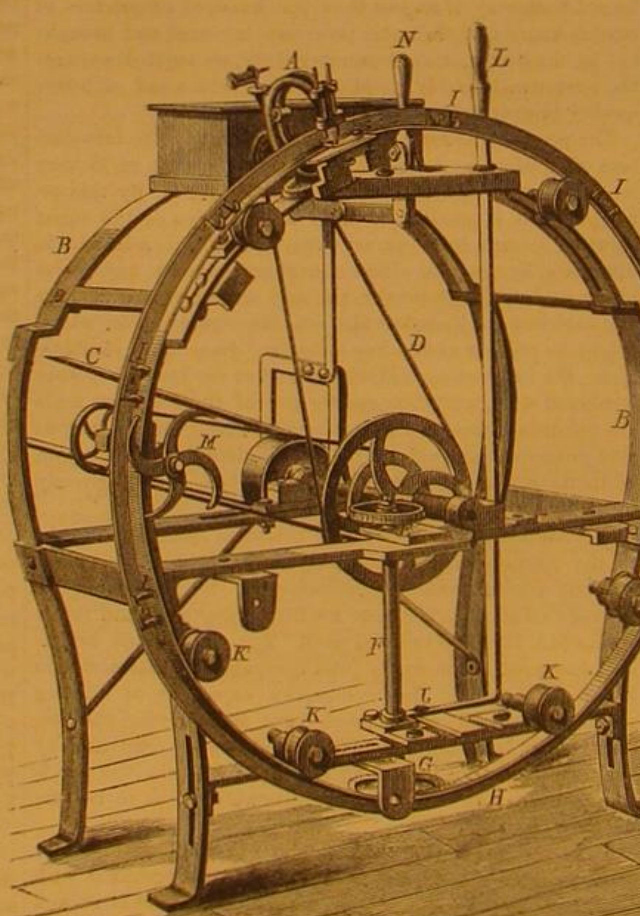
New Composing Machine.

The New York *Tribune* gives an account of a new composing machine, designed to supersede the use of fonts of type in printing. It says; The great feature of the invention is a mechanical device by which ordinary type setting and type distributing are dispensed with, and one hundred types are made to perform the service of a full font set in the usual way. The letters of the alphabet, together with figures, punctuation marks, and combination words, are arranged in regular order in a type-head two inches square, and are operated upon by keys, manipulated as in a piano. When the keys are touched, the type-head moves to its position, and action is had upon whatever letter or figure is touched, the type moving downward a prescribed distance, and making a printed impression on transfer paper. The platen on which the paper is laid is moved backward and forward by a feed-wheel for each impression of the type, and the spaces between the lines are produced by lateral motion by means of a ratchet wheel. In this way one hundred impressions are made per minute, and proofs can be corrected very easily. The impressions are finally transferred to a zinc plate, and printed by an improved lithographic press at the rate of 2,500 impressions per hour. In place of transfer paper a mold of clay or wax may be used to receive indentations, from which a stereotype cast can be obtained of uniform thickness, and ready for the press. The machine is driven with a treadle like a sewing machine, and occupies about the same space. It can be manufactured for $200, and the type-heads for $3 each. Every style of type borders, ornamentation, and also music, can be produced, only requiring one type to represent each character. The type-heads are easily changed, and as many as fifty styles can be employed by the compositor without rising from his seat. As originally patented, the types were arranged on the periphery of a disk or wheel, and the impressions, made upon prepared pulp or clay were justified with difficulty. By the improved machine, impressions are made upon paper, and justification and correction are accomplished without loss of time.

WE are glad to hear that the efforts to supply Nebraska with salt have been successful, and that saline water has been brought to the surface by an artesian well. A party of enterprising men in Lincoln city struck, at a depth of 600 feet, a stratum of sandstone, from which a torrent of salt water came upwards, and shot over eight feet into the air. When the well is tubed, a constant flow may be expected. The value of this discovery will be great, and a proper reward for Dr. Evans' untiring labors in the search. The strength of the saline water is estimated at 80 degrees.

IMPROVED SEWING MACHINE.

The invention which forms the subject of the present article is designed to provide a means for sewing goods together



in a continuous operation, as required in cotton mills, hosiery and bag manufactories, printing mills, and other similar works.

The stitching part of the machine may be of any approved kind of sewing machine now used, and is placed at A, as shown in the accompanying engraving, where it is sustained by the frame, B. The frame, B, also supports a central shaft with pulleys, as shown, which receives motion through the main driving belt, C.

The belt, D, conveys motion from the central shaft to the stitching part of the apparatus, A. Upon the central shaft is cut a screw thread which actuates the worm gear, E, and through it the vertical shaft, F. Upon the lower end of the vertical shaft, F, there is keyed a toothed wheel, G, which meshes into teeth (not shown in the engraving) on the back of the flanged feed-ring, H. This ring is suspended on flanged friction wheels, K, which sustain it vertically and laterally, but leave it free to rotate in the proper direction when actuated by the wheel, G.

At intervals around the flange of the feed ring, H, are placed hooks, I, upon which the edges of the cloth to be sewn are stretched, and are fed to the sewing attachment as the ring revolves in the manner described.

A sliding plate, J, which sustains the lower bearing of the vertical shaft, F, is moved back or forward by the hand lever, L, which throws the toothed wheel in or out of gear with the feed ring, as desired by the operator.

The friction rollers and all the moving parts below the central shaft are covered by a flat plate or shield, not shewn in the engraving, as when in place it conceals the working parts. To prevent the cloth from being carried under this shield, four bent arms, M, are attached to a short pulley shaft driven by a belt from the central shaft. These arms press the cloth off from the hooks on the feed ring, and thus released, it falls down upon the floor which supports the machine.

The hand lever, N, runs the stitching part of the machine into or out of gear, as may be desired.

We are informed by the inventor that this machine has stitched one thousand pieces of cloth, 28 inches wide, per day, with one hand, and it has stitched, in one day, forty-five pieces (of same width) more, with one operator, than was done by two operators with the Willcox & Gibbs sewing machine without the attachment.

Patented through the Scientific American Patent Agency, Nov. 1, 1870. For further information address W. A. Rayer or W. S. Lincoln, patentees, care Willcox & Gibbs, sewing machine manufacturers, 147 Tremont st., Boston, Mass.

A 30-Inch Gage Railroad in Ohio.

The Toledo *Commercial* having stated that the Piqua, St. Mary's and Celina Railroad Company had been incorporated on a capital basis of $400,000, to build between Piqua and Celina, through Miami, Shelby, Auglaize and Mercer counties, Ohio, about forty-four miles, a Piqua correspondent gives us the details of the scheme.

The country along the line is very populous and productive, and the question of an outlet by railway has long been agitated. But the Miami and Erie canal passes through it already; and though inadequate to the wants of the country, there is scarcely warrant for the construction of an expensive road. Last winter, the plan of a narrow-gage road, to cost, fully equipped, less than half a million of dollars, in place of one of the ordinary gage, costing a million and a half, was discussed. The design is identical with that of the Welsh railways, which have been so often described in engineering journals of late. A road of this kind, for trans- porting coal—the only one in this country as yet—is already in operation between Akron and Massillon, Ohio. A system of narrow-gage railways is also projected from Toronto, Canada, as feeders to the wide-gage roads now centering there. We learn that parties interested in the proposed Buffalo and Springfield road are now examining the Canada system, with a view to the adoption of the narrow gage. The Kansas and Denver Pacific Companies also contemplate reaching the mining regions near Denver, and probably at no distant day penetrating the Great Mountain Parks, and perhaps passing over the entire range, by narrow-gage roads, costing only one seventh as much as the present gage, where the latter is practicable. In all these cases the data, showing the entire practicability of these roads, and giving the cost of construction and operation, are such as to reduce the prospects of any such enterprise to a certainty.

To return to the Ohio road. The right of way is to be fifteen feet in place of forty feet; twenty pounds instead of fifty-six pounds iron will be required; the locomotives, weighing six tuns instead of thirty, will draw from ten to twenty loaded freight cars, each having a capacity of two and a half tuns; under freight and passenger cars alike (the latter seating twenty persons) four-wheel trucks will be placed; the ties will, of course, be nearer than on the wide gage; while finally, on account of the lightness of car equipment, in comparison with capacity, and of the central position of the trucks, both higher gradients and sharper curves will be practicable, greatly reducing cost of excavation, and other important items of construction.

In the present instance, the route presents no engineering difficulties—Piqua, thence following the canal to Berlin; thence to Minster, Bremen, and St. Mary's, where it will leave the canal, and make Celina its northern terminus.

The enterprise, which is to be begun in January, is in the hands of able and energetic citizens—among the corporators being Hon. J. F. McKinney, member of Congress elect; William Scott, one of the oldest citizens, and President of the Piqua National Bank; J. G. Young, Cashier of the same; Henry Flesh, a wealthy merchant of the city; Chas. C. Clute an experienced railroad builder, of New York city.—*Chicago Railway Review.*

Additions to Clubs.

For the information of subscribers the publishers of the SCIENTIFIC AMERICAN give notice that they will receive additional names at any time, to clubs already formed, at club rates.

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VOL. XXIV., NO. 6 . . . [NEW SERIES.] *Twenty-sixth Year.*

NEW YORK, SATURDAY, FEBRUARY 4, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

ENGLISH AND AMERICAN SCIENTIFIC, MECHANICAL, AND ENGINEERING JOURNALISM.

To those who have access to the files of English and American periodicals devoted to the above-named subjects, a very striking difference between those published abroad and at home, is apparent. Whether the average English reader peruses the contents of such papers as *The Engineer*, *Engineering*, *The Artizan*, etc., or not, it is certain he tolerates in them much that, persistently published in an American journal, would limit its circulation to a very few readers.

England has done much to render science popular with the masses, but this work has been done through books and lectures rather than through her periodical literature devoted to technical subjects. *All the Year Round*, *Macmillan's Magazine*, *Chambers' Journal*, and others devoted to general literature, have done vastly more for the enlightenment of the general English public, on matters of science, than all the technical journals put together. The short but interesting (because easily comprehended) articles on scientific subjects, which the periodicals last enumerated have printed, have been many of them models of their kind. They were written with the full appreciation of the fact that to the general reader technical language is an unknown tongue, and that to attempt reaching their understanding through its use, is the hight of absurdity.

What, for instance, could the general reader make of the page after page of mathematical formulæ with which, in a foreign cotemporary, Prof. Rankine sought to dignify the "gay velocipede?" There is not an American journal in existence that would have risked its popularity by the publication of the series of articles referred to.

Similarly, we find in many of the English publications like the one alluded to, prolonged serial discussions so technical in character, and so burdened with mathematics of the most abstruse kind, that we venture to say that not one in ten thousand Englishmen, not to speak of American readers, could read them understandingly in a year's time.

We have no means of knowing what the exact circulation of any of these papers must be, but from our stand-point of view it cannot be large. They seem, however, to be able to hold their heads above water, probably because their advertising columns are so liberally patronized, and because their regular price of subscription is much higher than American readers are willing to pay for the amount of reading matter they furnish.

If there is any one thing our English cousins know thoroughly, it is the value of advertising. Even papers of admittedly limited circulation are enabled to obtain a mass of advertising that makes a struggling Yankee newspaper publisher sigh that he was not born on British soil.

The tone of the discussions in most of the journals under consideration, is unexceptionable, except that to a Yankee reader it is wearisome on account of its length; and it puzzles an American to understand how many of the items can possess even a local interest to any.

If we should gravely inform our readers that the Messrs. Monotone had just successfully cast a bell for a rural church, or that Mrs. Fatpurse had bestowed upon the same edifice a stained glass window, or that the trustees of the village of Schaghticoke had just built a new schoolhouse, or supplied their town with water from a convenient spring; and if we should fill a column week after week with such puerile items, we should soon expect to hear from our correspondents that they did not care to pay for such garbage. Yet this is only (perhaps a somewhat extravagant) sample of what many English journals designed for general circulation treat their readers to in every issue.

A profuseness in letter-writing is also a marked feature of English papers. Everything is fish which comes to their net in this line, provided it is, or can be made grammatically correct. Personal explanations, long preambles, and verbiage are allowed to burden a very small modicum of fact. A correspondent writing a recipe for the relief of corns, and feeling it necessary to relate his sufferings with divers unlucky purchases in the way of boots, would be sure to be permitted to tell his dismal "yarn" without restriction, at least in many English publications we could name.

It would seem that quantity, and not quality, is the aim of the average English correspondent, and that to fill space with printed matter is the ultimatum of publishers of technical periodicals. There are, however, some honorable exceptions to be made in this respect.

A few periodicals in America have imitated the English model, but have never achieved extensive popularity. American readers prefer their mental food cut in thin slices. A single point made and well wrought out in a short article suits them better than exhaustive essays; and facts, rather than theories, are sought by them. Few have leisure to peruse very long essays; and if they have, they prefer them published in book form rather than serially.

SOLUBLE GLASS.

A great many uses have been ascribed to this substance, some of which are obviously absurd. Others which seem rational, have been failures in the hands of most people who have tried them, and we are frequently called upon to explain the causes of failure. This is in all cases difficult. The causes are in many cases obscure, even when ample opportunity is afforded for examination; and as we seldom or never have opportunity to make a thorough examination, we are generally unable to reply definitely and intelligently to such queries.

Our own experiments with this material have not been of the most satisfactory character. In general, we have found that after it has been applied for a longer or shorter period it becomes crumbly, and cleaves off from the surface of wood or iron. We are informed by a thorough chemist that such has uniformly been his experience, and that he thinks soluble glass becomes crystalline in structure when exposed to the action of the atmosphere.

A gentleman has just left our office who purchased some of this material from a dealer in this city, with a view to use it as a protective coating to iron. He says it would not long adhere to the metal. He applied to the manufacturers for directions in correcting his supposed errors in its use, but could get no information by which he could secure any improvement in his results, and consequently he voted "water glass" a humbug.

A clue to these failures is perhaps found in a lecture recently delivered by T. S. Barff, F. C. S., in the hall of the Society of Arts in London. It seems from the observations of Mr. Barff, that soluble glass (silicate of soda or potash) is frequently too alkaline for satisfactory use in painting. The best way to make these silicates is to fuse the component materials together in a reverberatory furnace. When cold they should be put into open vessels of hot water, when an oily liquid is formed, which is a solution of soluble glass. Either of the silicates of potash or soda, will generally be discolored from the presence of organic matter. This will, however, settle to the bottom, if the solution be allowed to stand for some days; when the clear supernatant fluid may be drawn off.

But even then, according to Mr. Barff, the solution is unfit for use in painting, on account of the presence of too much alkali. To remedy this defect, he recommends charging it as much as possible with silica, in the form of white powder obtained from the fluoride of silicon by precipitation with water.

We think it is probable that this alkaline quality would render soluble glass coating less permanent, wherever applied, and as Mr. Barff's experiments point out the way by which the defect may be remedied, a trial of his method could easily be made in any of the general applications of this substance for which it has been recommended.

TYPE-SETTING MACHINES.

The invention of a type-setting machine has justly been considered one of the most knotty problems ever attempted by mechanics. When it is considered how many characters and sorts are comprised in the upper and lower cases of the compositor's desk, and then that the exigencies of modern printing demand the multiplication of these cases, the frequent use of characters not found in the ordinary case at all, and also the fact that all these sorts must be kept unmixed in the cases, it would seem, at first glance, sheer madness to attempt to accomplish by automatic machinery what requires for its present performance intelligence to guide the work at every step. What the printers call "justification," that is, the spacing out of the lines so that they shall be of equal length, also requires that if words or syllables which cannot be divided, cannot be made to go entire into a line, the line must be lengthened by the insertion of spaces between the letters and the word be carried on into the next line.

It is evident that there must be intelligence to guide somewhere, and that if a machine shall ever be made that can be successfully employed to set type, it must require the attention of a compositor at every movement. But if a single motion of the compositor's hand could set in operation mechanism by which all the other movements, now required to place each type, or their equivalent, could be automatically performed the problem would be solved, provided the single movement could be made much quicker than the several movements are now made and the machine could be made sufficiently cheap and durable.

Machines have been constructed approximating these conditions very closely, considering the difficulties to be surmounted; but none have ever yet been able to compete with the living type-setter.

The host of difficulties attending the construction of type-setting machines might be greatly reduced could certain conventionalities of printing be relinquished. We have never been able to see any good reason, other than that "it is the fashion" for dividing words by syllables, or indenting paragraphs. Of course it would look very singular at first to forego these conventionalities, but their omission would certainly simplify the problem of type setting by machinery very much, if not open the way to its complete solution.

It is singular with what tenacity conventionalities like these are adhered to in the arts. We once saw a machine for putting up Seidlitz powders, which would do the work with extreme rapidity, yet the inventor informed us, the powders would not sell, because they were not put up in the way the trade had been accustomed to.

So long as the art of printing is hampered by the conventionalities we have mentioned and many we have not mentioned, there will be little chance for type-setting machines.

The inventor of a machine, an account of which is given in another column, has, we believe, hit upon the right principle in the construction of such machines, namely, that of making impressions of letters in some soft material from which casts can be taken.

THE USES OF HABIT.

There has been much declaiming on the part of a certain school of philosophers against the propriety of allowing the mind to run in a groove; or, in other words, to acquire any particular habit of thought. All habits, say these declaimers, are bad. There are no good habits. No man should do anything from mere force of habit. The effect of habit is to prevent thought and to open the door for error in reasoning. It cramps the mind within limits beyond which it cannot expand, and thus becomes an obstacle to healthy growth.

We regard these views as false in the extreme, and propose to devote a brief space to the presentation of the uses of habit, meaning, of course, good habit.

We assert that all expertness is the result of persistent habit. Perhaps this proposition can be best illustrated by examples of manual expertness. One of the most striking of these examples is the skill acquired in musical execution. At first the beginner finds the process of producing the various tones on an instrument in their proper sequence and length, very slow and painfully fatiguing. But by dint of long and arduous practice, he comes to a point where the fingers move by mere habit, without any sensible effort of his will. Indeed, the habit of doing what he has to do right, becomes so strong, that to attempt to do it wrong, would be almost as painful and tedious as his first attempt to acquire the proper method.

So in the performance of all kinds of mechanical work, dexterity is only to be acquired by habit formed by continuous practice. These facts seem so obvious in connection with manipulation, that it appears strange they should be disputed when applied to mental operations, or moral impulses.

As in manual operations a certain sequence and order, strictly followed, will enable the operator to perform each detail with greater facility and accuracy, and so shorten the time expended in reaching the desired result, as well as make the result more perfect, so a proper method gives rapidity and accuracy to thought. A mind trained to think methodically is a mind which has acquired habits of thought.

This methodical thinking is absolutely indispensable to success in many professions, of which we may cite "law" as one conspicuous example.

But perhaps in no field of study is it of greater importance than in invention, and this brings us directly to the main objection urged against habit in thought; namely, that it is a foe to originality. We take direct issue on this point, and assert that, on the contrary, it is the very basis of originality in so far as originality is useful or desirable.

The originality that is desirable in literature, in invention, in the arts, is employment of elementary principles in new combinations. We may refer to music again for an illustration of this point. The elementary combinations are represented by the exercises upon which the pupil is required to devote his practice. These exercises comprise difficult combinations, elements of composition which, in themselves, are dry and unpleasing, but which, combined in various ways, are formed in the compositions of the great masters. The elements being acquired by practice, the originality appears in the combination of them into new and melodious arrangements.

So in invention, a new device always consists of a novel arrangement of elements previously known. An original thinker, worthy of the name, is one who, while he perhaps explores new fields, employs in his research the facts of previous experience and the methods he has found valuable in former investigations, modified to suit the particular exigencies of the case. Let him throw aside ascertained facts and methodical thought, and he at once degenerates into a framer of baseless theories, which are original only because they are like nothing else.

THE SCIENTIFIC VALUE OF THE CENTRAL PARK.

Twenty years ago, Ambrose C. Kingsland, the Mayor of the city, transmitted to the Board of Aldermen a special message setting forth the limited extent of the places devoted to the public on the island of New York, and urging the importance of prompt action towards the creation of a great park for the moral, scientific, and sanitary benefit of the people. His message attracted much attention and originated the movement which finally ended in the establishment of the Central Park. The Mayor and Street Commissioners were a few years later, created Commissioners of the Central Park, and they associated with them "certain well-known citizens, whose public reputation, peculiar avocations, and cultivated taste, gave assurance that their opinions would possess the force of a clear, unbiased judgment."

Invitations were extended to Washington Irving, George Bancroft, Stewart Brown, and others, and these gentlemen met on the 29th of May, 1856, and organized by electing Washington Irving as President of the Board, and settled the preliminaries for carrying into effect the objects of the commission,

It is not necessary to pursue the history of this important work, as it is fresh in the memory of the youngest inhabitant, and down to a recent period was the pride and glory of our city. Our object is to call attention to the value of the Central Park as an agent in the scientific education of the people. We have before us the thirteen annual reports of the Board of Commissioners of the Central Park, and are gratified to trace in them the progress of public opinion in favor of the establishment of Museums, Zoological Gardens, Historical Collections, and Art Galleries, within the Park, for the instruction as well as the amusement of the people. The Commissioners have all the time recognized the value of such aids to knowledge, and have done all in their power to promote them.

As early as 1861, the Legislature chartered the American Botanical and Zoological Society, and gave the Commissioners of the Park authority to set apart a portion of the grounds, not exceeding sixty acres, for the use of the Society, for the establishment of a Zoological and Botanical Garden; and subsequently the Board, in compliance with the provisions of an act passed March 25, 1862, made to the New York Historical Society, a conditional appropriation of certain grounds about the Arsenal building for the purposes of establishing and maintaining therein, by the said society, a Museum of Antiquities and Science, and a Gallery of Art. It does not appear from the records that either of these societies ever availed itself of the opportunity thus afforded of obtaining a permanent foothold in the Park, and we fear that this neglect will result in a permanent loss to our community.

The Legislature of the State, at its last session, authorized the Board "to erect, establish, conduct, and maintain on the Central Park, a Meteorological and Astronomical Observatory, and a Museum of Natural History, and a Gallery of Art, and the buildings therefor, and to provide the necessary instruments, furniture, and equipments for the same."

In the meantime we have, in the city, the Lyceum of Natural History, chartered more than fifty years ago, the American Institute, founded forty years ago, and two new societies—the American Museum of Natural History, and the Metropolitan Museum of Art—they occupying, with the Historical Society, pretty much the whole field of letters, arts, and sciences.

So many societies and so many men of many minds, have evidently perplexed the Commissioners of the Central Park, and after waiting more than ten years to see what propositions these various organizations had to make, they appear to have taken the matter into their own hands, and to have had the act of Legislature, above cited, passed, to enable them to go to work on their own authority and in their own way.

The distinguished architects of the Park, Messrs. Olmsted and Vaux, and the efficient comptroller, Mr. Green, have, to our personal knowledge, been in constant communication with the leading thinkers and workers in this country and in Europe.

They have all of them traveled over the continent of Europe for the purpose of studying the construction of museums, zoological gardens, pleasure grounds, and galleries of art, and they have had the advice and assistance of the officers of all the organizations named above; and, as a result, have planned and carried forward the best laid scheme that was ever yet devised for the instruction and amusement of a people. As a part of this scheme, the Commissioners employed Professor B. Waterhouse Hawkins to reconstruct some of the extinct animals of this continent, and to establish a paleozoic museum. Their action in this matter has been highly commended by the scientific societies abroad, and by the unanimous approval of the best minds of our country. It has been said by geologists in England that no one thing has exerted so great an influence upon the study of geology and natural history in England, or has done so much to give popular information upon the origin of the plants and animals on the globe, as the restorations made by Professor Hawkins in the gardens of the Sydenham Palace. As soon as it was understood that this celebrated naturalist had come to the United States, a rivalry at once arose in the large cities to secure his services for their respective parks, but as he first landed in New York, the Central Park Commissioners were so fortunate as to make arrangements to have the work done in our city; and Mr. Hawkins had made considerable progress, when the work was summarily stopped by the new Commissioners, who, having just been appointed, naturally enough did not know what great value the scientific men of the country put upon the success of this particular undertaking. Under the management that has made the Central Park what it now is, there is no question that we should soon have had the best organized Zoological Garden, the most complete Museum of Art and Natural History, to be found in this or any other country. The Commissioners, after a study of many years, were in possession of all the requisite information to enable them to push the whole scheme to perfect success; and under their direction the Park would have become the right hand of our public schools as an aid to amusement, health, and instruction. They ought never to have been removed, and their departure from the conduct of affairs awakens the fear that the artistic and scientific value of the Park may be considered as gone forever.

How long will it take the present Commissioners to acquire as much knowledge of all the details of a great park as was obtained by the gentlemen who have just been removed from office, after a service of nearly fifteen years? Is there such a thing as scientific administration in this country, or must we always be subject to the whims and caprice of the moment? Surely if there were ever a public undertaking requiring knowledge and experience, it is the Central Park; and yet we see old public servants removed, and new men appointed, without any regard to the lessons of the past, or to services already rendered. And as a consequence we read that the work on the Paleozoic Museum is to be stopped, the Zoological Garden to be removed from the site which had been selected after years of study and consultation with experts. And what is to become of the other museums, we do not know, but we may be justified in predicting a foreclosure of the whole concern. What are the names of "the well-known citizens whose public reputation, peculiar avocations, and cultivated taste give assurance that their opinions would possess the force of a clear, unbiased judgment," who are in consultation with the present Board of Public Parks? What artists and men of science are members of the advisory board?

THE ECLIPSE EXPEDITIONS.

So far as heard from, the Eclipse expeditions seem to have been, if not total failures, unsuccessful in doing very much useful scientific work. Bad weather interfered with the operations of nearly all of them. We shall summarize as briefly as possible the news received up to the present date in regard to them.

Our European exchanges inform us that the Oran, Gibraltar, and Cadiz expeditions accomplished very little. The private expedition of Lord Lindsay had better luck, and, being favored by a break in the clouds at just the right moment, obtained, by means of long exposure, two pictures of the corona, and, by means of shorter exposures, seven photographs of the prominences, including one of Baily's beads. The official expedition at Cadiz, under the leadership of Father Perry, detected some bright lines in the spectrum of the corona; also that the light of the corona was polarized. The work of the Gibraltar expedition was spoiled by clouds, and Mr. Buckingham, who went to Estepona, thirty miles north, with a great heavy telescope and portable house for photographic operations, had all his labor in vain, for rain came on during the total phase. Some of the observers near Gibraltar had a glimpse of the total phase, and in that short instant detected bright lines in the spectrum of the corona. The Oran expedition was a total failure, because of bad weather. The expedition to Sicily also could do little, because of the clouds and bad weather; a telegram from Mr. Norman Lockyer says that the American observations of last year are confirmed.

The *Gibraltar Chronicle* publishes communications from a number of private observers on the Rock, one of whom writes:

As the moment of "totality" approached, and the moon's shadow, perceptibly traveling from west to east across the sun's disk, veiled his light more and more, earth and sky began to assume a weird, unnatural aspect; and the effect was so solemn and fascinating that it was with painful anxiety one saw one of the dense clouds, with which the sky was largely covered, moving speedily from the west in the direction of the sun, and threatening to hide the whole phenomenon. Heavy and looming, on it came, and at seven minutes before totality the view was completely lost. It was fortunately blowing hard. The friendly gale soon swept off the interloper, and at about four minutes before the eclipse the brilliant crescent again appeared. At 11h. 34m. 30s. ($1\frac{1}{2}$ minutes before totality), the clouds having left a considerable space of pretty clear sky, an extensive halo of deep shadow, with a faintly luminous fringe of prismatic rays, became visible. It was concentric with the sun, and in diameter about one third of the arc between the zenith and the horizon, seemingly about fifty times the apparent diameter of the moon's shadow. This halo, visible only for half a minute, was effaced by another cloud, which again obscured the view. After a minute's breathless anxiety, the "curtain again rose,"* revealing the longed-for *tableau*, a grand, impressive sight! It presented itself through a rent in the clouds not greater in area than ten times that of the disk of the moon's shadow. That part of the opening which was above the eclipsed orb was clear like the sun at twilight, and in it were visible to the naked eye the planets Venus, Mercury, and half a dozen stars. The remaining part was covered with a thin haze. The moon's shadow appeared to the eye, assisted by a somewhat weak binocular glass, to be a dark circular disk, with an even boundary and of uniform shade. Within the corona, and touching the circumference of this shadow, appeared five or six spots of brilliant carmine, varying in form and size, and at irregular distances apart. Two of these spots, or "red flames," as they are called, on the eastern side of the disk, and at about fifty-five degrees and eighty degrees, respectively, from the vortex, seemed decidedly the largest and most prominent; they were tongue-shaped, and protruded about one sixth the width of the corona. In their neighborhood the corona was brightest and widest. There, too, the rays of the corona appeared to be gathered more distinctly into groups than elsewhere, faint shadows being visible between the groups. The corona consisted of brilliant rays of extremely faint prismatic hues; these rays, at first sight, appeared pretty evenly distributed all round, but closer examination seemed to detect the fact of their being bundles of rays in nearly regular groups. The width of the corona was about one eighth the apparent diameter of the moon's shadow. It was very nearly concentric with the disk of the shadow; its boundary was well defined, but "jagged;" the perimeter, except opposite the two most prominent red flames above mentioned, where the boundary slightly protruded, was circular. It was blowing a gale of wind while these notes were taken, which interfered somewhat with the steadiness of one's sight, either naked or assisted by glasses.

The scientific world will feel great disappointment at the results of these expeditions. It was hoped that the success, of last year in America might be followed with equal success this year in Europe, and that more light would be shed upon the great scientific problem of the sun's constitution, and the origin of solar heat and the mystery of the corona. As it is, another opportunity must patiently be waited for.

The results of Lord Lindsay's expedition will, in view of the failures attending the others, be of double importance. Some substantial results are reported, by Mr. J. Norman Lockyer, of the Sicilian expedition, so that the astronomers will have something to discuss and speculate upon during the interval that will elapse before other observations of a similar character can be made.

So far as we can gather from the news now received, the results obtained seem to indicate that the corona is a real appendage of the sun, not ether made luminous by the sun's light, and whether it shine by its own, or by reflected light, that it is the origin of the green line in the spectrum, which has been supposed by some to indicate the presence of some substance yet unknown to chemistry.

THE PRESENT AND THE PAST.

NO. II.—FACTS OF THE PRESENT—DESTROYING AGENCIES.

As a preliminary step towards the right comprehension of geological history, man must endeavor to realize his own insignificance in the vast scheme of creation. A may-fly coming into perfect existence with the morning sun and perishing before the close of the day, may well imagine, as she reposes for a few moments upon the water-lily, that no change is going on within the plant; she has not seen the gradual growth of stem and leaf, the formation of the bud and its blossoming, nor can she be cognizant of the movements that are in progress within, whereby in a few hours the flower, scarcely less ephemeral than herself, will fade away and perish. Yet the years of the whole human race do not bear as great a proportion to the periods of the earth as the moments of the insect to the days of the lily; and man has remained for thousands of years as unconscious of the mutations around him, as the may-fly is of the vital actions of the growing plant.

The next point with which the student must familiarize himself is, that in Nature there is no such thing as rest and repose; laws alone remain unaltered, but the matter which they control is forever shifting its forms and its combinations. That gases and liquids are forever in motion is easy of comprehension, but you must also unfix all your notions of the stability of solids, you must become vividly alive to the fact that the land and the hardest rocks are undergoing incessant changes; change from without and change from within; mechanical change and chemical change; change of form and change of substance. Both these kinds of change take place alike on the surface and within the crust of the earth; they are intimately blended together and incessantly react on each other. For instance, the chemical action of the atmosphere eats into a rock, mechanical abrasion detaches an eroded fragment; the fragment is mechanically reduced to sand and deposited in the depths of the ocean where chemical action cements many such fragments again into a solid rock.

With mutations taking place at or near the surface, the geologist may make himself familiar by observations in the field or in the laboratory, but with deep-seated actions he must remain more or less in doubt, as the conditions under which they are effected are so different from any that he can see in operation or that he can hope to imitate. For these he must rely upon inferences from circumstantial evidence. But even of most superficial changes, man can only hope to see the full proof in their accumulated effects; for his earliest lessons will teach him that Nature's transformations are often of the slowest. She has infinite time at her disposal, and she uses it without stint; her might and power are none the less therefore. It requires as great an exercise of Omnipotence to build up a continent in a million of years as in the twinkling of an eye; but in the latter case we miss the workings of that infinite foresight which provides that every atom throughout time shall fall at the exact moment into its exact place, and which has peopled the vast past as it has done the present, with an endless succession of living forms, each coming in when required and dying out when its day of service has expired.

Now, let us see what are the most remarkable of these geological changes that are in progress incessantly around us.

It has been a dry summer; the roads are covered with dust; the fields are dried up, and the soil is cracked and pulverized. It is the fall of the year—every plant has been robbing the dry land of some of its constituents, and now that the season of growth is over, its leaves strew the surface. Presently heavy rains will turn the dust to mud, every roadside be but fluid mud, every brook will be foul with it, every river will be dense with sediment, all bound with their common burden on one course onward to the estuary, and thence to the open sea, whose waters will be stained for many a league from shore by the abundance of earthy particles. Leaves and branches, and dead trunks of trees, and the carcasses of animals will mingle with them in the tide.

Then, for awhile, let us leave them and return to the land, where the parched earth and dried, but porous, rock are greedily drinking up the rain as it falls. By and by every crack and crevice will be full of moisture, and every rock will be saturated; then comes the winter's frost, and all the moisture is congealed—with congelation there is expansion, each moistened grain is forced apart from its neighbors, each scale of rock is moved a trifle more from the main mass; for a time icy moisture holds altogether, but with the thaws of spring the bonds are reft—the banks crumble away, mass after mass falls crashing from the precipice, long-weathered blocks are at last reduced to dust, and the earth is strewed with fresh particles, which are swept away in pursuit of those whose course we have already traced.

And again—

> "Listen! you hear the grating roar
> Of pebbles, which the waves suck back and fling
> At their return, up the high strand,
> Begin and cease, and then again begin
> With tremulous cadence slow, and bring
> The eternal note of sadness in."

Those waves are at this same work of change, and, to the ear of the geologist, their "note of sadness" is a wail over the land in time to be no more, the land they themselves are doomed slowly, but surely, to destroy. The pebbles are but fragments of the cliff around in process of destruction; adamantine granite, or soft chalk, or crumbling clay; low banks, or mighty walls of rock, all alike must yield in the end to the incessant battering of the breakers. It is only a question of time. The foundation of the cliff, be it what it may, is slowly sapped; if its material be soft the process of destruction is rapid, and every storm stains the waves for miles and miles with the *débris;* but if the rock be hard, the siege is a protracted one; deep caverns are formed in the cliff, and in every hollow the waters ply their ceaseless task, until at last a portion undermined topples over on to the shore beneath. A pause in the attack occurs, the breakers have to demolish the fallen mass which for a times serves as a breakwater to protect the cliff; slowly, but surely, the largest of the fallen masses are ground down and broken up —the smaller fragments are hurled hither and thither in the heavier storms, until, by constant attrition, they are reduced to more manageable size when they are tossed by the sport of lesser waves. Smaller and smaller they become, and more and more rapidly does the constantly-increasing friction tell upon them, until we hear their grating roar as every swell rolls in upon the beach. But their destruction is not yet complete; each time the pebbles are flung in and sucked back they lose a portion of their substance, the pebbles become fine gravel, the gravel is worn done to sand, which is finally swept away by the tides and currents, to be mingled with that which has been brought down by the river. And when the hungry waves have devoured the fallen mass, they resume their attacks upon the cliff, and thus by slow degrees the land is swallowed up by the sea.

"Why tell us all these common-places? Each one of us has seen or read of these things." Granted, good reader! but have you *thought* of them? have you carried the argument of these commonplace facts out to its legitimate conclusion? For the last three thousand years these phenomena have been going on beneath the gaze of generations of philosophers—yet it is only within the last century that geology has sprung up to interpret their meaning in the Book of Nature. And we venture to say that there are thousands of educated beings at this day who have never thought to ask themselves what becomes of the earth washed away from the hillside. Enough for them if it rested for a few years on its onward course in the plain beneath, where grow their crops; they care not to note that this mud is the wreck of the land they live on; much less do they dream that its particles are

> "The dust of continents to be."

Emerson, we believe, somewhere says, "Most persons do not see the sun—at least they have a very superficial seeing." And so it is with the rain and the frost and the waves; we see them, it is true, but how few of us recognize the work they are engaged upon, or endeavor to estimate its magnitude!

THATCH MADE BY SEWING MACHINES.

The difficulty of getting farm laborers capable of putting a good, durable, and waterproof thatch on a rick or building, will, in all probability, disappear, if the following method be adopted: Construct a sewing machine, with two motions, and two needles sufficiently large to carry strong tarred yarn; and the needles must be long enough to go through the required thickness of thatch. The straw is fed to the machine on an endless belt, and the needles, working alternately, stitch the straw into heavy matting. This is rolled up, and applied to the roof, or the rick, until it is covered. The sheets of matting should overlap each other as shingles do, and may be fastened to ricks or stacks with wooden pegs, in the usual way. Fifteen hundred square feet can be made in an hour, and can be applied without the aid of any skilled labor. If properly made and carefully taken off the ricks, it can be used for two or more seasons. This method is simple, and, after the first cost for the machine, is cheap. It is particularly advantageous in use where straw is scarce, as it wastes nothing. And the portability of the thatch in rolls is another recommendation, as thatching frequently is wanted for haystacks at a distance from the homestead.

THE size of the tracts of land under tea-cultivation will be readily conceived when we say that an acre, on which are 1,200 plants, will yield about 1,200 pounds of dry tea yearly. Four pounds weight of green leaves are required to make one pound of dry tea.

OBITUARY.—HON. DAVID LYMAN.

Died in Middlefield, Conn., on Tuesday, Jan. 24th, Hon. David Lyman, a prominent manufacturer and most worthy citizen, whose public and private labors have rendered his life one of continued usefulness, and who will be long remembered as one of those "whose works do follow them." Mr. Lyman had built up an extensive manufacturing business, in the washing and wringing machine line, in Middlefield, and through his efforts in the State Legislature that place became an incorporated town. Towards the close of his life, he became greatly interested in the Air Line railroad enterprise, and his efforts in its behalf are thought to have brought on the attack of typhoid fever of which he died, after a brief illness. In all his social relations, Mr. Lyman was greatly esteemed. His business talents and enterprise were of that rare kind which yield to no obstacle, and his success in life is a brilliant example of what perseverance and integrity can accomplish, when coupled with sound judgment and good sense. He had amassed quite a fortune in his business, and it is said his life was insured to the amount of $80,000.

CRYOLITE AND ITS USES.

There is only one place in the world where this stone is found, and that is in Southern Greenland, at Ivigtuk. On account of its resemblance to frozen water it was called by the early settlers, "ice-stone," or in Greek, "cryolite," just as a magnesian stone, from its resemblance to the foam of the sea, was called meerschaum.

In 1850, Professor Thomsen, of Copenhagen, analyzed the rock, and found that it could be decomposed by lime by fusion or by boiling, and he must thus be regarded as the father of the cryolite industry. He found that pure cryolite was composed of

Fluorine	54·2
Sodium	32·9
Aluminium	12·9
	100·00

After complete decomposition, 100 pounds of the mineral will yield 24 pounds of alumina and 44 pounds of soda—both anhydrous. Large quantities of cryolite are now sent to this country and Europe, and are worked up for the following purposes:

1. Sulphate of alumina, also called concentrated alum, because it contains 14 per cent alumina, against 11 per cent in the ordinary crystallized alum.
2. Hydrate of alumina, as a basis for the manufacture of salts of that oxide.
3. Crystallized and caustic soda.
4. Metallic aluminium.
5. Cryolite fluorspar as incidental product, used as a patent flux.
6. In the manufacture of white glass.
7. Cryolite, oxide of zinc, and quartz for artificial marble.
8. Hot cast porcelain.
9. Hydrofluoric acid.
10. In the analysis of minerals.

It will be seen from the above that the Greenland stone is capable of extensive uses, and it is to be regretted that other deposits of it have not been found in more accessible regions.

A Warning to Inventors.

The New York *Tribune* of the 25th ult., utters the following warning:

"All who have business with the Patent Office or any of the Departments at Washington are warned that they are surrounded by "agents," who do not hesitate to borrow the names of M. C.'s and others to adorn the circulars wherein they spread nets for the unwary. Many of them are arrant swindlers; others simply inefficient and bankrupt, so that money sent them is simply thrown away. Don't mind their begging, hiring, or stealing some M. C.'s frank—that doesn't help the matter a bit. A correspondent suggests that all such agents should be required to procure a license. We are not sure that this would do any good, but we throw out the suggestion."

Annual Meeting of the Society of Engineers and Associates.

The annual meeting of this association was held on the evening of January 26, at No. 9 Lafayette Place, New York. The meeting was designed to be a social reunion only, and no business was transacted. A large number of the most eminent engineers and manufacturers of steam-engine work in New York and vicinity were present. At 9 P.M. the gentlemen sat down to a splendid collation, and the evening was passed in a very pleasant manner. The number present was smaller than would have been the case had the night been less inclement, but notwithstanding the storm, the efforts of Messrs. George H. Reynolds, President, A. S. Cameron, Vice-President, and M. B. Smith, Secretary, with the cooperation of other members, rendered the meeting a complete success.

Cheap Hydrogen.

A correspondent asks the cheapest way of hydrogen gas. We believe the method of Du Motay gives in the SCIENTIFIC AMERICAN, August 27, 1870, to be the best.

Take quicklime, slake it, let it cool, and crumble into a dry hydrate; then mix it with charcoal, coke, or peat, and heat in a retort. The hydrate of lime (slaked lime) gives up the water that was used in slaking it, and becomes quicklime. The water is decomposed into hydrogen and carbonic acid, and these two gases can be separated by passing them through water, or the carbonic acid may be economized by employing it in the manufacture of bicarbonates. The quicklime can be again slaked and used as often as required. In a small way, hydrogen can be made from water by means of zinc and sulphuric acid.

The Effect of Watered Stocks.

Rufus Hatch, of this city, publishes a circular in which he discusses the subject of watering stocks by the process so successfully carried out by Vanderbilt in connection with his railroads. Referring to the capital stock of the Lake Shore and Michigan Southern Railroad, which has been raised from $3,300,000 to $8,750,000, Mr. Hatch declares with great force that "if the State and General Government should impose a tax of one cent a bushel on grain it would create a revolution, and yet Commodore Vanderbilt taxes the producers ten cents a bushel, that an eight per cent dividend may be paid on his watered stock."

This is a very clear illustration of the character of the imposition now being heaped upon the heads of a patient and long-suffering people. These railroad monopolists get possession of some important line of communication, and no sooner is this accomplished than they set about to double the stock, and then, in order to make the earnings pay on the increased stock—which often has no real basis of value—the fares and tariffs are also largely increased, while the people bow their necks in submission. The public would almost mob the man found guilty of watering their mess of milk, but these railroad stock waterers and tax increasers do worse things and escape serious censure. The people seem rather to enjoy the thing than otherwise.

Sulphurous Acid.

The *British Medical Journal* reports the publication, by Professor Gamgee, of a new and convenient mode of using sulphurous acid, the disinfecting qualities of which are universally known. Cold alcohol, the Professor asserts, will dissolve three hundred times its own volume of the gas; and a fluid possessing such powers of concentration cannot but be as efficient as it is portable and convenient. A few drops of the sulphuretted alcohol in the bottom of a trunk, will disinfect any clothing that may be put into it; and fungous germs, such as must in casks, etc., may be destroyed by the use of a very small quantity. The Professor does not tell us the price at which it can be produced; but it must be a very low one, if the new preparation is to supersede permanganate of potash (Condy's Fluid).

Novel and Convenient Mode of Using Lunar and Other Caustics.

The extreme danger of conveying infection on the point of a frequently used pencil of caustic, will recommend this simple device to the medical profession: Take a bundle of splints of wood, similar to lucifer matches; dip the ends in melted caustic, separate them, and allow them to dry. A fresh match of caustic may be used for each application, and a fine caustic point is thus always at hand. Lunar and carbolic acid, and all the solid caustic bodies, may be used in this manner, of which the original suggestion appeared in a London newspaper.

ILL EFFECTS OF HYDRATE OF CHLORAL.—Certain ugly facts concerning the fashionable sedative, hydrate of chloral, will probably diminish the frequency of its use. We have the high authority of Dr. Habershon for the statement that its action on the pneumo-gastric nerve produces bronchial and pulmonary congestion. A fatal case recently happened in Guy's Hospital, London. Another English physician, Dr. Shettle, of the Royal Berkshire Hospital, stated, in his recent lecture to the Reading Pathologic Society, that formiate of soda is frequently produced in the blood by the use of chloral, and that, from its tendency to decompose the blood, it will render hemorrhage very dangerous. Obstetric practitioners will not fail to notice the last fact. As a hypnotic, there is much to be said in its favor. It is powerful and safe, equalling opium in its pain-relieving power. But like all anesthetics, the continued use of it is sure to be hurtful; and if it aid congestion it were better for a patient to suffer weeks of sleeplessness than to habituate himself to its use.

PHOSPHATE OF LIME AS A MORDANT.—Dr. Reimann has lately communicated the following, which will correct a very erroneous impression as to the use of phosphate of lime as a mordant: A thick, sirupy solution of phosphate of lime (boneash) in hydrochloric acid having been recently recommended as a mordant to be used after a previous sumaching of the goods, I find that, according to my experience, the phosphate of lime solution is altogether superfluous, since a sumaching with 4 lbs. of sumac to 20 lbs. of cotton is of itself a sufficient mordanting to fix aniline colors excellently. The application of the phosphate of lime solution as a mordant for cochineal colors upon cotton, is equally superfluous.

SPONGIO-PILINE is the name of a very ingenious contrivance, recently introduced abroad, which may be used either as a poultice or as the means of fomentation. It consists of wool and small particles of sponge, apparently felted together, and attached to a skin of india-rubber. It is about half an inch in thickness. It will be found of great value and convenience for either of the purposes referred to. It retains heat for a considerable time, and vinegar, laudanum, camphor, hartshorn, etc., can be, by its means, placed on the skin, accompanied by heat and moisture, much more readily, and with greater cleanliness, than by means of ordinary poultices.

CHEESE, MILK, AND BUTTER contain caseine in large proportions. This important member of the organic chemical world is a powerful counteragent to lead in the human system, and may be freely taken in all cases of lead poisoning with great benefit. Lead colic, an unfortunately common disease among workmen employed in white-lead factories, may be entirely prevented by the free use of pure milk as a daily beverage.

A REMARKABLE BODY OF WATER.

From the American Journal of Microscopy, by Prof. J. P. Stelle.

From an Oregon paper I take the following relative to a remarkable body of water known to exist in the Cascade range of mountains:

"This lake rivals the famous valley of Sinbad the sailor. It is thought to average two thousand feet down to the water, all round. The walls may be reported as entirely perpendicular, running down into the water and leaving no beach. The depth of the water is unknown, and its surface is smooth and unruffled, as it lies so far under the surface of the mountain that the air currents do not affect it. Its length is estimated at twelve miles and its breadth at ten. There is a beautiful island in its center, with luxuriant trees upon it. No living man has ever yet reached the water's edge, and it is not probable that any ever will. It lies silent, still, and mysterious in the bosom of the "everlasting hills," like a huge well scooped out by the giant genii of the mountains in the unknown ages of long ago, and all around it, great primeval forests an eternal watch and ward are keeping."

Remarkable as this body of water may seem, it is by no means the most remarkable one on our continent. I write this in Central Florida, where I have just examined a body of water which certainly excels the great sunken lake of the Cascades in very many particulars. As nothing has yet been published concerning it, I have concluded to give our readers of the *American Journal of Microscopy* a brief account of what I saw, believing that it will not prove wholly uninteresting, even to them.

In company with an experienced guide I reached the little lake in question at about the hour of ten in the morning. How large it was I could not tell, but I judge it must be of considerable size, from the fact tha t I could not see across it, although enjoying a kind of b ird's-eye view from a location some distance above the level of the water.

Seeing nothing unusual about the place, I was on the point of expressing my disappointment to the guide, when he, having read my thoughts, cut all short by asking that I make a careful survey of the water, remarking, at the same time, that while there was really nothing extraordinary about the lake itself, it was strangely and wonderfully inhabited.

I turned my attention to the water, and was soon convinced that I had, undoubtedly, met with a phenomenon, for it was so clear, so very transparent, that I could see through it in every direction with as much apparent ease as if it had been the atmosphere itself. Presently I saw one of the inhabitants hinted at, a little creature of a light brown color, looking, as it glided here and there, through the pure element, not unlike a common chimney swallow. Then came another, and another, and another, until all the waters of the lake seemed to be thickly swarming with them. They were very busy and very swift in their motions, darting, whirling, and angling with the greatest ease and the most charming grace; the guide said that like birds of the air they were in quest of their prey, feeding upon animals too small to be seen by us from our standpoint.

Suddenly, while I was gazing in wonder upon these strange creatures, a new actor appeared in the person of a larger animal, about the size, shape, and color of a huge muskmelon. He was quite transparent, so much so that I could see through and through him as plainly as if he had been a glass jar; and as he moved leisurely about I noticed that he was catching and devouring the little "swallows" without mercy. His interior, which seemed to be a huge cavity—nothing more—was literally filled with them, some still alive and swimming about in their strange prison. The entire mass held within his gigantic stomach kept up a rapid whirling round and round in one direction, from which I inferred that he had no regular digestive organs, but simply *wore* out his food; that is, reduced it by friction to a proper condition for his sustenance.

Scarcely had I got fairly interested in this extraordinary animal when along came something which looked, with its slim, arching neck, very much like a swan. Its course was so directed that ere long it was brought into contact with the "musk melon," and a fight was the consequence. It was a short fight, however, for neither of the parties seemed to relish the business, so they separated and struck off in opposite directions. A little distance, and the "swan" met another of its own kind, and they commenced billing and cooing like two mated doves; but their pleasures were destined to be of short duration, for just at that instant a large and hideous looking creature, with great horns and glaring eyes, pounced upon them from a covert hard by, seizing them both. A terrible struggle ensued, in the course of which one of the "swans" made its escape, but the monster gripped the other fiercely by its slender neck until it ceased to struggle, after which he settled down with it to the bottom of the lake, and very quietly began converting it into a meal.

About this time I noticed a second monster equally as frightful in appearance as the one just referred to, though evidently of a different species. He was moving along on the bottom of the lake, and, unless his course were changed, would pass very near the other. The first monster's treatment of the "swans" had made me his enemy, so I was well pleased with the turn affairs showed a prospect of taking; I desired that his banqueting should be disturbed. And it was. The new comer found him, and went in for a share of the prey. A battle, the most frightful that I had ever before witnessed between two living creatures, immediately commenced. They seized each other and rolled over and over in a real death struggle, for several minutes, in the course of which they actually tore each other limb from limb. Finally, one of them yielded up and died, after which the other, with but two legs left out of six, dragged itself slowly away. And another instalment of animals, some like gigantic leeches, and others like Oriental turbans, and all effecting locomotion by stretching and pulling themselves into every conceivable shape, settled down and fell to regaling themselves upon the carcasses. They were, doubtless, the vultures of this remarkable body of water.

Half a day or more was spent by me in watching the inhabitants of this Florida wonder. In the course of that time I saw very many strange sights—more than I could hint at in a short article like this. Besides, a written description could convey but a faint idea of the reality; one must see for himself before he can appreciate. Every reader of this *Journal* who has not already examined the remarkable body of water under consideration should do so without fail before he dies, for it will give him new ideas attainable from no other source. If he cannot make it convenient to come all the way to Florida for that purpose, let him arrange to see the lake at home. A good microscope with a drop of impure or stagnant water upon the stage will enable him to have the same kind of lake at any locality he may select.

SPIRITUALISM AND SCIENCE.—We have received several communications on this subject. Both sides have had a fair hearing—two articles each—and we decline to continue the discussion at the present time.

WHY MAINSPRINGS BREAK.—The controversy upon this subject has exhausted its interest, and we propose to drop the discussion.

In the five largest libraries in Paris are contained 1,450,000 volumes and 87,000 manuscripts.

Answers to Correspondents.

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

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

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

TO TAN SHEEP'S PELTS WITH THE WOOL ON.—Let B. F. P. wash the pelts in warm water, and remove all fleshy matter from the inner surface: then clean the wool with soft soap, and wash clean. When the pelt is perfectly free from all fatty and oily matter, apply the following mixture to the flesh side, viz: For each pelt take of common salt and ground alum, one quarter of a pound each, and one half an ounce of borax; dissolve the whole in one quart of hot water, and when sufficiently cool to bear the hand, add rye meal to make it like thick paste, and spread the mixture on the flesh side of the pelt. Fold the pelt lengthwise, and let it remain two weeks in an airy and shady place; then remove the paste from the surface, wash, and dry. When nearly dry, scrape the flesh side with a crescent-shaped knife. The softness of the pelt depends much on the amount of working it receives.—J. S., of Minn.

CHEAP FURNITURE VARNISH.—In reply to Query No. 2, page 9, present volume, the following recipe, I think, will answer. For a cheap article it is a good one. Take of the best raw linseed oil, 1 gallon, and boil it an hour; then add 2 pounds light colored rosin, finely powdered, stirring it thoroughly until dissolved; then take it from the fire, and add one pint spirits of turpentine. It shoutd be strained before using, and kept from the air, and care also should be used, in making it, to prevent its taking fire.—B. E. W., of N. J.

CEMENT FOR LEATHER BELTING.—Let B. B. G. take of common glue and American isi nglass, equal parts; place them in a boiler and add water sufficient to just cover the whole. Let it soak ten hours, then bring the whole to a boiling heat, and add pure tannin until the whole becomes ropey or appears like the white of eggs. Apply it warm. Buff the grain off the leather where it is to be cemented; rub the joint surfaces solidly together, let it dry a few hours, and it is ready for practical use; and if properly put together, it will not need riveting, as the cement is nearly of the same nature as the leather itself.—J. S., of Minn.

FILTER FOR RAIN-WATER CISTERN.—There is no better filter for a rain-water cistern, than a wall of soft-burned bricks, built up within it. I have one twenty inches square in the center of my cistern, from which the pump draws. It may be built in one corner as well. The water percolates through the substance of the bricks, which detain every impurity, except such as are chemically united with the water.—N. D., of Me.

BARKER'S MILL.—The cause of motion in Barker's mill is the pressure that there is on every part of the inside of the arms except where the orifices are; this destroys the equilibrium, and hence the motion. The recoil of a gun when fired, the rising of a skyrocket, and many other motions are due to the same cause. It would be difficult for "Curious" to calculate the speed of the water in the arms, since the centrifugal force generated in the machine would cause an increased flow of water.—L. G. M., of Ark.

OUT-DOOR GILDING.—If N. M. will take unruled writing paper, and wax it, he will solve his problem. Let him first put on his size, then take his book of leaf, and laying it on any convenient surface, slip his waxed paper into the gold leaf, pressing it down with the hand so as to bring the waxed surface in contact with all parts of the leaf, then he may withdraw the paper and the leaf will adhere to it, so that he may almost defy a hurricane.—W. L. T., of Conn.

F. F. F., of Cal.—The explosive material in gun caps is composed of the following constituents, several of which are carefully made compounds, and dangerous to handle: Chlorate of potash, 26 parts, niter 30 parts, and fulminate of mercury 12, sulphur 18, ground glass 14, gum 1. Two to three grains of this composition are applied to the bottom of each cap.

A. R. S., of Ohio.—With cylinders of the same length and everything else, except the diameters of the cylinders, being equal, the same amount of steam used non-expansively will do the same work.

C. P., of Pa.—Crucibles for melting brass, gold, and other metals requiring a high heat, are generally made of plumbago, or graphite, commonly called black lead, mixed with clay. "Hessian crucibles" are also used; they are made of very refractory clays.

G. W. R., of Pa.—Your plan for boring out segments of cylindrical rings is impracticable. We shall shortly publish a correct way of doing this, with an engraving, and then drop the subject.

W. F. S., of Ind.—We should be glad to hear from you more at length on the subject of wooden railroads. Facts relative to this subject are valuable.

J. P., of Md.—An examination of the mineral you send shows that it is the hematite ore of iron. If plentiful it is of course valuable

H. F., of Ind.—We refer you for the information you seek to "Bacon's Revision of Porter's Treatise upon the Steam Engine Indicator," published by D. Van Nostrand, New York.

F. E. H., of Mass.—It is the impurities in coal that melt and form cinders. Bituminous coal will, however, often cake when allowed to cool before it is wholly consumed. Such cakes are not cinders, properly speaking.

P. P., of Pa.—If you will submit the drawing of the tool you would use to turn a plunger for the segment of a hollow, cylindrical ring we will give it careful examination, and, if deemed worthy will publish.

N. H. E., of N. Y.—We do not wish to discuss the subjects of leveling and balancing millstones any further at present.

O. W. C., of Mo.—Davies' Practical Mathematics, published by A. S. Barnes & Co., of New York, contains rules for measuring bricklayers', plasterers', and carpenters' work.

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Queries.

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

1.—REMOVING INCRUSTATION BY THE USE OF POTATOES.—A correspondent says that potatoes are a good solvent for mud and scale in steam boilers, but gives no data for use. I would like to know in what quantity? and how long after putting in before the boiler should be blown off, etc.?—H. A. H.

2.—REMOVING CHIMNEY STAINS.—How can I remove the stain and smell of creosote, caused by the condensed empyreumatic oil which has trickled down and soaked into the plaster wall below the stove-pipe hole in a chimney?

3.—JAPANNING CAST IRON.—How can I japan cast iron so that it will have the color of russet leather?

4.—PAPER PERCUSSION CAPS.—How are paper percussion caps made, and what is the fulminating material used therein?—F. F. F.

5.—SAWS AND SAW STEEL.—Is saw steel welded up after rolling, or is it welded up in large pieces and afterwards rolled? Are hand-saw blades cut from sheets, heel and point alternately? and what is the reason that such saws are often thicker at the point than at the heel?—A. R. S.

6.—RESTORING THE COLOR TO GOLD AFTER SOLDERING.—How is the color of gold restored after hard soldering?—R. K.

7.—SHOE BLACKING.—I wish a good recipe for a varnish or blacking for boots and shoes.—W. H. P.

Recent American and Foreign Patents.

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

CORN DROPPER.—J. H. Gross, Niantic, Ill.—This invention relates to improvements in corn dropping and check marking machines, and consists in the application to a pair of runners of a pair of star wheels, a dropping slide, and a check marking device, whereby the star wheels derive the rotary motion by the points coming in contact with the ground as the runners are drawn along and actuate the dropping slide and the marker, the whole arrangement being very simple, cheap, and efficient.

MILL-STONE BALANCE.—John Walch, Galena, Ill.—This invention relates to improvements in balancing apparatus for mill stones, and consists in a frame made in two parts, having lugs for attachment to the upper and lower edges of the hoop of the mill stone, and clamping bolts, connecting them together and clamping them on the hoop; on which frames are arranged a pair of weights to be adjusted to or from the plane of the point of suspension of the stone. Three of these frames are to be attached to the hoop, and adjusted.

GATES.—L. W. Sebley, Ames, Iowa.—This invention relates to improvements in gates, and consists in an improved arrangement of means for opening and closing the gate by the action of the wheels of a vehicle coming in contact with levers at the side of the gate.

PUMP.—G. H. Laub, West Lebanon, Ind.—This invention relates to an improved manner of attaching metal barrels, for the valves to work in, to wooden pipes, for detaching and removing the barrels when required for cleaning or repairs.

BARK MILL.—G. E. Palen and F. P. Avery, Tunkhannock, Pa.—The object of this invention is to improve the machines for grinding bark in such manner that they can be adjusted to any extent, readily repaired, and perfect in their operation.

GANG PLOW.—J. R. McConnell, Marengo, Iowa.—This invention has for its object to furnish an improved gang plow, which shall be so constructed and arranged that it may be conveniently adjusted to work at any desired depth, or to cut a narrower or wider furrow, as may be desired.

TREATMENT OF FRUIT TREES.—William J. Everett, Mahony City, Pa.——This invention relates to a new and useful improvement in the treatment of fruit and other trees, for preserving them from the ravages of worms, grubs, and insects.

BEE HIVE.—David H. Swartz, Lancaster, Ohio.—This invention has for its object to furnish an improved bee hive, which shall be so constructed as to protect the bees from moths and ants, and which shall at the same time be simple in construction, and will enable the bees to be conveniently controled.

MILL-STONE DRIVER.—John J. Tomlinson, Bazeman City, Montana.—This invention relates to a new and useful improvement in drivers for mill stones, by means of which the running stone adjusts itself to the bed-stone, and to the resistance when the latter is out of level, or when the spindle is out of "tram," or varies from a line peruendicular with the face of the bed.

TRAY HOLDER.—Obed Fahnstock, Indianapolis, Ind.—This invention relates to a new and improved holder for trays, by which to carry them on one arm; and it consists in a plate provided with handles for supporting and carrying it on the arm, on which plate suitable holding devices are placed at the top to hold the tray.

BELT TIGHTENER.—G. W. Runk, Franklin, La.—This invention relates to a new apparatus for clamping belts while the same are on the pulleys, and for stretching the same so that they may be tightened.

WATER COOLER.—Abel Putnam, Jr., Saratoga Springs, N. Y.—This invention relates to a water cooler having two separate compartments, one to contain water and the other ice, the annular water space being exterior to the ice compartment, and each chamber having an opening of its own.

CAST-IRON BARREL.—Abel Putnam, Jr., Saratoga Springs, N. Y.—This invention consists of a cast-iron barrel, provided with a porcelain lining, and one solid and one detachable head.

HOUSEHOLD IMPLEMENT.—E. H. Schmults and Jacob Baker, New York city.—This invention relates to a new instrument which can be used for picking and breaking ice, opening all kinds of bottles, and lifting kettles, stove plates, etc.

GATE.—W. G. Franklin, Shelbina, Mo.—This invention has for its object to furnish an improved gate, which shall be so constructed and arranged, that, when opened, its forward end may swing up from the ground, to pass over snow or other obstructions, and which shall be simple in construction and inexpensive in manufacture.

PORTABLE ESCRITOIR.—W. G. Mitchell, Holliston, Mass.—This invention has for its object to furnish a simple, convenient, and inexpensive escritoir, which shall be so constructed and arranged that, when opened up for use, it may serve as a smooth and firm writing table, and when closed for transportation, may be folded up into small compass, and at the same time serve as a receptacle for paper, pens, inkstand, stamp box, etc.

NEW BOOKS AND PUBLICATIONS.

THE PHOTOGRAPHER'S FRIEND. An Illustrated Quarterly Magazine, devoted to the Photographic Art. Published at 103 West Baltimore Street, Baltimore, Md. G. O Brown, Editor.

We have received the first number of this magazine, and find in it a great deal of matter, of value to persons interested in photography. Under the caption of "The Great Quartette," are given the formulas and methods of working of four of the most distinguished photographers of this country Messrs. Sarony, Kurtz, Gurney, and Fredricks. This is certainly information worth having, and it is greatly to the credit of the gentlemen named that they have been willing to give the trade the benefit of their large experience. Accompanying the first number is a fine photograph of Mrs. Scott Siddons, by Sarony, which, in the management of drapery and control of light, could not easily be excelled. Photography under such treatment ceases to be a trade, and is elevated to the dignity of an art. No one but a first-class artist which could produce such a picture. There is a little over-exposure in the editorial management of the journal that needs toning down in the printing, but all this will improve with time and experience.

THE KIDNEY.

This pamphlet of 44 pages treats practically of the structure, functions and diseases of the kidney, Bright's disease, and the urine, its constituents chemical tests for the various diseases, their symptoms, and treatment, adapted to popular comprehension. By Edward H. Dixon, M.D. J. S. Redfield, Publisher, No. 140 Fulton street. Price, 25 cents.

Official List of Patents.

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111,102.—CHARGER FOR SHOT POUCHES.—Thomas W. Allen Waterbury, Conn.
111,103.—CHILDREN'S CARRIAGE.—Rodney C. Britton, Springfield, Vt.
111,104.—BAGGAGE TRUCK.—William Hammond Brown, Bangor, Me.
111,105.—AUTOMATIC LUBRICATING CUP.—James A. Bryan and William Stainfield, Kent, Ohio.
111,106.—PRUNING SHEARS.—John Calder, Macedon, N. Y.
111,107.—BEE HIVE.—Albert Claypool, Weston, Ohio.
111,108.—PARLOR BEDSTEAD.—Francis E. Coffin, Boston, Mass.
111,109.—SLEIGH BRAKE.—Eustace J. Cooper, Mineral Point, Wis.
111,110.—STEAM LUBRICATOR.—Daniel Currie, Belleville, Ill.
111,111.—TYPE CASTING MACHINE.—William Wallace Dunn, San Francisco, Cal.
111,112.—GOVERNOR FOR ELECTRO MOTORS.—Thomas A. Edison, Newark, N. J., assignor to himself, Elisha W. Andrews, George B. Field, and Marshall Lefferts, New York city.
111,113.—MACHINE FOR CUTTING PAPER COLLARS.—Alfred L. Elliot, Boston, assignor to himself and Edwin A. Eaton, Winchester Mass.
111,114.—FLUX FOR WELDING STEEL OF HIGH AND LOW GRADES.—John Farrel, New York city.
111,115.—TRUSS.—Alexander Folleau, San Francisco, Cal. Antedated January 13, 1871.
111,116.—STEAM-BOILER FEEDER.—Lucus Foote, North Fairfield, Ohio.
111,117.—BURIAL CASE.—Patrick H. Griffin, Albany, N. Y Antedated January 7, 1871.
111,118.—THILL COUPLING.—Collins W. Griffith, Cincinnati Ohio, assignor to himself and Charles H. Mackintosh, Strathroy, Canada.
111,119.—BACK-PAD PRESS.—Edwin W. Harlow, Hastings Mich.
111,120.—PUMP.—Patrick Harvey, Chicago, Ill.
111,121.—EVAPORATOR.—Richard Hawley, Jr., Detroit, Mich.
111,122.—FEED-TROUGH GUARD.—Edwin Hovenden, Bushnell, Ill.
111,123.—RAILWAY-CAR COUPLING.—Lewis Huddle and Jacob K. Huddle, Tiffin, Ohio.
111,124.—GATE.—Robert Henry Hudgin, Fairfield, Canada.
111,125.—HARROW AND CULTIVATOR.—James F. Jaquess, Commerce, Miss.
111,126.—ASH SCREEN.—Edward C. Jenkins, Jr., Worcester, Mass.
111,127.—CAR SPRING.—James Leland, Springfield, Mass.
111,128.—METHOD OF SECURING JOINTS OF FRAMES, ETC.—Charles F. Linscott (assignor to Edward S. Torrey and Joseph Torrey) New York city.
111,129.—SEWING MACHINE.—T. A. Macaulay, New York city.
111,130.—GATHERING ATTACHMENT FOR SEWING MACHINES.—William A. Mack, Norwalk, Ohio.
111,131.—SAWING MACHINE.—James D. Matthews, Niles, Mich.
111,132.—GRAIN DRILL.—Daniel E. McSherry, Dayton, Ohio.
111,133.—COMPOUND FOR PRESERVING DRAIN TILES, BRICKS, ETC.—Edward Milner, Marquette, Mich., assignor to Charles H. Mackintosh, Strathroy, Canada.
111,134.—METER.—Charles Moore (assignor to José F. DeNavarro), New York city.
111,135.—CHAIR CLAMP FOR RAILWAY RAILS.—Wm. Morehouse, Buffalo, N. Y.
111,136.—MACHINE FOR UPSETTING IRON.—Martin L. Munger and Corodon D. W. Gibson, Grand Blanc, Mich.
111,137.—BOOT STRETCHER.—Isaac M. Myers, San Francisco, Cal.
111,138.—HAY RACK.—Franz Louis Nagler, Irving Township, Mich.
111,139.—CORN SHELLER.—Franklin Nelson (assignor to himself and Joseph Maseth), Wyandotte, Mich.
111,140.—CLAMP FOR CARRIAGE SEATS.—Henry J. Northrup, Lansingburg, N. Y.
111,141.—MACHINE FOR PRESSING FABRICS.—George H. Nussey and William B. Leachman, Leeds, England.
111,142.—OBTAINING MADDER EXTRACTS.—Alfred Paraf (assignor to Edward S. Renwick, trustee), New York city. Antedated December 29, 1870.
111,143.—WATER METER.—Webster Park, Norwich, Conn.
111,144.—ANCHOR.—Gurney C. Pattison, Baltimore, Md.
111,145.—ANCHOR.—Gurney C. Pattison, Baltimore, Md.
111,146.—TUBE EXTRACTOR.—Isaac S. Peters, Marshall, Mich.
111,147.—MACHINE FOR GRINDING HAND SAWS.—Edwin S Piper, Rochester, N. Y.

111,148.—Composition for Coating Wooden Structures, to Protect them against Fire.—Anthony Pirz (assignor to himself and Henry Torstrick), Long Island City, N. Y. Antedated January 7, 1871.
111,149.—Toy Carriage.—Frederick W. Porter, Springfield, Vt.
111,150.—Horse Hay Rake.—Samuel Rockafellow, Moline, Ill.
111,151.—Asphaltic Pavement.—Samuel R. Scharf, Baltimore, Md., assignor to himself and Hugh M. Funston, New York city.
111,152.—Coupling for Shaftings.—Scott A. Smith (assignor to Cresson & Smith), Philadelphia, Pa.
111,153.—Sizing Machine.—Albert H. Sturgis (assignor to himself and Joseph A. Pierce), Lewiston, Me.
111,154.—Furnace for Steam Boilers.—Morse K. Taylor, United States Army.
111,155.—Manure Rake Attachment for Plows.—Marinus Van Duine and Jan De Jonge, Zealand, Mich.
111,156.—Coffer Dam.—John E. Walsh, New York city.
111,157.—Coffer Dam.—John E. Walsh, New York city.
111,158.—Plow Colter.—Seth Way, La Porte, Ind.
111,159.—Steam Generator.—Samuel West (assignor to Elmwood Mining and Manufacturing Company), Elmwood, Ill.
111,160.—Serving Reel.—Joseph Henry Westcott, Medford, Mass.
111,161.—Mop Heads.—Henry H. Wetmore, Barre, Vt. Antedated January 12, 1871.
111,162.—Window Protector.—William K. Winant, Rye, N. Y., assignor to himself, William Wilmot Kissam, and Emily Winant.
111,163.—Grain Drier.—Levi Abbott, Lewiston, Me., and Joseph A. Sherburne, Boston, assignors to themselves and Earl W. Johnson, Boston, Mass.
111,164.—Saw.—Emanuel Andrews, Williamsport, Pa.
111,165.—Earth Scraper.—Asher S. Babbitt (assignor to Babbit, Hinckley & Co.), Keeseville, N. Y. Antedated January 14, 1871.
111,166.—Concrete for Pipes, Tubes, Buildings, etc.—Thomas J. Barron, Brooklyn, E. D., N. Y.
111,167.—Hollow Auger.—Aaron Bauman and Orin O. Witherell, Toledo, Ohio.
111,168.—Atmospheric Pressure Attachment for Dental Plates.—John B. Beers, San Francisco, Cal.
111,169.—Liquid Compass.—John Bliss and George H. Bliss, Brooklyn, N. Y.
111,170.—Car Coupling.—Joseph Boothroyd, Michigan City, Ind.
111,171.—Coal Box.—Timothy S. Bozart, Jr., Indianapolis, Ind.
111,172.—Railway-car Truck.—Louis D. Boyce and George H. Jones, Rochester, N. Y.
111,173.—Collapsing Cores.—Anthony T. Brodie and Robert E. Smith, Pittsburgh, Pa.
111,174.—Gas Generator.—John Butler, New York city.
111,175.—Apparatus for Carbureting Air.—Henry Albert Chapin, New York city.
111,176.—Scouring, Washing, and Wringing Machine.—William H. Churchman, Indianapolis, Ind.
111,177.—Die for making Felly Plates.—Allison N. Clark, Plainville, Conn.
111,178.—Hat.—James W. Corey, Newark, N. J.
111,179.—Fluid Meter.—Robert Creuzbaur, Williamsburg, N. Y.
111,180.—Variable Cut-off for Steam Engines.—William B. Cross, Sacramento, Cal.
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111,182.—Furnace for Burning Small Coal or Culm.—Alfred Dart, Carbondale, Pa.
111,183.—Wine Press.—George L. Davenport and Charles G. Case, Davenport, Iowa.
111,184.—Removable Car-seat Backs.—Peter F. Duchemin, Somerville, Mass.
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111,186.—Tray Holder.—Obed Fahnestock, Indianapolis, Ind.
111,187.—Pipe Coupling.—John P. Fink, Mechanicsville, Pa.
111,188.—Hoisting Apparatus.—Henry Flad and J. B. Eads, St. Louis, Mo.
111,189.—Water Closet.—Charles Frankish, Chicago, Ill. Antedated January 14, 1871.
111,190.—Gate.—W. G. Franklin, Shelbina, Mo.
111,191.—Steam Boiler.—John L. Frisbie (assignor to M. T. Davidson), Brooklyn, N. Y.
111,192.—Steam Radiator.—John L. Frisbie (assignor to M. T. Davidson), Brooklyn, N. Y.
111,193.—Caster.—F. A. Gardner, Danbury, Cond.
111,194.—Pen Holder.—Alfred M. George, Sand Fly, Texas.
111,195.—Medical Compound for the Cure of Rheumatism.—Rebecca Gilkinson, New York city.
111,196.—Spring-catch for Doors.—William Glue, Muskegon, Mich. Antedated January 14, 1871.
111,197.—Machine for Sewing Boots and Shoes.—Chas. Goodyear, Jr., New Rochelle, N. Y.
111,198.—Compound for Removal of Scale from Steam Boilers.—Wm. T. Grant, Neelyville, Ill.
111,199.—Baster-guide for Sewing Machines.—Franklin T. Grimes, Liberty, Mo.
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111,201.—Gate.—John K. Harris, Springfield, Ohio.
111,202.—Hand Corn Planter.—James M. Harrison, Spartanburg, Ind.
111,203.—Beer Cooler.—Carl W. Haug (assignor to himself and Henry Bunz), New York city.
111,204.—Beehive.—Henry L. Heckman, Brooklyn, Iowa.
111,205.—Cock.—Wm. H. Hedges and M. E. Campfield, Newark, N. J.
111,206.—Machine for Cutting and Dressing Stone.—Jacob Hedrick, William Tash, and Henry Kreidler, York, Pa.
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111,212.—Operating Cutter for Steam Plows.—Oliver Hyde, Oakland, Cal.
111,213.—Elastic Tire for Traction Engines.—Oliver Hyde, Oakland, Cal.
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111,225.—Stove-pipe Shelf.—James McCallum (assignor of one third of his right to H. E. Gillam), Rochester, N. Y.
111,226.—Gang Plow.—John R. McConnell, Marengo, Iowa. Antedated January 18, 1871.
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111,228.—Combined Gang Plow and Cultivator.—J. A. McHarris, Sullivan, Ind.
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111,246.—Connector for Telegraph Wires.—G. B. Prescott, New York city.
111,247.—Plow.—J. P. Pritchard, Conn Valley, Cal. Antedated Jan. 14, 1871.
111,248.—Machine for Cutting Screw Threads on Bolts.—S. W. Putnam, Jr., Fitchburg, Mass.
111,249.—Stair Rod Fastening.—Emil Rath (assignor to Moritz Krickl), New York city.
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111,252.—Hay Loader.—J. P. Rideout, Bowdoinham, Me.
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111,254.—Card for Mariners' Liquid Compasses.—E. S. Ritchie, Brookline, Mass.
111,255.—Cattle Stanchion.—J. A. Rosback, Hermon, N. Y. Antedated Jan. 18, 1871.
111,256.—Cultivator.—H. M. Rose, Clinton, Ill.
111,257.—Belt Tightener.—G. W. Runk, Franklin, La. Antedated Jan. 14, 1871.
111,258.—Mowing Machine.—G. T. Savary, deceased (N. J. Savary, administratrix, assignor to J. N. Pike), Newburyport, Mass.
111,259.—Lath Machine.—Chas. Schleicher, Louisville, Ky.
111,260.—Ice Pick and Hook.—E. H. Schmults and Jacob Baker, New York city.
111,261.—Railway Switch and Signal Apparatus.—Adolph Schnabel and Theodore Henning, Bruchsal, Grand Duchy of Baden.
111,262.—Liquid Meter.—H. C. Sergeant, Newark, N. J., assignor to J. F. De Navarro, New York city.
111,263.—Burial Case.—F. B. Shearer, Columbus, Ohio.
111,264.—Apparatus and Process for Canning and Preserving Meats, Fruits, Vegetables, etc.—N. H. Shipley, Baltimore, Md.
111,265.—Rock Drill.—Henry Shoemaker and John Shoemaker, Putneyville, Pa.
111,266.—Gate.—L. W. Sibley, Ames, Iowa.
111,267.—Plaster for Walls.—B. R. Smith and J. C. Harris, Philadelphia, Pa.
111,268.—Liquid Meter.—W. E. Snediker (assignor to J. F. De Navarro), New York city.
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111,270.—Bolster and Pillow.—Timothy S. Sperry, Chicago Ill.
111,271.—Burial Casket Handle.—Clark Strong, Winsted, Conn.
111,272.—Harvester.—Henry Stuckey (assignor to A. C. Stock), Bucyrus, Ohio.
111,273.—Bee Hive.—David H. Swartz, Lancaster, Ohio.
111,274.—Lamp Burner.—Alvin Taplin, Forestville, assignor to the Bristol Brass and Clock Company, Bristol, Conn.
111,275.—Shuttle for Sewing Machine.—E. C. Thaxter, Providence, R. I.
111,276.—Sewing-Machine Motor.—William C. Thornton and James D. Cooley, Hillsville, Va.
111,277.—Millstone Driver.—John J. Tomlinson, Bozeman City, Montana Territory.
111,278.—Loom.—Hamilton E. Towle, Newark, N. J.
111,279.—Rein Supporter.—Ross Townsend, Liberty township, Ohio.
111,280.—Ice Machine.—David K. Tuttle and Orazio Lugo, Baltimore, Md. Antedated January 7, 1871.
111,281.—Salt Cellar.—John T. Walker, Brooklyn, N. Y.
111,282.—Millstone Balances.—John Walsh, Galena, Ill.
111,283.—Bee Hive.—William Wambach, Indianapolis, Ind.
111,284.—Nutmeg Grater.—Dewitt C. Warner, Chicago, Ill.
111,285.—Elevator.—John Jacob Weber, St. Clair, Pa.
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111,290.—Floor-bolting Reel.—Allison L. Williams, Orth, Ind.
111,291.—Roach and Bug Trap.—Thomas Williams, Tompkinsville, N. Y.
111,292.—Apparatus for Making Ice and Cooling.—Franz Windhausen, Brunswick, Germany, assignor to Louis Schneider, C. T. Buddecke, and John A. Blaffer, of New Orleans, La.
111,293.—Ice Machine.—Franz Windhausen, Brunswick, Germany, assignor to Louis Schneider, C. T. Buddecke, and John A. Blaffer, New Orleans, La.
111,294.—Car Starter.—Finley J. Wright and Livingston W. Wandell, New York city. Antedated January 21, 1871.
111,295.—Paint for Ship's Bottoms.—Isaac J. Wyman, New York city.

REISSUES.

4,237.—Construction of Electro-magnets.—Henry M. Paine, Newark, N. J., assignor by mesne assignments to the Paine Electro-Magnetic Engine Company.—Patent No. 103,231, dated May 17, 1870.
4,238.—Railway Car Truck.—William Petit, Philadelphia, Pa.—Patent No. 38,980, dated June 23, 1863.
4,239.—Compound to Increase the Friction between Belts and Pulleys.—Louis F. Robertson, New York city.—Patent No. 104,356, dated June 14, 1870.
4,240.—Passenger Fare Box.—John B. Slawson, New York city.—Patent No. 17,899, dated July 28, 1857; reissue No. 550, dated May 4, 1858.
4,241.—Railroad-car Seat and Couch.—Theodore T. Woodruff, Philadelphia, Pa.—Patent No. 16,159, dated December 2, 1856; reissue No. 1,439, dated March 17, 1863; extended seven years.

DESIGNS.

4,588.—Heating Stove.—Nicholas Brayer (assignor to "Equitable Co-operative Foundry Company)," Rochester, N. Y.
4,589 to 4,601.—Carpet Pattern.—Jonathan Crabtree (assignor to Leedom, Shaw & Stewart), Philadelphia, Pa. Thirteen Patents.
4,602 and 4,603.—Box for Tops of Bureaus.—Daniel A. Hall and David Garrison (assignors to Swan & Clark), Philadelphia, Pa. Two Patents.
4,604.—Sewing-machine Stand.—Henry Loth, Philadelphia, Pa.
4,605.—Frame of School Desks.—Albert E. Roberts, Des Moines, Iowa.
4,606 to 4,609.—Box for the Tops of Bureaus.—Baxter & Swan, Philadelphia, Pa. Four Patents.
4,610.—Bed Quilt.—Francis C. Van Horn, Camden, N. J.
4,611.—Cooking Stove.—Nicholas S. Vedder and Francis Ritchie, Troy assignors to Russell Wheeler, Utica, N. Y.
4,612.—Fence Cap.—George W. Young, St. Louis, Mo.

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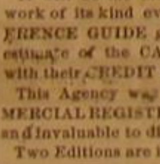

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SCIENTIFIC AMERICAN

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

Vol. XXIV.--No. 7. [NEW SERIES.] NEW YORK, FEBRUARY 11, 1871. $3 per Annum. [IN ADVANCE.]

Cochrane's Mariner's Sound Indicator.

The novel device shown in our engraving, to which the inventor has given the above name, has for its object to enable a mariner to determine the direction of sound, when from any cause he is prevented from exercising the sense of sight. In the specification of his letters patent, he so forcibly sets forth the uses and advantages of the invention that we cannot do better than quote his own language:

"Great inconvenience and many accidents fatal to life and destructive to property, have resulted from the difficulty of determining the direction of sound in navigation; for instance, when, in approaching or navigating harbors or rivers, many vessels, moving in different directions, are enveloped in a thick fog, sound is resorted to as a means of signaling to prevent collisions, and also to enable ferry-boats to make out their landings. Under such circumstances every mariner is aware of the extreme difficulty and inconvenience at present experienced in determining from what locality the sound originates. It would be impossible for me (fifty years a mariner) to cite the numerous instances where difficulties of this kind have rendered the position hazardous and frightful in the extreme.

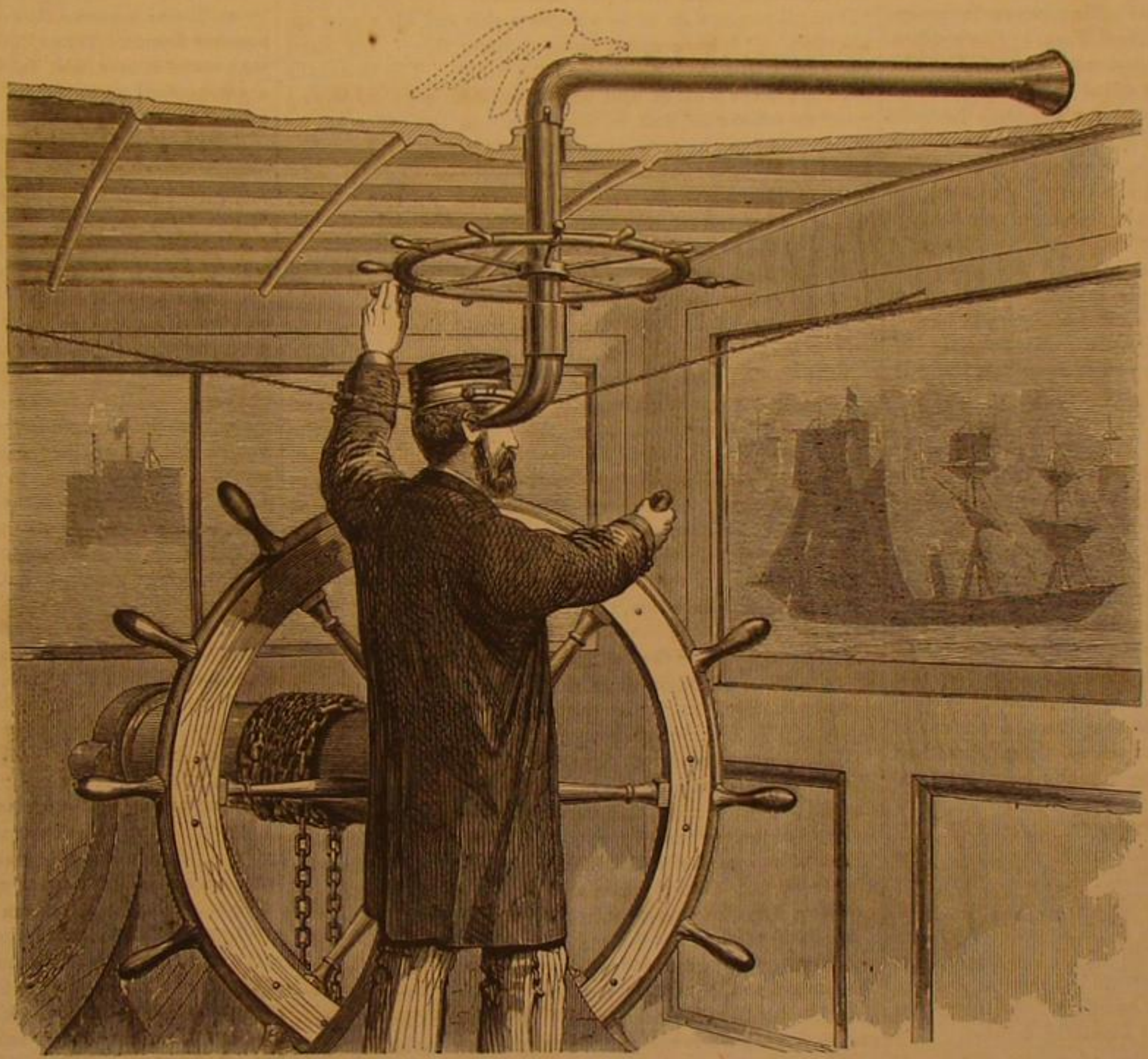
"My invention proposes to obviate measurably these difficulties, by enabling the pilot (or other person whose duty it may be) to determine, if possible, without leaving his station, from what locality the sound originates.

"I accomplish this by means of tubes—one stationary, with an opening convenient to the pilot's ear, and another forming a continuation of the first, movable to all points of the compass, by means of a wheel or lever under the mariner's immediate touch and control."

The person desiring to ascertain the point from which the sound proceeds, turns the tube, by means of a wheel or lever, until the greatest intensity of sound through the opening in the fixed tube indicates that the bell of the movable tube points in the direction of the source of the sound. Then, by observing any suitable indicator (as the king-spoke in the wheel), which, being previously adjusted, shows the direction to which the opening of the movable tube points, the pilot is enabled to steer in the manner indicated by the signal, the sense of feeling even being a guide in case all artificial light should be extinguished, and the vessel should be groping in the dark.

The engraving completes the story of the design of this invention. It is shown attached to the roof of the pilot-house of a vessel, and its parts and use are so well delineated by the skilled hand of an artist as to need no detailed description. The inventor has, however, claimed in his patent the general principle of the combination, and does not confine himself to the particular construction shown.

Patented, Jan. 10, 1871, by James Cochrane, whom address for further information 64 West Tenth street, New York.



COCHRANE'S MARINER'S SOUND INDICATOR.

Purifying Gas and Soap Limes.

Mr. Thomas Prideaux, of Sheffield, Eng., has, according to the New York *Mercantile Journal*, invented and patented a process for purifying gas and soap limes, which, it is well known, are so exceedingly offensive in smell as to render their proper disposal, when spent, a matter of difficulty.

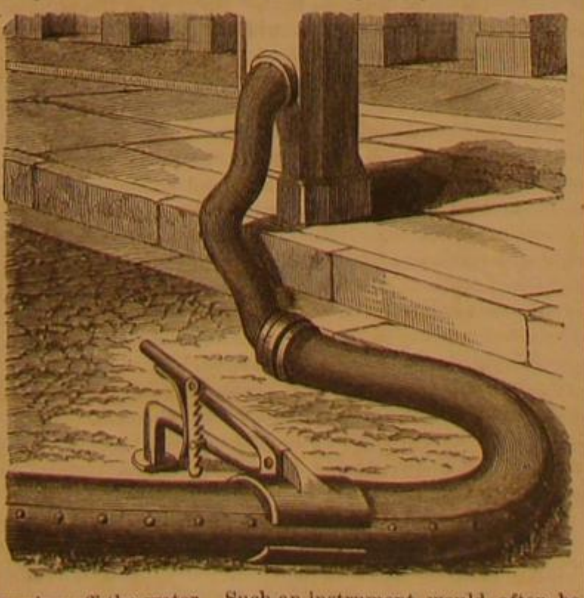
In Mr. Prideaux's process, the gas lime is thoroughly incorporated with the substances formed in the passage of the gas through the lime, and with that portion of the lime which yet remains in the caustic state. This is done by grinding the gas lime in a mortar mill, or other suitable machine, the lime either being ground dry, or, in some cases, having some water added. By this means the offensive sulphides are oxidized, and the mixture produced obtains the property of hardening in a short time, so that it can be used alone, either for plaster, concrete, or cement, or for building blocks. The specification further sets forth that iron scale and coloring matters are also used when required for decorative purposes.

By the forementioned treatment it is found that the sulphides and other offensive compounds are so much oxidized that the prepared gas lime can be used for the interior work or decoration of dwelling houses. The substance upon hardening is quite free from unpleasant smell, and is of a light-gray color. If the proportions of lime remaining in a caustic state be insufficient, a suitable quantity of quicklime is added when using the prepared gas lime for the formation of blocks, or for cement, plaster or mortar.

When this substance is calcined and pulverized, it may be kept and used as cement, by mixing with water. The cement is claimed to set hard in a very short time, and to be very strong, and suitable for all purposes to which good water cement is applicable.

DEVICE FOR CLOSING RUPTURES IN FIRE HOSE.

Our engraving shows a useful and simple device by which a rupture in a fire hose may be temporarily closed without



turning off the water. Such an instrument would often be of great use, saving time in uncoupling and coupling on new lengths of hose in cases where loss of time might result in great damage. Our artist has shown the form of the device so well that it almost tells its own story. Two pivoted clamps made in the form of tongs, one handle of which has a pivoted ratchet bar, engaging with a pin in the other handle, constitute the instrument. The extremity of the lower handle is bent downward as shown, and terminates in a foot plate which rests upon the ground when in use. The instrument is the invention of P. H. Collins, Philadelphia, Pa.

Something about Skates.

Prof. A. Dembinsky writes to the *Mechanics' Magazine* as follows:

"Fifty years of practice has enabled me to detect all those defects in skates by which the performer is inconvenienced, or prevented from executing those artistic displays of movement which require the acquisition of bodily balance, and elasticity in the various supporting parts of the skates during evolution. Among other faulty or objectionable constructions of skates, I beg leave to mention here the unproportionate hight of the steel blade, by which often the spraining of the ankle, premature fatigue, and temporary spasmodic contraction or dilatation of the sinews and muscles, are caused. The great vibration of the blade, subject to sudden changes of motion, causes a break in the balance of the body, and is sure to cause heavy falls, the more so when there exists a curvature of the blade instead of a straight, uniform shape, which allows motion in the center without being elevated in form, and which motion ought principally to be performed and supported by the part of the fixed heel provided with a screw, which fastens not merely the blade, but secures the fixing of the heel of the boot by the spike-formed head of the screw. All balancing power of the body ought to find its support on the frame, and prevent any fall backward, by which concussions of the brain are frequently caused. The hight of the blade depends entirely on the side-balancing or bending of the skater's body, and therefore must be in proportion to the side extension of the foot-plate, so that the surface of the ice cannot be touched by the wooden plate, which would cause a sudden stop of the gliding blade.

"All forms of metal skates on boots increase fatigue, and cause an unsteady footing during thawing temperature, and any fastenings for securing the toes by metallic bands provided with buckles, are not merely chilling to the compressed toes, and thus becoming inconvenient, but are from their pressure and prevention of the free circulation of the blood, the cause of frost-bitten toes, and also most painful to skaters who suffer from corns or bunions.

"I am fully convinced that any so-called improvement of skates, by the application of more metallic parts than hitherto in use, is rather an evil instead of a benefit to the skater, because it increases the weight of the skate, and thus fatigues prematurely, without increasing whatever the security against any ordinary accident.

"By experience I have found that the most suitable skates are those of the original simple form, provided with a steel blade, having a sharp incision, or groove, which reaches or extends to its ends, and without having any projecting neck or head, and fastened to the boot by a single leather strap, with two buckles, one to form a sling or noose, for the toes, passing through three holes of the wooden supporting sole, the other buckle reaching exactly that part of the boot containing the elastic jointure of the ankle. This strap must carefully be secured at the first hole of the sole or support, by means of wooden pegs, so that no shifting or dislocation of the strap at the toes can take place."

[Had the writer of the above been introduced to some of the improved American skates, we think he would have changed his views on metallic fastenings.—EDS. SCI. AM.

OSWEGO manufactures annually from 600,000 to 700,000 barrels of flour, and 10,000 pounds of starch.

A WOMAN'S VIEW OF THE PATENT OFFICE.

Elizabeth Kilham has recently visited the Patent Office, and she there saw a good deal that gratified her curiosity. In a letter to the *Evening Post*, she tells

WHERE INVENTIONS COME FROM.

"Since the organization of the Patent Office one hundred and ten thousand patents have been granted. Between five and six hundred of these were to citizens of foreign countries; the remainder to American citizens. The acting Commissioner, General Duncan, in an exceedingly able and interesting lecture delivered before the American Social Science Association last March, makes the following distribution of patents: 'To New England, about twenty per cent, Massachusetts having as her share ten per cent, and Connecticut five; to the Middle States, thirty-six per cent, New York alone receiving twenty-three per cent; to Ohio and Illinois seven per cent each; to California, two per cent.; and to the eleven States that engaged in the rebellion, but four and one half per cent.' In evidence of the impulse given to the southern mind by the removal of the institutions which produced such complete mental and physical stagnation, may be taken the fact that while, before the war, the agricultural inventions of the South were barely two per cent of the whole, they have, since the close of the war, reached seven per cent.

"Inventions are most numerous in agricultural implements and household conveniences. Of agricultural inventions, the greatest number is from the West; of inventions in manufactures, from New England and New York. The applications for patents form a curious index to the mind of the country. There are what may be called epidemics of invention. Whatever interest is dominant for the time being is almost unerringly indicated by the business of the Patent Office. It is like laying the finger on the pulse of the nation and counting its heart beats. During the rebellion, inventions and improvements in everything that could in any way be used in war, completely overwhelmed the examiners. During the velocipede mania four hundred and thirty-two applications were made for patents in four months' time. Never a great fire but brings out some improvement in fire-escapes or heating apparatus. Never a great burglary but is almost immediately followed by one or more inventions in locks. Scarcely a kerosene accident, but brings an improved burner. In this one article over four hundred patents have already been granted. Last spring, when so many banks were deceived by checks altered from small to large amounts, there were filed in less than a week over forty applications for patents for an invention by which such alteration could be at once detected. Each one of the forty applicants expected, no doubt, to make his fortune from so exceedingly useful and important an invention. They all embodied nearly the same idea; and an examination showed that a patent had been issued for the very same thing thirty years ago. When planchette was the rage a dozen inventions of that kind were before the examiner at one time. To all of them patents were refused on the ground that it was not a useful invention; but, on the contrary, decidedly pernicious and mischievous; many persons having thereby been rendered insane.

HOW TO GET A PATENT.

"Before granting a patent various questions besides the novelty of the invention are considered. This is, of course, the primary question, 'Is it new with the applicant?' The decision of this question involves an immense amount of labor and research; an examination of all the reports and drawings, not only of American patents but those of foreign countries, and numerous scientific works. Legal questions are also involved which must be carefully decided. The question of novelty being settled, that of utility arises. Is the invention useful: or is it trivial, inoperative, or positively injurious and hurtful? In either case a patent is refused. A notable case of refusal of a patent on account of the mischievous tendency of the invention occurred under the administration of Hon. Joseph Holt. The applicant desired a patent for 'a policeman's club, so constructed that, upon releasing a spring, a triple row of keen-edged lancets would leap from hidden recesses and mangle the hand of an adversary.' The applicant's professed object was to provide a weapon which should obviate the necessity of the carrying of firearms by policemen, and yet to furnish them with a full means of protection. The Commissioner refused the patent on the ground that while the professed object was a laudable one, 'the transforming of the implement to a weapon of offence in the hands of desperadoes, as would inevitably be done, would be a great evil.' In his decision occurs this forcible sentence: 'An invention, to be patentable, must not be useful to the few with a chance of its becoming hurtful to the many; but it must clearly appear that, in view of the interests of the whole community, the good would decidedly preponderate over the evil.'

"In almost all classes of invention the names of women appear as patentees. In articles of wearing apparel they are largely represented. Several improvements in cooking stoves bear female names. An Indiana lady has invented a fluting machine; another, within a few months, has taken out several patents for different improvements in the construction of axles; and women's names are attached to some valuable improvements in surgical apparatus, this last forming a strong argument in favor of the idea advanced by some eminent physicians that women are peculiarly fitted by nature for the study and practice of medicine.

A PLACE OF ARBITRATION.

"Leaving the 'model hall,' we descend to the lower floor, and passing the examiners' rooms; the library, with its twenty thousand volumes; the draftsmen's room, where are preserved drawings of every invention for which a patent has been sought since the organization of the office; the record room, where are the printed reports of patents granted, the issue of each week in a separate volume, we come to the sunny southeast corner, where, in a pleasant room, brightened by the most cheerful of inanimate things, a blazing wood fire, the Commissioner 'improves each shining hour.' We will go in here.

"The stream of business is at flood tide, and we sit quietly and watch and listen. One o'clock is set for the hearing of a case of interference.' An interference is a proceeding to determine which of two or more persons has the right to an invention, each claiming to be the first inventor. The principals are not present. Their respective attorneys argue the case—outwardly calm, inwardly raging. 'Their words were smoother than butter, but war was in their hearts.' The decision is made, and they retire; one jubilant, the other in an unmistakable fit of the sulks. 'Will the General see a gentleman?' inquires the magnificence at the door. The General will; and a quiet-looking elderly man enters, evidently under great excitement; that kind of excitement so intense that it produces a calm almost like death. He lays a model on the table. 'This does not represent my case,' he says. 'I find that the model is made wrong. This,' holding out a little piece of machinery, 'should have been put in instead of that. Can I substitute it now?' 'How is your drawing?' the Commissioner asks; 'does it correspond with this model, or with what you intended?' 'It is like this.' 'Then all you can do is to withdraw this and file a new application.' 'I have spent months upon this;' his hand trembles and there is a quiver in his voice. The General's keen eye takes it all in, and very gently he says: 'I wish I could do otherwise; but in these matters the office has no jurisdiction; we have to go according to law.'"

Law of Increase in the Population of the Globe.

The law of the relative increase in the numbers of mankind, and in the supply of food and other commodities required for their support may now be found in the following propositions:

Motion gives force, and the more rapid the motion the greater is the force obtained.

With motion matter takes on itself new and higher forms, passing from the simple ones of the inorganic world, and through those more complex of the vegetable world to the highly complicated forms of animal life, and ending in man.

The more rapid the motion the greater is the tendency to changes of form, to increase of force, and to increase of the power at the command of man.

The more simple the forms in which matter exists, the less is the power of resistance to gravitation; the greater the tendency to centralization, the less the motion, and the less the force.

The more complex the form, the greater becomes the power of resistance to gravitation; the greater the tendency to decentralization, the greater the motion, and the greater the force.

With every increase of power on the one hand, there is diminished resistance on the other. The more motion produced the greater must, therefore, be the tendency to further increase of motion and of force.

The most complex and highly organized form in which matter exists is that of man; and here alone do we find the capacity for direction required for producing increase of motion and of force.

Wherever the greatest number of men exist we should therefore find the greatest tendency to the decentralization of matter, to increase of motion, to further changes of form, and to the higher development commencing in the vegetable world and ending in the increased production of men.

With every increase in the extent to which matter has assumed the form of man, there should, consequently, be an increase of his power to control and direct the forces provided for his use;—with constantly accelerated motion, and constantly accelerated changes of form, a constant increase in his power to command the food and clothing needed for his support.

In the material world, motion among the atoms of matter is a consequence of physical heat. Greatest at the equator, it diminishes until, as we approach the poles, we reach the region of centralization and physical death.

In the moral world it is a consequence of social heat; and motion, as has been already shown, consists in "an exchange of relations" resulting from the existence of those differences that develop social life. It is greatest in those communities in which agriculture, manufactures, and commerce are happily combined, and in which, consequently, society has the highest organization. It diminishes as we approach the declining despotisms of the East, the regions of centralization and social death. It increases as we pass from the purely agricultural States of the South towards the regions of more diversified industry in those of the North and East, and there, accordingly, do we find decentralization, life, and force.

Centralization, slavery, and death, travel hand in hand together in both the material and the moral world.

The view here presented differs totally from that commonly received, and known as the Malthusian law of population, which may thus be given:

Population tends to increase in a geometrical ratio, while the supplies of food increase in an arithmetical one only. The former, is, therefore, perpetually outstripping the latter, and hence arises the disease of over-population, with its accompaniments, poverty, wretchedness and death; a disease requiring for its remedy, wars, pestilences and famines on the one hand, or on the other, the exercise of that "moral restraint" which shall induce men and women to refrain from matrimony, and thus avoid the dangers resulting from addition to the numbers requiring to be fed. Reduced to distinct propositions, the theory is as follows:

1. Matter tends to take upon itself higher forms, passing from the simple ones of inorganic life to those more beautiful of the vegetable and animal life, and finally terminating in man.

2. This tendency exists in a slight degree in the lower forms of life, matter tending to take on itself the forms of potatoes and turnips, herrings and oysters, in an arithmetical ratio only.

3. When, however, we reach the highest form of which matter is capable, we find the tendency to assume it existing in a geometrical ratio; as a consequence of which, while man tends to increase as 1, 2, 4, 8, 16, 32, potatoes and turnips, herrings and oysters, increase only as 1, 2, 3, 4; causing the highest form perpetually to outstrip the lower, and producing the disease of over-population.

Were this asserted of anything else than man, it would be deemed in the highest degree absurd; and it would be asked, why a general law should here be set aside? Everywhere else, increase in number is in the inverse ratio of development. Thousands of billions of coral insects are needed to build up islands for men and animals that count by thousands or by millions. Of the *clio borealis*, thousands furnish but one mouthful for the mighty whale. The progeny of a single pair of carp would in three years amount to thousands of billions; that of a pair of rabbits would in twenty years count by millions; whereas that of a pair of elephants would not number dozens. When, however, we reach the highest form, we hear of a new law, in virtue of which man increases in a geometrical ratio, while increase of the commodities required for his use is limited to the arithmetical one.

Endowed with faculties that can be developed solely by association with his kind, made in the image of his Creator, and gifted with the power to distinguish right from wrong, man is thus required to choose between starvation on the one hand, or, on the other, abstinence from that association which tends, in accordance with the divine command, to promote increase of numbers. Such is the generally received doctrine of modern political economy, and, strange as it appears, no proposition has ever yet exercised more influence on the fortunes of the human race. That it should so have done has partly resulted from the fact that it has been propped up by another, in virtue of which man is supposed to have commenced the work of cultivation on the rich soils which would give large returns to his labors, and to have been compelled, with the growth of population, to resort to poorer ones, with constant decline in the reward of his toil—a theory that, if true, would establish the correctness of the Malthusian law of population.—*Carey's Social Science.*

Curiosities of Scientific Literature.

Among the curiosities of scientific literature, a little work, published a few years since, must find a place. It is entitled "Principles and Rudiments of Botany, delivered according to an Iulian system of arrangement and Iulian method of classification; by C. R. W. Watkins, Gent., late Captain in the Bombay Army." These "principles and rudiments" are here, according to the preface, delivered in language "better adapted for the intellectual amusement and instruction of young persons of both sexes" than that employed in previous works; and "Botanical science" is "rendered more agreeable to students in modern times." The following extract will give a faint idea of the mode in which these promises are fulfilled, and also of the contents of the volume: "The pink (*Dianthus*) has four or five idola, ten to twenty ikona, and twenty to forty petala. The flowers are few, and di, tri, quinque ligate, and they terminate separately and irregularly. The Sweet William (*Dirythme*) has two idola, ten ikona, and five petala. The flowers are numerous and chorovinkulate, and the mode of gemmation comprises several synterminal and equimarginal chorrythma, or conturrythma. They cannot, therefore, be of the same genus; because the numerical indices, and typical characters of each gemmos, or hermaphral gemm bud of the two kinds of plants, are not symbolical; but differ, as well as the mode of gemmation, more widely than the specific, and physical circumstances of their constitutional, or peculiar veget-organical structure."

Weights for Use in Experiments.

It is a source of constant annoyance to chemists and scientific investigators generally, that the minor weights in use are so small and so easily affected by atmospheric influence, that in a short time they cease to be trustworthy. The great requirement is a substance of less specific gravity than the copper, brass, or platinum, usually employed, and not liable to tarnish by exposure to the air—for which the proper name is decay. Dr. Phipson, of England, relates that he has used a set of weights made of aluminum, well known as the metal of the least specific gravity, for the last ten years, by MM. Collet Frères, of Paris. The doctor always touches the weights with pliers made of soft brass, and exposes them as little as possible to the air of the laboratory. He reports that they are almost as brilliant in color as when new, and although they have been used twice or thrice a day for the whole ten years, they are still perfectly accurate. Brass or copper will yield to the atmosphere an appreciable fraction of its gravity; and the small weights made of either metal are very troublesome to handle, and are likely to lead to errors. The aluminum is better for the purpose than even German silver and its kindred alloys, which are remarkable for their resistance to tarnish. Makers of scales for scientific purposes or druggists' use, will do well to note these facts.

Canadian millers are largely importing wheat from Chicago and Milwaukee.

THE INCRUSTATION OF BOILERS.

[Condensed from Engineering.]

It is somewhat curious that while the complaints of inconvenience resulting from the incrustation of boilers are so numerous, the attempts to avoid those inconveniences by providing boilers with pure water should be so few. Boiler owners are ready enough to patronize patent fluids, compositions, and a variety of nostrums having for their object the prevention of incrustation, but we rarely find efficient appliances in use for purifying the water before it enters the boiler, and thus rendering such doctoring as we have just referred to unnecessary. It must not be supposed, from what we have just said, that we object *in toto* to the employment of chemical means for preventing incrustation on the other hand, we believe that such means may be employed with great advantage in a vast number of cases, but we consider, first, that chemical "anti-incrustators" should not be applied indiscriminately and without a knowledge of the impurities which it is desired to remove; and, second, that as far as possible the purification of the feed water should be effected before it enters the boiler, and not in the boiler itself.

Many of our manufacturing towns are, as is well known, very badly off for water available for use in boilers, and preeminent amongst these towns is Oldham. Oldham stands on elevated ground, and is supplied with water conveyed a considerable distance from boggy ground at a higher level, and the supply is, moreover, so limited that the foul water from drains has to be used for boilers and for condensing purposes. Under these circumstances it has, of course, been necessary to provide means for purifying the water. In the first place, to make the water fit for use for condensing purposes, it is made to pass in succession through three settling reservoirs, the second reservoir receiving the overflow from the first, and so on. The injection water is taken from the last reservoir and the waste water from the hot well flows back into the second. The boilers are fed from the hot well, the feed being filtered on its way to the boilers. In one establishment the filters consist of a number of vertical cast-iron vessels strong enough to stand an internal pressure of 25 lbs. per square inch more than the boiler pressure; these vessels being each provided, at about the middle of its hight, with a perforated plate or grating, on which a layer of calcined bones, about 3 ft. in thickness, is placed. The water is forced by the feed pump up through these bones, and is led off from the top of the filter to the boiler. The water in the hot well is so filthy that the bones become choked with dirt in about half a day's working; and each filter is therefore cleansed twice a day—namely, during the dinner hour and at night—by blowing steam downwards through it. By this simple means the bones are thoroughly cleansed and the filters made ready for work again. The results obtained by the use of the plans we have described have been of a very satisfactory kind, and the whole arrangement is so simple as to commend itself at once to those suffering from the use of very dirty water.

In the case of non-condensing engines an arrangement of feed-heater in addition to the filters is employed, so as to obtain a supply of hot clean water. For this purpose the water is conveyed from the last settling reservoir into a covered tank, 6 ft. deep by 6 ft. 3 in. wide, having the water level regulated by a ball-cock, so that it is maintained 9 in. below the cover. At one end there is fixed on the cover a vertical cylindrical feed-water heater, 12 ft. high by 2 ft. 6 in. in diameter, this heater being traversed by tubes, whilst at the opposite end of the cover stands a vertical pipe, 20 in. in diameter, 30 ft. high, and open at the top. By means of a circulating pump the water is lifted from the cistern and made to fall in a shower down the pipe just mentioned, meeting in its course the exhaust steam from the engines, which is made to pass down through the tubes of the feed heater, then over the surface of the water in the tank, finally rising up through the vertical pipe, to be met by the falling shower. By this arrangement the water in the tank is heated to about 170°, at which temperature it is taken off by the feed pump and forced, first through a bone filter, and then through the feed-water heater to the boiler, which it enters at a temperature of about 210°. By the employment of this arrangement, an important saving has been effected in fuel and labor, and the boiler, which formerly had to be cleaned out every week or fortnight, now has to be cleaned at holiday times only.

In many cases trouble is experienced from the presence of an excessive quantity of bicarbonate of lime in the water used for feeding boilers, and in such cases Clark's process for purifying the water might frequently be resorted to with advantage. It is very usual to speak of the presence of large quantities of carbonate of lime in water, but this is an error, the carbonate of lime being almost insoluble, a fact on which Dr. Clark's process is founded. This process consists, as many of our readers are no doubt aware, in treating the water containing the bicarbonate of lime which it is desired to remove, with lime water, or a kind of milk of lime, the effect being that the lime thus added deprives the bicarbonate of a portion of its carbonic acid, thus converting it—and being itself also converted—into carbonate of lime, which, being almost insoluble, is deposited. The greater part of the lime will be deposited in the mixing tank; the water drawn off may be subsequently filtered by passing it slowly upwards through another tank partially filled with small pieces of coke. The coke is contained in a loose cylindrical casing within the tank, so that it can be conveniently renewed when clogged with lime. This apparatus has been at work over two years, and it has been found to be very effectual in keeping the boiler clear of all hard scale.

Although, however, the adoption of such methods of purification as those above described will be found exceedingly beneficial in a vast number of cases, yet we believe that ultimately it will be acknowledged that the only true remedy for bad water is the adoption of surface condensers. In applying surface condensers to land engines arrangements will in many cases have to be adopted differing greatly from those employed at sea. The condensing water available on land, in many instances is of such an impure kind that such condensers as are fitted to marine engines would be clogged by it in less than a week. In these cases the condensers should be so arranged as to permit of all parts being thoroughly accessible, and they should be made to stand rough work. Where the condensing water contains much floating matter, and where appliances for purifying it cannot conveniently be provided, evaporative surface condensers are particularly suitable, as they can be made without any passages to clog up, and with all the surfaces in contact with the condensing water fully exposed at all times. Condensers of this class, in fact, have been far from receiving the attention to which their simplicity and the comparatively small amount of water with which they can be worked, entitle them. Probably the chief objections to them are their cost and the space they occupy; but the first can scarcely be considered excessive, when their advantages are taken into consideration, and by a little management they can generally be arranged to occupy space which would not otherwise be turned to account.

In instances where, from some cause or another, surface condensers cannot be applied, and where, notwithstanding bad water being used, elaborate arrangements for treating it cannot be employed, attempts should still be made to cause the water to deposit the greater part of its impurities in a separate receiving vessel, in which the water may be heated under pressure, rather than in the boiler itself. The boiler should only be allowed to receive with the water such matters as cannot practically be removed elsewhere, and if this result were generally sought after, we should hear little of over-heating, distorted flues, and a host of other troubles which now annoy the boiler proprietor, to say nothing of the more serious failures which are but too frequently caused by incrustation.

THE LAND OF FIRE AND ICE.

By Professor Willard Fiske, in the Cornell Era.

Was there ever such an anomaly as the island of Iceland? Geographically it belongs to the Western continent, and yet, historically and politically, it is a member of the Eastern. It lies close under the Arctic circle, where winter prevails during three quarters of the year, and is surrounded by seas filled with icebergs; and yet boiling geysers and fountains of heated steam burst everywhere from its surface, while great volcanoes pour down into its valleys and upon its plains streams of molten lava. The nearest neighbors of the Icelanders are the Eskimos of Greenland; yet while the Eskimos are sunk to the nether level of ignorance, the Icelanders have raised themselves to an elevated plane of enlightenment. And so the wonderful island lies there, a link between the two hemispheres; a site where the most opposite of elements, heat and cold, are constantly contending for sovereignty; the seat of a race of the highest civilization in close contact with a race of the lowest barbarism. Nor does this end the chapter of contradictions. Lying almost beyond the range of either animal or vegetable production, the island still yields commodities which many more favored localities cannot furnish. It rivals semi-tropical Italy in the value of its sulphur mines, temperate Germany in the variety of its mineral waters, Scotland and Norway in the fertility of its salmon fisheries, and annually produces, in proportion to its population, three times the number of horses and sheep raised in our own State of New York. It exports several articles which are either found nowhere else, or, if found, are of greatly inferior quality, such as the down of the eider duck, which makes its way to every palace, and upon which the heads of all the kings of the earth easily or uneasily lie, the feldspar so largely used in optical experiments, and that semi-carbonized wood, known as surtubrandur, which, as a material for the manufacture of furniture, equals the famous ebony of the tropics. A land of glaciers, and suffering keenly from the chill winds that blow off the icy shores of Greenland, Iceland's chief harbors are open all the year round, while those of the Baltic, far to the south, are frequently closed. A treeless country, its inhabitants often burn the costliest of woods—mahogany, rosewood, and Brazil wood—which has been borne to them from the tropics, at no expense for freight, by the current of the Gulf Stream. A land where wheat will not ripen, its people possess in abundance a vegetable growth, the *lichen islandicus*, which, in far richer countries, is accounted a luxury. A nation almost destitute of schools, all of its sons and daughters are taught to read and write from their earliest years.

The history and philology of the island present features equally strange and striking. It is the smallest of all Teutonic communities, while its speech is the most ancient, and, grammatically, the richest of all the Teutonic dialects. In it are preserved the oldest poems, the oldest political orations, and the oldest religious ideas of our race. It is, as has been said, the feeblest of all Teutonic communities, yet it was the first to develop a republican system of government, the first to establish trial by jury, the first to compile codes of law. The colonization of the island furnished a parallel in the ninth century to the colonization of New England in the seventeenth, its pioneers seeking its barren shores for the self-same reason that led the Puritans to the rock-bound coasts of Massachusetts and Connecticut. Its sturdy sons helped to delay the fall of the Eastern Empire by enlisting in the body guard of the Byzantine monarchs; took part, under Rurik, in the foundation of the Russian monarchy; took part, under Rollo, in the establishment of that Norman dynasty which subsequently conquered England; set up kingdoms, and left traces of their speech, in Ireland and Scotland; built churches and towns in Greenland; and preceded Columbus, by five hundred years, on the dreary, watery path which led to the mainland of America.

No nation so small as Iceland has so large a literature The number of printed books amounts to many thousands, and the number of unprinted works, preserved as manuscripts in the public libraries of Europe, is at least equally great. Nor is this literature, as is the case with many minor nationalities, and with most colonial communities, made up of translations, but is almost wholly composed of original works. With the exception of the Bible and a few theological works, Homer and one or two other classics, Milton, Klopstock, Pope, and portions of Shakespeare, Byron, and Burns, very little of the literature of other nations has been translated into Icelandic. The modern literature, especially of this century, is rich in poetry and in poetical works.

The Icelandic throws a flood of light upon the history of the English language. In their early stages, so nearly connected were the two tongues that we can very well imagine an intelligent Anglo-Saxon and an intelligent Icelander making themselves mutually understood, with some little slowness and difficulty perhaps. At a later period the Icelandic greatly influenced the English, especially in its northern dialects, so that most of the dialectic words used by Burns are at once comprehensible to the student of the insular language. Yet, notwithstanding its importance to the English scholar, the Icelandic has hitherto been, to the great mass of students of English lineage, a sealed book. While the philologists of Scandinavia were making broad reputations by their investigations in the old Northern domain, while the philologists of Germany were cleverly availing themselves of this field, the English knew so little of the harvest which was awaiting the reaper, that the number of men in England and America who had ever paid any attention to Icelandic might almost, until within the last decade, have been reckoned up on the fingers of a single man. But in England a new era has dawned. The labors of Laing and Dasent and Thorpe in Icelandic literature are beginning to excite interest in the Icelandic language, and a great impulse has latterly been given to the new movement by the publication of the first part of an excellent Icelandic-English lexicon, through the agency of the University of Oxford.

But through it all, through the present days when its speech opens up a mine of wealth to the linguist of every Germanic tribe, as through those past days when its writers were the chroniclers of all the neighboring Germanic nations, the venerable island floats upon the gray waters of the distant Northern sea, the wonder alike of the naturalist and the philosopher. The former sees in it a display of nature's powers under forms which they nowhere else assume; the latter sees in it a nation, weak in numbers, maintaining unchanged for almost a thousand years, against obstacles never before surmounted by man, its language, its literature, and its customs.

The Prussian Percussion Fuse.

The percussion fuse used by the Prussian artillery consists of a small metal socket into which fits a metal striker, which is a nearly cylindrical piece of brass, having at one end a needle point. The socket with the striker in it is carried in the shell, being fixed in its place by means of a screw plug which screws into the nose of the shell. The screw plug is tapped for the reception of a small detonator, which, however, is not screwed in until the shell is required to be used. The striker, being free to move forward by its own weight, would, of course, be liable directly the detonating plug is screwed in, to cause an explosion by falling forward upon it, either by the accidental tilting forward of the head of the shell, or from the jar given in loading, or by the sudden movement of the parts at the moment of firing. To prevent this, a stout iron pin is passed through the head of the shell, and through the fuse between the striker and the detonator, preventing any contact between the two. The centrifugal force generated by the rotation of the shell throws out the pin immediately the shell has left the bore, and there is now nothing to prevent the striker from coming into contact with the detonator. But this it cannot do until something occurs to suddenly check the flight of the shell—in other words, until the projectile impacts upon the ground or against some obstacle, such as a man's body, which will momentarily reduce its velocity. At that moment the striker falls forward, on the same principle and from the same cause as a bad rider is thrown over his horse's head when the beast stops suddenly in its gallop. These fuses have been much extolled, and some writers have not hesitated to ascribe to them a great part of the successes of the Prussian artillery, yet, says the *Pall Mall Gazette*, they are open to many serious objections, and very far from uniform or satisfactory in their action, even in peace time. The Belgians, who copy the Prussians very closely in their artillery *matériel*, use the Prussian percussion fuse, and Capt. Nicaise says that out of 8,245 shells and shrapnel fired with this fuse between 1863 and 1869, there were 128 premature bursts—1·5 per cent; 433 fuses slow in action—5·25 per cent; 131 blind fuses—1·59 per cent; being a total of 692 failures—8·39 per cent. Exception may also be taken to the employment of a fuse which necessitates the operation of fixing a detonator and pin at the moment of firing—an operation which has to be very carefully performed for fear of accidents. If in the hurry of action the pin should be omitted, or if it should fall out of the shell, or if the man holding the shell and charged with the duty of keeping the pin in its place should happen to be shot, an ac cidental explosion, likely to be attended with fatal consequences to the gun detachment, must also certainly result. Other reasons might be given for not accepting the high estimate of this fuse, which, on insufficient grounds, seems to have been hastily formed. That the fuses have done better than the exceedingly defective French time fuse, does not prove much. Nevertheless, it may be fully admitted that the percussion fuse problem is very far from having yet been satisfactorily solved by our artillerists. It is one of exceeding difficulty; and it is quite certain that if not solved in England, they are just as far or farther from having satisfactorily solved it in Prussia. In France it seems to have been abandoned in despair, and Belgium can think of nothing better than following the Prussians.

The Catacombs of Rome.

Few travelers come to Rome without making a visit to the Catacombs, although few penetrate far into those dark and intricate recesses. Their origin is unknown—at least, there are no authentic records of their excavation. The purpose for which they were last used—the burial of the Christian dead—does not necessarily indicate the purpose for which they were formed. It is probable that they were dug out in order to obtain, for building purposes, the volcanic stone and sand which underlie the whole Campagna; but when, or by whom, is not known. The excavations may have been commenced before the time of the ancient Romans; but if so, they were continued in their day, as they contained the material required for the construction of many of their works. It was taken out by quarrying or digging, leaving only enough to sustain the superincumbent mass of earth. They are of great extent, reaching in every direction as far as modern research has extended. The whole Campagna is honeycombed by them. Openings occur in various places, and accidents have not been uncommon, in which riders over the Campagna have broken in and sustained severe injury. They are regarded as so unsafe, that visitors are usually taken only through a limited portion of those connected with the Church of St. Sebastian on the Appian Way. The rock and earth are liable to fall, and sad indeed would be the fate of those who should be buried beneath the falling mass; and sadder, yet, of those whose retreat should be cut off, while they were left to wander hopelessly, until compelled by weariness and weakness to lie down and die. Several years ago, a school, consisting of a teacher and more than twenty boys, descended into this subterranean city of the ancient dead, but not one of them returned to tell what was their fate. The fall of the earth over one of the passages by which they had left the main route, rendered their escape by the same way impossible; and although diligent search was made, nothing is known to this day of how or where in the vast labyrinth they met their death.

The peculiar interest attaching to these Catacombs is, that during the early ages of Christianity, in the times of persecutions by the Roman Emperors, they were the resort of Christians who fled to these recesses for safety, and probably to some extent for worship.

The passages are very narrow, not more than three or four feet wide, and about six feet in hight. On each side and throughout their whole extent they are lined with niches, or shelves, cut into the wall one above another and usually four or five in hight, in each of which there was just room for a body to be laid lengthwise. The fronts of the niches were closed with long slabs of terra cotta, cemented. Occasionally marble was used, with an inscription, containing some motto or symbol expressive of the wishes or hopes of the living for the dead. These niches are now all tenantless and open, but we could see where the dead had been reposing. The inscriptions are preserved elsewhere as relics. One of the long halls of the Vatican is lined with the marbles taken from these tombs.

The Catacombs connected with the church of St. Agnese, in another part of the Campagna, are nearly in the state in which they were discovered. The excavations are much more regular and on a larger scale than those which we had previously seen. Instead of being more unsafe, as they are generally supposed to be, they are less liable to crumble and fall. The rock in which the excavations are made is more solid, allowing the passages to be cut with more exactness, and they run often to a great distance in a right line. The roofs are vaulted with regularity, and the sides cut perfectly square. The same niches occur as in the other Catacombs, and rise above one another to the number of five or six, but they have not been rifled excepting to remove the slabs and inscriptions. The bones of the dead by hundreds and even thousands are lying where they were deposited sixteen or eighteen centuries ago.

After walking for a long time through these halls, some seventy feet below the surface of the ground, and having entered several chambers painted rudely in fresco, we ascended to another story, but not to the light of day. These passages are generally two or three stories in hight, but seldom have any intercommunication. The air is exceedingly dry, and the temperature higher than that of the air above, but after a time it becomes stifling, although there is nothing unpleasant in other respects. It appears to be perfectly pure.

The inscriptions which are found upon the marble slabs with which the niches were closed, are an interesting study, and may be seen at any time in the main entrance to the museum of the Vatican. There are many pieces of rude sculpture in bas-relief, representing Scripture scenes, and generally those scenes which were most appropriate to the persecuted state of the early Christians. The three children in the fiery furnace, and Daniel in the lion's den, are frequently represented. The baptism of Christ and various scenes in his life are sculptured in the same manner. The dove, as an emblem of peace, occurs very often. I give the translation of a few as a specimen:

"Lannes, the martyr of Christ, rests here. He suffered under Diocletian."

"In the time of the Emperor Adrian, Marius, a young military leader, who had lived long enough: with his blood he gave up his life for Christ. At length he rested in peace. The well-deserving, with tears and fears, erected this on the Ides of December, VI."

"Here lies Gordianus, deputy of Gaul, murdered with all his family for his faith. They rest in peace. Theophila, his maid, erected this."

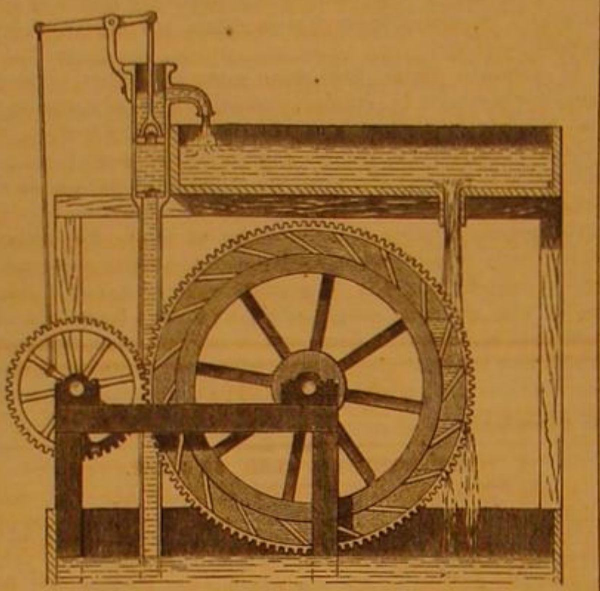
"In peace," and "In Christ," frequently occur upon the slabs which closed the graves.—*N. Y. Observer.*

PERPETUAL MOTION.

NUMBER XI.

Fig. 24 shows a principle so often employed for the production of self-moving machines that it ranks next to that of perpetually eccentric weights, in its delusive power upon minds of inventors. The attempt to compel a water wheel to raise the water which drives it, is, in one form or other, perpetually recurring in devices upon which our counsel and opinion is sought. The worst of the matter is, that in most

FIG. 24.



cases our advice to drop such absurd projects is received as evidence of our want of sagacity and knowledge, and our would-be client becomes the dupe of some not over conscientious patent agent, who pockets his fee, and laughs in his sleeve at the greenness of the applicant.

The device illustrated is one submitted by one of these enthusiastic individuals who, without understanding the first principles of mechanics, believes he is about to revolutionize the industry of the world by his grand discovery; and as honor, and not pecuniary reward, is his object, he seeks to make public his invention through the wide circulation of this journal. He is quite willing we should adversely criticise the device, because its merits are so great that no amount of skepticism, resulting from our blind prejudice, can, he thinks, influence candid minds against a principle so obviously sound and sublimely simple. It is unnecessary for us to describe the device, as it explains itself. The inventor has not tried it to see whether it will work. What need, when anybody can see on paper that "*it must go?*"

FIG. 25.

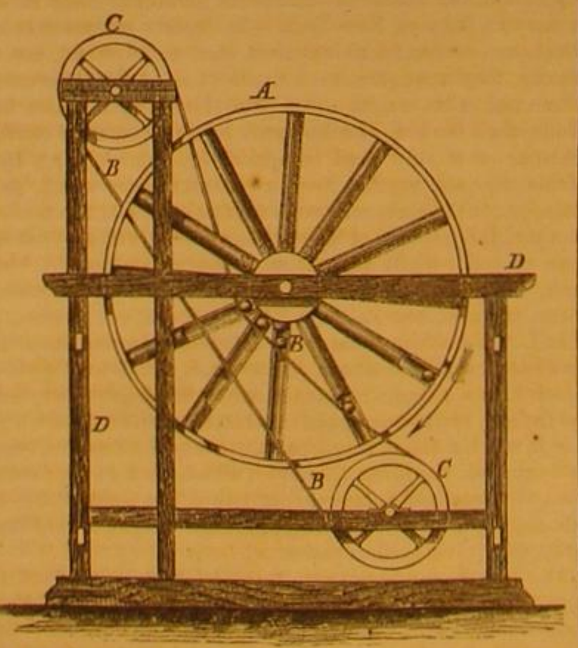


Fig. 25 represents an attempt at securing the desired object by means of eccentric weights, kept so by means of an endless belt and pulleys, of which the inventor thus writes:

The annexed drawing shows how I have at length taken this enticing jilt (perpetual motion), though after a long and weary chase—

Through pleasant and delightful fields,
Through barren tracts and lonely wilds;
Mongst quagmires, mosses, muirs, and marshes
Where dell or spunkie never scarce is!
By chance I happened on her den,
And took her where she didna ken.

A represents a wheel with twelve hollow spokes, in each of which there is a rolling weight or ball. B is a belt passing over two pulleys, C. There is an opening round the wheel from the nave to the circumference, so as to allow the belt to pass freely and to meet the weights. The weights are met by the belt as the wheel revolves, and are raised from the circumference till they are at last brought close to the nave, where they remain till, by the revolution of the wheel, they are allowed to roll out to the circumference. By this arrangement, the weights are, on one side of the wheel, always at the circumference, so that that side is more powerful than the other, which causes the wheel continually to revolve. D is the frame of the machine. The arrow points out the direction in which the wheel turns.—DIXON VALLANCE, Liberton Lanarkshire, Nov. 10, 1825.

In 1612, Thomas Tymme, Professor of Divinity, published a philosophical dialogue, in which he discourses of the perpetual motion invented by Cornelius van Drebble, a Dutchman, who was engineer to King James, in England.

Tymme's work is a small quarto. The author's name on the title papers occurs in the smallest type. It is repeated again in full—'Thomas Tymme'—both to the dedication "To the right Honourable Sir Edward Coke, Lord Chiefe Justice, &c., &c.," and also the Address to the Reader, which latter concludes:

And for that rare things move much, I have thought it pertinent to this Treatise, to set before thee a most strange and wittie invention of another Archimedes which concerneth Artificial perpetual motion, immitatjng nature by a lively patterne of the Instrument it selfe, as it was presented to the King's most royall hands, by Cornelius Drebble, of Alchmar in Holland, and entertained according to the worthinesse of such, a gift my paines herein bestowed and intended for thy profit and pleasure, if it seeme but as iron, yet let it serve for the Forge and Anvill of good conceit, if the discourse seeme rough, shadow it, I pray thee, with the curtaine of smooth excuse: &c.

The work is divided into two parts, the first containing six, the second four chapters.

Chap. 3.—Concerneth the nature and qualitie of the earth: and the handling of a question whether the earth hath naturall motion or no.

Also herein is described an Instrument of Perpetuall Motion, as stated in the list of Contents.

At page 56 commences chapter 3, from which we extract the following:

PHILADELPH.—For as much as the Earth and Sea make but one globous body united and combined together, I pray you describe the form thereof to me.

This is explained by Theophrast—the dialogue occupying four pages—at last he says:

. . . And to make plaine the demonstration unto you, that the Heavens move, and not the earth, I will set before you a memorable Modell and Patterne, respecting the motion of the Heavens about the fixed earth, made by Art in the imitation of Nature, by a gentleman of Holland, named Cornelius Drebble, which instrument is perpetually in motion without the meanes of Steele, Springs, and waights.

PHIL.—I much desire to see this strange Invention. Therefore I pray thee, good Theophrast, set it here before me, and the use thereof.

THEO.—It is not in my hands to show, but in the custody of King James, to whom it was presented. But yet behold the description thereof here after fixed.

PHIL.—What use hath the globe, marked with the letter A?

THEO.—It representeth the Earth: and it containeth in the hollow body thereof divers wheels of brasse, carried about with moving, two pointers on each side of the Globe doe proportion and shew forth the times of dayes, moneths, and yeeres, like a perpetuall Almanacke.

PHIL.—Both doth it also represent and set forth the motions of the Heavens?

THEO.—It setteth forth these particulars of Celestiall motion. First, the houres of the rising and setting of the Sunne, from day to day continually. Secondly, hereby is to be seene, what signe the Motion is in every 24 houres. Thirdly, in what degree the Sunne is distant from the Moone. Fourthly, how many degrees the Sunne and Moone are distant from us every houre of the day and night. Fifthly, in what signe of the Zodiacke, the sun is every Moneth.

PHIL.—What doth the circumference represent, which compasseth the Globe about?

THEO.—That circumference is a ring of Cristall glass, which being hollow, hath in it water, representing the sea, which water riseth and falleth, as doth the floud, and ebbe twice in 24 houres, according to the course of the tides in those parts, where this instrument shall be placed, whereby is to be seene how the Tides keepe their course by day or by night.

PHIL.—What meaneth the little globe above the ring of the Glasse?

THEO.—That little Globe, as it carrieth the forme of a moone cressent, so it turneth about once in a moneth, setting forth the encrease and decrease of the Moone's brightnesse, from the wane to the full, by turning round every moneth in the yeere.

PHIL.—Can you yeeld me any reason to perswade me concerning the possibility of the perpetuity of this motion?

THEO.—You have heard before that fire is the most active and powerful Element, and the cause of all motion in nature. This was well knowne to Cornelius, by his practise in the untwining of the elements, and therefore to the effecting of this great worke, he extracted a fierie spirit, out of the minerall matter, joining the same with his proper aire, which encluded in the Axeltree, being hollow, carrieth the wheeles, making a continuall rotation or revolution, except issue or vent be given to the Axeltree, whereby that imprisoned spirit may get forth. I am bold thus to conjecture, because I did at sundry times pry into the practise of this gentleman, with whom I was very familiar. Moreover, when as the King, our Soveraigne, could hardly beeleve that this motion should be perpetuall, except the misterie were revealed unto him: this cunning Bezaleel, in secret manner, disclosed to his Majestie the secret, whereupon he applauded the rare invention. The fame hereof caused the Emperor to entreate his most excellent Majestie to licence Cornelius Bezaleel to come to his Court, there to effect the like Instruments for him, sending unto Cornelius a rich chaine of gold.

PHIL.—It becometh not me to make question concerning the certaintie of that, which so mighty Potentates out of the limity of their wisedomes have approved, yet me thinketh that time and rust, which corrupteth and weareth out all earthly things, may bring an end to this motion in a few yeeres.

THEO.—To the end of time may not weare these wheeles by their motion, you must know that they move in such slow measure, that they cannot weare, and the lesse, for that they are not forced by any poyse of waight. It is reported in the preface of *Euclydes Elements*, by John Dee, that he and Hieronimus Cardanus saw an instrument of perpetuall motion, which was solde for 20 talents of gold, and after presented to Charles the fift, Emperour: wherein was one wheele of such invisible motion, that in 70 yeeres onely his owne period should be finished. Such slow motion cannot weare the wheeles. And to the end rust may not cause decay, every Engine belonging to this instrument, is double guilded with fine gold, which preserveth from rust and corruption.

PHIL.—This wonderful demonstration of Artificiall motion, immitating the motion Celestiall, about the fixed earth, doth more prevaill with me to approve your reasons before aleadged, concerning the moving of the Heavens, and the stability of the Earth, then can Copernicus assertions, which concerne the motion of the Earth. I have heard and read of manie strange motions artificiall, as were the inventions of Boetius.

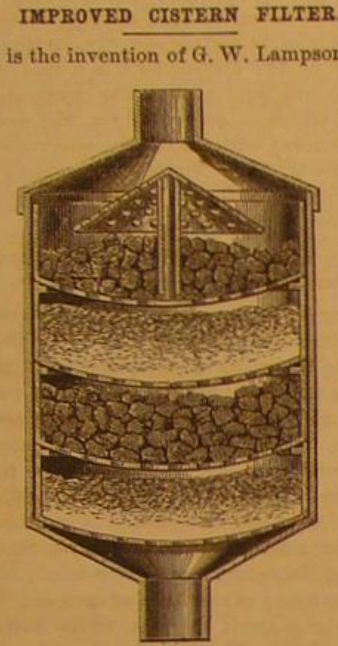
After enumerating these and others, Phil. concludes:

These were ingenious inventions, but none of them are comparable to this perpetuall motion here described, which time by triall in ages to come, will much commend.

THEO.—These great misteries were attained by spending more oyle than wine: by taking more paines than following pleasure.

IMPROVED CISTERN FILTER.

This filter is the invention of G. W. Lampson, of Waterloo,



N. Y. It consists in a series of pans arranged one above the other, in the manner shown, in a suitable receptacle. Charcoal and gravel may be used as filtering material, or any other approved material found convenient may be substituted. The water entering the filter falls upon a perforated cone, which distributes it over the filtering material in the upper pan. It then passes through the substances placed in the lower pans, and is drawn off free from impurities at the bottom.

PRUNING SHEARS.

It is well known that a curved edge, or one which cuts obliquely across the grain of wood, is more effective than a straight edge, cutting square across the grain. This principle has long been recognized in the construction of turning tools, carving tools, axes, etc.; and even in the use of tools with straight edges, the apprentice soon learns unconsciously to give the edge a slight inclination, finding that in that position the cutting is accomplished with much greater ease.

In the use of tools constructed on the shears principle, where the blades are short, and the substance to be cut is thick, the latter is liable to be thrust out from between the blades, and thus defeat the attempt at cutting it. Especially has this been the case in the use of shears for pruning trees, vines, and hedges where the branches vary greatly in size. The invention shown in the annexed engraving shows a form of pruning shears, wherein the principle of inclined cutting edges is combined with a curved blade, which prevents the branch from slipipng from between the blades, and therefore renders the tool much more effective than those with straight blades. The branch is also liable to force its way between the blades and strain the pivot. In this device this is prevented by a blunt blade, which construction gives two points of support for the branch instead of one, as in the old form of shears.

This tool is the invention of George H. Clinton and D. H. Harris, of New Haven, Conn., and has been patented.

American Needles.

A new demand for articles of American industry has, says the *Bureau*, just come to light in the shape of an order from England, to the agent of one of the largest manufacturers in this country, for 50,000 American needles to be sent to Birmingham, England, which was for years the only city in the world in which the manufacture of needles and fish-hooks in a large scale was carried on. For something more than a year past the same concern has been shipping fish-hooks to England in considerable quantities. The reason for this order is that we are making good needles cheaper than they can be made in the Old World, on account of the improved machinery in use in our factories. This exchange of business seems very strange at first, but we will soon become accustomed to it and expect it. A large number of articles are now made here for shipment to England and the Continent, which a few years ago were not manufactured in this country at all; and many articles are now exported, which we have procured abroad for many years, and which are now made much cheaper in this country than any other.

The Broken Atlantic Cables.

The recent failure of the two British cables leaves both continents at the mercy of the single French submarine telegraph, and considering that damage to the latter may occur at any time, it is of the utmost importance to the commercial world that the repairs be made at once.

What the trouble is, with the two cables that have ceased working, is difficult to apprehend, but that some under-current has moved the cables upon the edge of a cliff or rocky point, till the coatings are abraded and insulation destroyed, is not improbable. The *Robert Lowe* (British steamer) is at St. John's, Newfoundland, on a grappling and repairing expedition, and it is to be hoped that we may soon hear that both cables are perfect and communication restored. The survey of the bed of the Atlantic ocean is now so complete, that, in any future cable there will be less difficulty in placing portions of wire rope, heavier and better protected, in such parts as the difficult places at the bottom of the sea may make necessary.

The damage is known to have occurred at about 65 miles from Heart's Content, Newfoundland. The grappling for the cables is simple enough, but the rough weather, usual at this time of year, off Cape Race, may delay the completion of the work until Spring.

Correspondence.

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

A Defect in the Patent Law of 1870.

MESSRS. EDITORS:—Allow me to call your attention, and that of your readers, to the closing paragraph of section 33 of the new patent law. The whole section reads as follows:

SEC. 33. *And be it further enacted*, That patents may be granted and issued or reissued to the assignee of the inventor or discoverer, the assignment thereof being first entered of record in the Patent Office; but in such case the application for the patent shall be made and the specification sworn to by the inventor or discoverer; and, also, if he be living, in case of an application for reissue.

This closing paragraph enacts that all applications for reissues shall be sworn to by the original inventor, if he be living.

This is not only a great hardship on assignees, but will probably prove disastrous to inventors, if it be not speedily abrogated. The hardship of it upon assignees is well illustrated by a case which has lately come up in my practice as an attorney. A manufacturing company paid some $30,000 to an inventor, for his patent of an improvement in the manufacture of an article which is one of their staples. He squandered the money, and then attempted to make precisely the thing he had before sold to the company, who, of course, resorted to legal proceedings and stopped him. This naturally left bad blood between them.

Now other parties, having discovered an oversight in this patent, have procured patents based thereon, and are proceeding to claim as their own that which plainly belongs to the company. To stop these pirates, it is first necessary to reissue the company's patent; but, under the present law, to do this, they must procure the oath of the original inventor, who would about as soon part with his right hand as thus oblige the company. It is useless to talk about bills in equity; he would soon put himself beyond the bailiwick of any officer, if this were attempted. Now, is this an isolated case? Probably four out of every ten assignees would at this moment find it very difficult to ascertain the whereabouts of their assignors, and equally difficult to procure their oaths when found, except upon payment of considerable, and oftentimes large, sums of money.

In just the degree that this provision is found a hardship on assignees, will it prove disastrous to the interests of inventors, as a rule. To a large majority of inventors their inventions are valueless if they cannot sell them, for very few inventors are, themselves, possessed of means to manufacture and introduce their inventions; and if purchasers are to be practically almost deprived of the right to reissue the patents they purchase, thus putting it out of their power to suppress ingenious evasions of their rights, they will be very slow to purchase even valuable inventions. Poor inventors find abundance of difficulty now in disposing of their patents, and they can ill afford to have this heavy load put upon their camel's back. They will surely revolt when they come to understand the practical working of this seemingly harmless little enactment.

The new patent law was, probably, drafted by the late Commissioner of Patents; and this provision must have taken its rise in a curious hostility that he seems to have had against reissues, a hostility that he carried so far as to push him into—as the writer believes—an unprecedented overslaughing of the acts and decisions of his predecessors—a charge which, when made, it is perhaps well to illustrate.

The writer had, during the late Commissioner's term of office, occasion to prosecute an extension case on a reissued patent, before the Office; it was favorably reported upon by the examiner who had it in charge, and on the last day before the expiration of the patent it came before the Commissioner in person for his final approval. He made no objection to the findings and decision of the examiner below, but refused the extension on the ground that the reissue contained new matter not in the original patent.

Now, as this very question had been expressly decided upon when the patent was reissued by one of his predecessors, every way competent and fit for his office; and as a Commissioner is not, in law, a court of appeal to overturn the decisions of his predecessors; and as the late Commissioner, being a trained lawer, cannot be ignorant of the true doctrine of *stare decisis*, it is fair to put this act down as most arbitrary, and, with his approval of the enactment spoken of above, as indicating a strong hostility to reissue.

Inventors and owners of patents should lose no time in pressing upon their Representatives and Senators in Congress, to have this enactment repealed, and that right speedily.

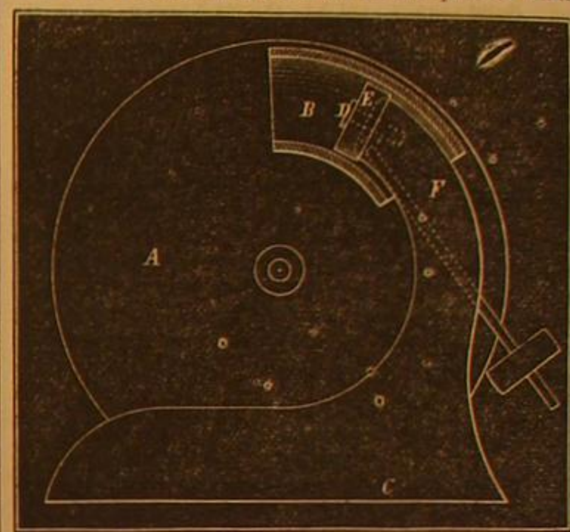
W. E. SIMONDS.

Hartford, Conn.

Boring out Curved Cylinders.

MESSRS. EDITORS:—Permit me to give you a solution of L. Q.'s problem in your issue of Nov. 20th.

A, in the accompanying sketch, is the face plate of a lathe



on which B, the piece to be bored, is fastened (by blocking and straps, not shown) at the right distance from the center to give the desired curve to the hole. A cast-iron piece, C, is to be bolted to the lathe bed, while the part, F, (which is cast at about the same curve that it is desired to give to the hole) is set so that, when the face plate is turned backward, it will enter B centrally. D is a pin passing through E, and driven or screwed into E is a revolving head, which carries one or more cutters, and is made to turn on the pin, D, by means of internal bevel teeth, which engage with the pinion shown in dotted lines. A strip of tin soldered to the revolving head, and projecting back a little over B, will keep the chips out of the gears.

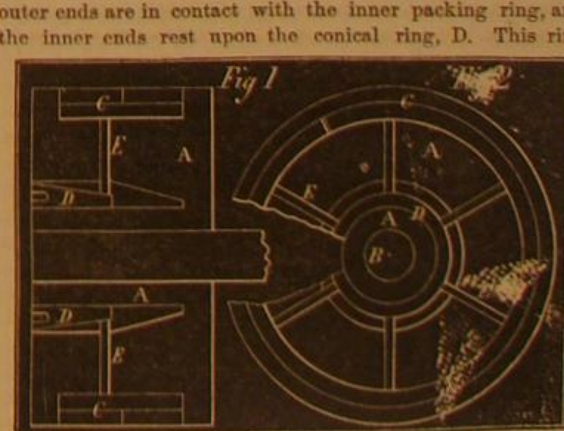
S. G. STODDARD.

Bridgeport, Conn.

A New Piston.

MESSRS. EDITORS:—The annexed diagram is illustrative of a new steam engine piston, which is so constructed that its rings may be set out or adjusted without removing either of the heads of the cylinder. I know that this feature in a piston is not new, but I am sure that I have never seen one of so easy mechanical construction and so simple and perfect in adjustment as this one.

The body, A, of the piston has several radial holes for the reception of the spindles, E. These spindles fit easily in the holes, and are of course exactly of the same length. Their outer ends are in contact with the inner packing ring, and the inner ends rest upon the conical ring, D. This rin



works upon a screw thread cut on the hub of the piston, A. The engineer has only to remove a plug in the center of the cylinder head, and apply a forked wrench to the ring, D, when any adjustment of the rings, C, is necessary.

When cast-iron packing rings are used, a stiff spiral spring should be applied in each spindle hole to prevent chafing the cylinder.

F. G. W.

Preservation of Honey. Invention Wanted.

MESSRS. EDITORS:—Whenever we desire light upon subjects of general interest, or wish to call out new inventions, we are wont to turn to the SCIENTIFIC AMERICAN, and seldom fail to awaken attention, and elicit a satisfactory reply from some of your many readers.

Every one who is at all acquainted with the nature of honey knows that in a short time the transparent, viscid liquid changes to a thick candied substance. On placing a jar of this candied honey in warm water, it will soon return to its former transparency. But dealers who have tons of it on hand cannot profitably, with the present appliances, do this; consequently it depreciates very much in value, though the nature of honey, and the remedy for the evil, be explained to the purchaser.

The honey now shipped in such quantities to the cities is produced directly from the comb with the honey emptying machine, and this machine is destined to revolutionize the culture of the honey bee. Apiaries that formerly afforded but little profit now produce a hundred fold, and as a consequence, a widespread interest in the management of this industrious little insect is manifesting itself throughout the country. But just as the interest is becoming one of national importance, one of our largest honey merchants in New York city says: "Mel-extracted honey sold lavishly for a time, but it has candied now, and looks like lard, and is of very dull sale. There must be some means devised to use it, or mel-extracted honey will prove a failure." Many other experienced dealers and apiarists express the same opinion.

Now, I have faith in the modern idea that "whenever an article or process becomes absolutely necessary, there is some one created for the purpose of inventing it."

I wish the army of inventors who read the SCIENTIFIC AMERICAN would devise some simple method to prevent pure, transparent honey from taking the appearance of lard. Could not the covers to the glass jars, in which the honey is sent to market, be so constructed that several hundred jars could be connected with a battery, and a strong current of electricity sent through the honey, creating heat enough to prevent candying?

Can honey or any of its elements be used extensively for manufacturing purposes?

Will some one versed in the mysteries of chemistry give the entire chemical composition of honey? I doubt not that, with proper attention from persons skilled in chemical manipulation, much benefit would arise from the study of honey.

Chemists have brought forth the beautiful aniline colors from the dirty refuse of the gas house. Why not endeavor to produce something equally useful from one of the most abundant of nature's sweets? J. H. M.

Hartford, N. Y.

Roman and Egyptian Artificial Stone Reproduced. Paving Blocks, etc.

MESSRS. EDITORS:—In No. 2, current volume, page 23, I notice an article on Pavements, with 10 or 11 requisites. Such a pavement will be hard to meet with, unless you resort to the old Roman, Pompeian, or Egyptian stone pavement. This stone is artificial. Of the Egyptian stone, (paving stone) I have had some specimens. I have analyzed it, tested it, and have made similar stone, quite equal in quality, from material found in the mountains of Virginia. I have also had a piece of a sanitary tube with which Pompeii is sewered, and have seen oval-shaped sanitary tubes 9×6, two feet long, commonly called egg shape, coated inside and outside with glass, as the American term the glaze on the Scotch sanitary tube, but which is in reality produced by the volatilization of salt, burned on at a high degree of heat, and best known as "salt glaze." The ancients, more especially the Egyptians, certainly did understand building, paving, and sewering, better than we know-alls of the present day.

For paving blocks this stone certainly does possess all the requirements you name; besides, it can be made of three or four different colors—red, blue, white, and cream—not artificially, but naturally; and it forms a very beautiful carpet-like footpath up each side of the street. I do not mean the encaustic tile of Staffordshire, England, but the old Roman stone or flint (rough to walk on) paving blocks 12×8×6; that is 12 inches long, 8 inches broad, and 6 inches thick. One thousand of these blocks will cover 74 square yards, and could be made for about $100 per 1,000.

Perhaps a prettier pavement is made of blocks 12×12×9, with tongue and groove, or dove-tailed, so that the blocks will fit tight in each other and cannot be moved; requiring neither cement nor mortar, but only to be bedded in sand.

With regard to horse or wagon roads, color is not of so great importance as utility. The thing required is a hard, rough, even, and sure-footed pavement. These blocks can be made so as to fit into each other with as little labor as ordinary paving blocks, and can be taken up with the least trouble by loosening one of them. They could be made for $150 per 1,000, which number will pave about 111 square yards.

My errand into this country from the Staffordshire tileries, in England, is to search for material of which to make the real Roman and Egyptian stone. I have spent more than two years exploring some parts of the great Blue Ridge and Alleghany mountains, and have found more than I ever expected to. I have now specimens of these blocks, Roman stone, sanitary tubes, or flint tubes, salt glazed inside and outside, or coated with glass, and imperishable in water. Unlike iron, they are incorrodible.

I have bricks imperishable in water, coated on two sides with glass for culvert purposes; also red, white and blue Egyptian flint bricks, imperishable in atmosphere, for building purposes, and almost proof against the ravages of time, made from what is termed by practical claymen, Egyptian clay. I have a brick or block imperishable in fire; the Egyptian swimming brick, which is almost a non-conductor of heat, proof against fire, weighs only about 17 ounces, and is 9×4½×2, suitable for ships' cooking apparatus and powder magazines; paving blocks for stables and other uses, as known best to the Egyptians.

If any of your scientific readers would like to see specimens in miniature of the above materials, I should feel great pleasure in sending the same to them before I return home.

Before I go back, I purpose giving you some account of the *scientific principles* of burning the above-mentioned articles, as adopted by the ancients, so much superior to anything of the present day; especially of burning bricks for building purposes.

I wish most heartily all success to the SCIENTIFIC AMERICAN. "Go on and prosper."

Lynchburg, Va. JOHN DIMELOW.

Patents, or No Patents.

MESSRS. EDITORS:—I read in the Cincinnati *Gazette* for 1871, that the editors of that journal will oppose the present system of patents, and will favor the giving, to inventors of improvements deemed valuable, a suitable reward down, and then give the invention to the public. It seems to me, that to a poor fellow without means, or friends to introduce his discovery to public notice, this scheme is very favorable if it can be properly carried out.

In order to do this, it would be necessary to have a committee or board perfectly competent to judge of the merits of every device submitted to them. They must know whether it be practicable or not, so as not to pay for a worthless invention. They must be able to judge of the extent of its usefulness, so as to reward according to merit, and not give to one a large sum for a small improvement, and to another a small sum for a great improvement. They must be thoroughly informed on all matters on which they have to act, so that they may not be imposed on by any one palming off another's discovery for his own. They must be men of impregnable integrity, who will not favor one more than another, nor take a bribe, nor be partial.

It will need a large appropriation of money to pay for all the good inventions that will yet be brought out. To supply this, a tax proportionate to the amount required will be necessary. And as it cannot be known which branch of industry will be benefited most, all must be taxed alike. The farmer must help to pay for improvements in manufactures. The artisan must help to pay for improvements in navigation. Users of steam engines must help to pay for improvements in windmills, and *vice versâ*. If otherwise, the inventors must wait till their improvements are adopted, and the users of them taxed to pay for them. In which case, perhaps while the grass was growing, the horse might starve to death. Or, to anticipate the time, he might sell his claim; and thus bring about the state of affairs complained of under the present system—the inventor getting little, and the speculator getting all.

On the whole, the cure seems worse than the disease. I think the present plan the best. Let the fees be reduced as low as possible, that all may be able to secure a patent. Then it rests on its merit. If good, the inventor may reap his reward. If worthless, the people are not taxed for it. Those who use inventions are taxed for the benefit of the inventor. Those who do not like to pay this tax have only to refrain from using the article. If the sewing machine that is sold for sixty dollars does only cost twenty, and you find it to your advantage to buy one at that price, who loses by it? But somebody makes an enormous profit off it. And somebody ought to make an enormous profit off so useful an invention. Of course the inventor ought to have the lion's share. If he does not, more's the pity. I would hail any plan that would give it to him. But I feel sure, that that of the *Gazette* would not produce a result so desirable.

Charleston, W. Va. THOMAS SWINBURN.

The Tides in New York Harbor.

A lecture by Professor J. E. Hilgard, before the American Institute, was illustrated by twenty diagrams shown upon a screen, on a very enlarged scale, by means of the magic lantern. New York Harbor has two entrances—one from Long Island Sound, the other by way of Sandy Hook. The former is a natural depression, or arm of the sea, which is not changed by the forces now in operation. The tidal currents which flow through it do not change the channel, but are obliged to follow it in its tortuous course. The Sandy Hook entrance, on the contrary, is characterized by a cordon of sands, extending from Sandy Hook to Coney Island, intersected by channels, which are maintained against the action of the sea, that tend to fill them up by the scour of the ebb tide from the tidal basin of New York Harbor.

The depth of twenty-four feet at low water which the harbor now possesses in a direct channel, may be considered as depending upon the following elements: 1. The large basin between Sandy Hook and Staten Island, including Raritan Bay, which furnishes more than one half of the ebb scour, 2. What is called the Upper Bay, including the Jersey Flats and Newark Bay. 3. The North river, as far as Dobbs' Ferry, maintaining the head of the ebb tide, although not directly taking part in the outflow. 4. A portion of the Sound tide which flows in through Hell Gate. The two tides, from the Sound and from Sandy Hook, meet and overlap each other at Hell Gate; and since they differ from each other in times and hights, they cause differences of elevation between the Sound and Harbor, which produce the violent currents which traverse the East River.

The conditions of the tidal circulation through Hell Gate are such that if there were a partition across it, the water would at times stand nearly five feet higher on one side than the other, and again five feet lower on the same side. The westerly current, usually called the ebb stream, taking place when the Sound tide is highest, starts from a level 3½ feet higher than the easterly current, and thus a much larger amount of water flows out through the Sandy Hook channels than through Throgg's Neck. It is apparent, then, that this portion of the ebb stream, reinforcing, as it does, the ebb stream of the harbor proper, at the most unfavorable times, performs a most important part in maintaining the channels through the Sandy Hook bar. It may be estimated that the closing of Hell Gate would cause a loss of certainly not less than four feet in the depth of those channels. In order to procure the depth which we now have, it is important that the area of the tidal basin should not be encroached upon. In proportion as that is diminished, the depth of the channels will decrease. The flats, just bare at low water, but covered at high tide, perform as important a part as any other portion, for it is obvious that it is only the tidal pressure that does any work in scouring the channels. The water on the flats is especially useful by retarding outflow, thus allowing a greater difference of level to be reached between the basin and the ocean.

When we yield to the demands of commerce any portion of the tidal territory, we must do so with full cognizance of the sacrifice we are about to make in the depth of water in the channel. From what has been said with regard to the meetings of the tides in Hell Gate, it will be seen that the violent currents experienced in that locality are due to causes beyond our control. The dangers to navigation arising from these currents, however, by their settling vessels upon the rocks and reefs, may, in a great measure, be done away with by the removal of the obstructions, in which work considerable progress has been made. The removal of reefs at Hallett's Point, which is now looked for, will doubtless, in a great degree, do away with the eddies and currents produced by the sharp turn which the channel now takes at that point. It is not improbable that, the Sound entrance may yet become the entrance of New York Harbor.

The Ninth Census Complete.

The following table, prepared by the Census Bureau at Washington, gives the total population of all the States and territories of the Union, by the enumeration of 1870, as compared with that of 1860. Several statements, purporting to give the result of the last census, have been floating through the newspapers, but this is the first that has appeared with the official sanction. It will be seen that the total population of the United States in 1870 was 38,538,180, an increase in ten years of 7,094,859. The greatest percentage of increase is in Nevada, and after it, Nebraska. Two States only exhibit a decrease, Maine and New Hampshire. All the Western States show heavy percentages of increase, the Southern and Middle States, a small increase, while New England is almost at a standstill. The table is interesting and instructive.

STATES.	1870.	1860.	Gain, p. c.
Alabama	996,988	964,201	3·5
Arkansas	483,179	435,450	11·0
California	560,285	379,994	47·5
Connecticut	537,418	460,147	16·8
Delaware	125,015	112,416	11·5
Florida	187,756	140,424	33·8
Georgia	1,200,609	1,057,286	13·6
Illinois	2,539,638	1,711,951	48·4
Indiana	1,673,046	1,350,428	23·9
Iowa	1,191,802	674,913	76·6
Kansas	362,872	107,206	238·5
Kentucky	1,321,001	1,155,684	14·4
Louisiana	732,731	708,002	3·5
Maine	626,463	628,279	*·29
Maryland	780,806	687,049	13·7
Massachusetts	1,457,351	1,231,066	18·4
Michigan	1,184,296	749,113	58·1
Minnesota	435,511	172,023	153·2
Mississippi	834,170	791,305	5·5
Missouri	1,715,000	1,182,012	45·1
Nebraska	123,000	28,841	326·5
Nevada	42,491	6,857	519·7
New Hampshire	318,300	326,073	*2·4
New Jersey	905,794	672,035	34·8
New York	4,364,411	3,880,735	12·5
North Carolina	1,069,614	992,622	7·8
Ohio	2,662,214	2,339,511	13·8
Oregon	90,922	52,465	73·4
Pennsylvania	3,515,993	2,906,215	21·0
Rhode Island	217,356	174,620	[illegible]
South Carolina	728,000	703,7[illegible]	3·5
Tennessee	1,255,983	1,109,[illegible]	13·4
Texas	797,500	604,[illegible]	32·0
Vermont	330,552	31[illegible]	5·0
Virginia	1,224,830	1,2[illegible],030	·43
West Virginia	445,616	376,688	18·3
Wisconsin	1,055,167	775,881	36·0
Total	38,095,680	31,183,744	21·1
District of Columbia	131,706	75,080	75·5
TERRITORIES.			
Arizona	9,658	......	....
Colorado	39,706	34,277	15·9
Dakota	14,181	4,837	193·2
Idaho	14,998	......	....
Montana	20,594	......	....
New Mexico	91,852	93,516	*1·8
Utah	80,786	40,273	115·6
Washington	23,901	11,594	106·2
Wyoming	9,118	......	....
Total District and Territories	442,500	259,577	
Total of States	38,095,680	31,183,744	21·1
Total United States	38,538,180	31,443,321	22·6

* Loss.

BALLOONS AS A MEANS FOR ARCTIC RESEARCH.—The long voyages, made with entire safety, from the city of Paris, have concentrated much attention on the subject of ballooning. A correspondent, J. M., of Baltimore, suggests that any future expedition to the Arctic Ocean be furnished with balloons, properly fitted to secure the voyagers from the cold air, by which the eternal ice could be passed over, and the open polar sea reached. When the North Pole was once gained, the return voyage could be made easily, as whatever might be the direction of the wind, the balloon would be carried out of the circle into one hemisphere or the other.

A RESIDENT of Taunton, Mass., has obtained his ice for summer use for several winters past, in the following manner: Procuring about fifty empty flour barrels, at a cost of twenty cents each, he gradually pours in water, until each contains a solid mass of ice. The barrels are then put away in his cellar, and entirely covered with sawdust. As ice is required, a barrel is tapped.

A ROMANCE OF SCIENCE.

Under the above caption, *Chambers' Journal* gives an account of a passage in the life of the celebrated scientist, M. Arago, from which we extract the following portions. The story, as here told, of the pursuit of knowledge under difficulties, certainly reads almost like some of Charles Reade's sensational stories:

It is to be presumed that all well-informed persons are aware that the system of linear measurement used in France and most continental nations is based upon the meter, which has been extended to measures and weights in general, and carried into practice by a decimal system of computation. At the same time, few are conversant with the circumstances under which the metrical system was established at the commencement of the present century, and the difficulties encountered by the *savants* of the period in prosecuting their scientific operations for that purpose. Scientific expeditions were fitted out in France to determine a standard linear measure, by the admeasurement of a great arc of the earth's circumference, as nearly as possible at a fixed parallel of latitude, from which a fractional section would be taken as an unalterable basis. It is well known that the circumference of the earth is greatest at the equator, and gradually decreases towards the poles. As a medium between these two extremes, it was determined that the parallel of latitude forty-five degrees north should be the basis, especially as it intersected a part of Europe where a great arc of the meridian could be measured by a trigonometrical survey.

In making the survey in Spain, where the members of the expedition, headed by M. Arago, prepared to leave the isles of Formentera and Iviza, and remove their astronomical instruments to the mainland of Spain, the curate of the district where M. Biot was situated requested permission for himself and some of the inhabitants to see their instruments. Though one of the inferior clergy of Spain, yet he took considerable interest in scientific operations, and appreciated the instruments in the observatory. On the other hand, those islanders permitted to enter the building gazed on them with the astonishment of savages. It was a Sunday and a fête day, when a troop of them came in the evening, with the alcalde at their head, dancing and singing in a most extraordinary manner, both men and women. The men clattered with their feet in a kind of half African, half European dance; while the women, having their hair plaited into long pendent queues, turned and pirouetted on their naked feet, without raising them off the ground, like puppets on springs. The music that accompanied these strange postures was quite as barbarous in character; one played on a species of flute, another struck a tambourine, and some had wooden clappers, while the alcalde kept measured time by striking a large metal plate with a piece of iron. As each one, however, entered the observatory, he made his observations in silence; presenting a contrast between civilization and barbarism—a contrast of the most sublime science and the most profound ignorance. It must be admitted, however, that though ignorant of the instruments and objects of the expedition to their solitary isles, these people in no way interfered with the mission, but assisted its members in their simple way when they could be of use.

Not so with the inhabitants of the island of Majorca, where M. Arago was stationed with Señor Rodriguez, on the summit of Mount Galatzo, making his final observations, which he successfully accomplished. While on the eve of departure, the rumor suddenly spread amongst the inhabitants that these operations, these instruments, these fires, these signal lights, were for the purpose of guiding the enemies of Spain to conquer the island. It must be remembered that the fears of the ignorant islanders were excited by the accounts from the mainland. Napoleon was at that time preparing for his Peninsular campaign, and as the leader of the scientific expedition was a Frenchman, they concluded that he and his companions were emissaries of Bonaparte come to spy the land. Galatzo was instantly up in arms, and cries of treason and death to the traitors were raised by the excited peasantry. Fortunately, M. Arago obtained intelligence of these rumors in time to send the report of his observations by a faithful messenger to Palma, a town in the island of Majorca, with instructions to send the expeditionary vessel there to convey the instruments from the observatory in safety to the mainland. This was effected, and M. Arago himself managed to escape, and get on board the vessel.

Instead, however, of finding that an inviolable asylum, the learned French astronomer found new alarms for his safety as soon as he got on board; and from that time he experienced a series of mishaps in the Mediterranean, in his endeavors to reach a port belonging to his own country, that practically illustrate the pursuit of knowledge under difficulties. Hitherto, the captain of this vessel, which was attached to the expedition by the Spanish government, had behaved in a most friendly manner to M. Arago; but, whether from treachery or weakness, he not only refused to take him back to the mainland, but handed him over a prisoner to the custody of the captain-general of Majorca. Here he was confined in the citadel for many months, not merely regretting his want of liberty, but apprehensive of some design on his life. Upon this, his colleague, Señor Rodriguez, considering that the honor of his government was at stake, in the forcible detention of a peaceful *savant*, under its protection, boldly demanded his instant release. This was consented to, provided that M. Arago took his departure in a small trading bark bound for Algiers. Accordingly, he left these inhospitable islands, accompanied by a Majorcan sailor, named Damian, who took charge of the astronomical instruments.

Arrived safely at that city, M. Arago called upon the French consul, who received him with great kindness, and soon found a passage for him in an Algerian trader bound for Marseilles. After a fair and quick passage, the vessel came within sight of that port, when she was attacked by a Spanish privateer, seized, and taken as a prize into the port of Rosas. Here M. Arago thought he could easily escape across the Pyrenean frontier into France, but he was again unfortunate. He was entered on the list of passengers as a German merchant, but, by an unlucky chance, one of the privateersmen recognized him as a Frenchman, and thereupon M. Arago, together with the crew and passengers, were plunged into a frightful captivity.

At this time, Spain and Algiers were on friendly terms; consequently, this seizure of an Algerian vessel by a Spanish cruiser was contrary to international law. As soon as the Dey of Algiers was informed of this insult to his flag, he demanded instant reparation—the restoration of the ship, cargo, crew, and passengers; threatening, in case of refusal, to declare war. This had the desired effect. M. Arago and his fellow prisoners were released, and allowed to re-embark in their ship, to complete its voyage to Marseilles. Again she came within view of that port, but a frightful tempest from the northeast came on, which prevented her entering the harbor, and afterwards drove the vessel to seek shelter on the coast of Sardinia. Here was another peril to encounter; the Sardinians and Algerians were at war, and if the vessel were seized by a cruiser, they would again suffer captivity. Accordingly, it was decided to run for the coast of Africa before the tempest, and at last the vessel safely entered the small port of Bougiah, a hundred miles east of Algiers.

At this place they learned that the Dey who had acted so promptly in demanding their release from the Spanish prison and the restoration of the vessel, was dead. He had been killed in an *émeuté* among his barbarous subjects. Another ruler was in his place, who was of a less enlightened character. The customs officials at Bougiah boarded the vessel, and carefully examined the cargo. When they came to the cases of astronomical instruments, and felt their weight, they suspected that these contained heavy articles of gold. Their suspicions increased on opening the cases, and finding them filled with the highly polished instruments, so carefully wrapped up. They were quite sure they must be made of gold, on that account, and refused to deliver them up to M. Arago. Seeing the difficulty of treating with ignorant barbarians, whose cupidity had been excited, he resolved to venture on the journey by land to Algiers, where the road crosses a mountain chain, and travelers are in peril from the lawlessness of the people. In order to avoid notice, he dressed himself in Algerian costume, and in company with some friendly natives, made the journey without molestation.

When M. Arago called on the French consul at Algiers, that functionary was much astonished to see him dressed like a Mussulman; at the same time he gave his learned guest a hearty reception. Through his official position, the instruments were claimed, and ultimately delivered up. But it was chiefly on account of the Algerians finding them made of brass, and not of gold, that this was done. Even then it was a difficult matter to get them restored, so that M. Arago was detained six months at Algiers. By that time, the French consul had obtained permission to leave that consulate; and on appealing to Paris, the Emperor gave orders that a ship of war should convey him, his family, and M. Arago to Marseilles. They set sail with a fleet of merchantmen under convoy, and arrived in sight of that port. Here an English squadron blockaded the passage, ordering the French vessels to proceed as prizes to the island of Minorca. All obeyed the order except the ship in which M. Arago was, which, by a slant of wind, got safely into harbor.

Thus, after many "hair-breadth 'scapes by flood and field," this hero of science returned to Paris, where he received the reward of his genius and indomitable perseverance, in being appointed Astronomer-royal, which post he filled to a venerable age, and obtained a European reputation. Though he encountered more of the vicissitudes and dangers of travel than any of his colleagues in the expedition, yet he suffered less in health. One member, M. Chaix, fairly succumbed under the fatigue, and died at the town of San Felipe, in Spain, whither he had retired to recruit his strength. M. Biot suffered also from the exigencies of the expedition. His exposure on the island of Formentera brought on an attack of fever, which laid him prostrate for twelve days. After recovery, he embarked in a small Algerine vessel at Iviza, to return to Spain. On the passage it was seized by a privateer of Ragusa, on the Dalmatian coast, sailing under the English flag with "letters of marque." The captors declared this a lawful prize, and would have taken the vessel into the port of Oran, in Algeria; but on M. Biot exhibiting his safe-conduct pass from the British government, and his scientific instruments, he and his companions were allowed to proceed on their voyage. However, they kept several ounces of gold, which M. Biot had with him, and he thought himself lucky in getting off so easily. At last, he arrived safely at Denia, in Alicante, where he passed a short quarantine in an old chateau, formerly the residence of the Dukes of Medina-Cœli, during the time of their puissance in Spain. From thence he passed without hindrance into France, and reported the progress of his operations to the Institute.

LEAD ore lately brought from Jefferson county, Ohio, possessed the extraordinary proportion of 88 per cent of lead and 2 per cent of silver. The *Ohio Farmer* states that the ore was found only ten feet below the surface. When we add to its intrinsic value and its proximity, the fact that coal of the best smelting quality is abundant in the neighborhood, our readers will see the value and importance of the discovery.

Inventions Suggested by the Late Civil War.

The inventions to which our late war gave rise are as multifarious as were its wants. Some idea of its achievements may be gained by a look at the cases of models in the United States Patent Office. Shelf after shelf is loaded with inventions suggested by the necessities of war. Not a piece of ordnance, nor firearm, nor vehicle, nor tent, camp chest, cooking utensil, nor appurtenance of war of any kind, but was "improved" by the indomitable, self-confident, inventive, "tinkering" fellow. The caisson, gun carriage, bomb shell, gun wad, the cap, and the bullet, are all of new fashion. There are new modes of working, packing, transporting, cleaning, and loading such antiquated instruments of warfare as are permitted still to exist—new kinds of priming, new methods of ignition, and new-fashioned cartridges, with new machines for cutting, trimming, pressing, filling, and packing. An officer's arms must be attached by a modern method; his shoulder straps be fastened on with a spring; and even the old flag is expected to run up the staff and unfurl to the breeze by means of some new-fangled, patent contrivance.

As great ingenuity, if not as great genius, is shown in models of apparatus designed to promote the comfort of the sick or wounded. In the beginning of the war there was no hospital tent which gave satisfaction. That used in France is the same which answers the ordinary purposes of shelter—the regulation tent, as it is called—by its conical shape giving to the tented field a picturesqueness gratifying, no doubt, to French love of effect, but inclosing too many feet of useless space to suit Americans. The English "marquee" serves an excellent purpose after it is pitched and ready for use, but the qualities of compactness, portableness, convenience in pitching and striking are quite overlooked. It is substantial, ponderous, costly, but it isn't *handy;* and this, to Americans, is objection enough. A score or more are there, of all shapes and sizes, but that finally adopted and used during the war—the wall tent, with sloping roof and straight sides, is pre-eminently superior. It is light, easily managed, portable, and cheap. An umbrella tent was suggested and even made, having a central pole or handle, radiating arms, upon which the cover is spread, a hoisting apparatus raising and shutting it. But it was too complicated.

Still pursuing our search we see miniature ambulances, a procession of which adorns the shelves. The ambulance in use of old was bare of all comfort. Look now inside one of these new models, and you see every contrivance imaginable to lessen the suffering of the sick or wounded. The ambulance is no longer an instrument of torture. The mattresses, used as stretchers also, slide along the floor on rollers fastened to a frame work resting upon springs beneath and at the sides. An immense amount of ingenuity is shown in economizing and utilizing means and space. Each appliance is made to serve many purposes. Seats are used as beds; iron wheels answer for legs. A second tier of berths is suspended from the sides of the wagon by rubber rings. Seats, readily put out of the way, are placed outside for attendants. Each is furnished with a chest for supplies, ice, and water tanks. The cover is of enameled cloth, light and impermeable. Two horses can draw it, while on European battle fields four are required. The American ambulance combines strength and lightness; the European, with its wooden cover, enormous weight, and small capacity, carrying but two persons, supposes strength and clumsiness to be inseparable.

Inventive genius does not desert the soldier, after wounding him according to scientific methods and nursing him to health with the aid of its improved apparatus. It also does its best to make good his loss of members. The Patent Office shows a hundred model legs and arms, which seem so excellent, with all their springs and cords, tendons and joints, that if it were not for a suspicion that we might be as stupid as the Irishwomen with the washing machine, we should almost regret having no use for them. A dear old lady from the country, whose eyesight was poor, had her attention called to these models. Glancing at them without her "specs," she said, in a tone of deepest sympathy, "And these are the limbs of our soldiers shot to pieces in battle? Poor fellows! And now their legs are brought up here for *kuriosities!*" There are arms which bend backward to the shoulder, and over the head; hands of which the fingers and palm act with such facility that a pen or a playing card is held with ease. At the Paris Exposition the American specimens of this class were pronounced superior to all others. One is surprised to observe how greatly we are indebted to the use of caoutchouc for this degree of excellence. In this direction, as well as in the manufacture of surgical instruments and dentistry, it has effected a revolution. Contrary to the general rule, too, that cheapening processes are inferior processes, this substance is superior for the surgeon's use to the costly metals it supersedes. Mr. Seward's face bears testimony to its utility, one of the bones broken by the assassin's blow being restored to shape by its help. The capability which caoutchouc possesses of hardness or elasticity, its susceptibility of molding and coloring, the fact that it is incorruptible and inoxidizable, and cannot therefore poison or irritate the flesh, give it an essential advantage over any other material.—*From Lippincott's Magazine.*

THE frequent damage to trees by high winds and cattle will render the following directions for tree-surgery interesting to farmers: Let the broken limb be put into its place, and the torn and bruised bark be covered with clay and bound up, as in grafting. A correspondent of the *Cincinnati Gazette* reports the recovery of a cherry tree, broken by a horse. The writer supported the tree by tying it to a stake, and covered the broken place with grafting wax. The cure was complete.

Improved Dovetailing Machine.

We illustrate herewith a dovetailing machine that for simplicity, strength, efficiency in operation, and accuracy of performance, will, we think, commend itself to all who may inspect its working.

The cutters are arranged in a gang, shown at A, and are driven by a belt, B, which passes alternately over and under pulleys on the cutter arbors. A vertical guide bar, C, descends from a sliding way upon which the cutter head rests, and slides up and down with it in suitable guides, when actuated by the hand lever, D, the rock lever, J, and the connecting rod, I.

From the side of the cutter head, A, extends a collar which slides on the guide lever, K. This guide lever is pivoted at the bottom, and being set at the proper angle by means of a graduated arc, and held in place by a set screw, it causes the cutter head to move laterally upon the sliding way which supports it, whenever it is raised or lowered by the lever, D, rock bar, J, and connecting rod, I, the resultant movement of the vertical and lateral motions being oblique to the vertical axis of the guide bar, C. When the pivoted guide bar, K, is set to the center of the graduated arc, the motion of the cutter head will be vertical.

The guide lever, K, is adjustable vertically with the graduated arc, by means of the screw, H, which raises or lowers it, so that when raised the motion of K to the right or left of the center of the graduated arc increases or diminishes the lateral motion of the cutter head, according as it is set higher or lower. The motion of the guide lever, K, is limited and regulated by means of set screws at the ends of the arch bar.

In dovetailing with this machine, the mortises are cut in the following manner: A number of pieces are placed on the bed of the machine and adjusted laterally by guide plates moved by the screws, G. The pieces are held down firmly by a vertical screw, F, and a foot plate which rests on the top of the upper piece of the boards to be worked. The cutter arbors being armed with tools, the sectional outline of which, on the axis of revolution, is that of the mortises: and the guide lever, K, being set to the center of the arc, the machine is set in motion, and the lever, D, being moved outward, causes the cutters to rise vertically, cutting through the ends of the boards, and by a single upward movement forming a large number of mortises.

In making the tenons, as well as the mortises, the ends of the board are placed against a guide plate attached to the cutter head, by which they are uniformly adjusted.

In tenoning, only single pieces are worked, as many tenons being cut simultaneously, as the number of cutters, if desired.

The piece is clamped in the same way as in mortising. The guide lever, K, is first moved to the extremity of the arc on one side, and the cutters being raised by the lever, D, move upward obliquely, and cut one side of the tenons to the previously adjusted bevel. The cutter head thus rises till it engages with a stop previously fixed to regulate the depth of the cuts. The lever, K, is then pressed over to the opposite side of the arc, which causes the cutters to traverse laterally and complete the cuts, except beveling the remaining side of the mortise, which is done by reversing the position of the lever, D, which causes the cutters to descend in the proper angle.

The cutter head is counterpoised as shown, and the distances of the cutters are uniformly and simultaneously adjusted by the hand screw, E.

The inner angles of the dovetailed mortises are rounded in blind dovetailing, and the tools for cutting the tenons are shaped to give the corresponding form to tenons.

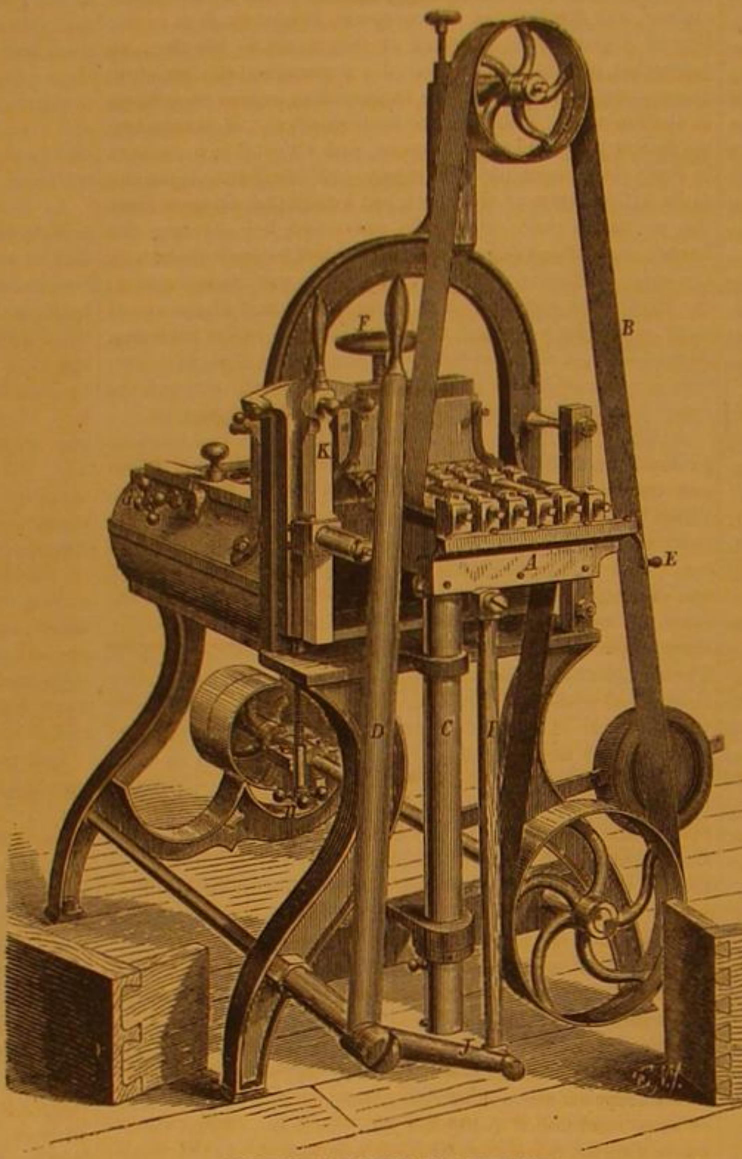
This machine makes a complete dovetail instead of a substitute for it, and does not weaken the work by cutting away wood unnecessarily for the sole purpose of making a fit. The cuttings are made by rotating cutters, which cut into the side of the grain of the wood, by which it is claimed they will retain a sharp edge to do four times the work that can be done by tools cutting endwise of the grain. This method of cutting also prevents splintering, in obstinate kinds of timber.

The lateral adjustment of the cutters to any desired width within the limits of the machine, without loss of time, attained by the use of the screw, E, is a great advantage.

The perfect adjustability of all the parts of the machine, is an important improvement, and it is claimed that it is more durable, and will perform more work in a given time, than other machines of its class.

We have seen the machine at work, but not under circumstances to test its speed of performance. Of the accuracy and beauty of its work we are, however, perfectly satisfied.

Patented June 7, 1870, and Jan. 3, 1871. For rights and other particulars, address H. H. Evarts, 93 Liberty st., N. Y., where a machine may be seen in operation, or at 66 Twenty-fourth st., Chicago, Ill., or Trevor & Co., manufacturers, Lockport, N. Y.



DOVETAILING MACHINE.

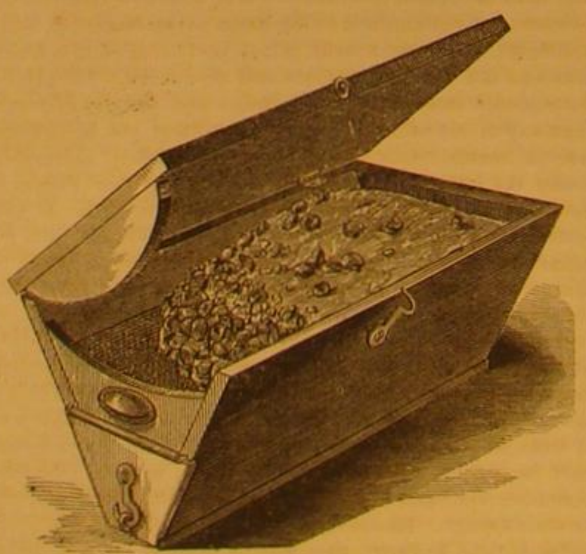
Trial of the New San Francisco Flying Machine.

The newly invented "flying machine," of which our readers have heard so much during the last year or two, was recently tried again, and, according to the San Francisco *Bulletin*, with considerable success. When everything was tightened and got in good running order, and the propeller arranged to cause elevation, it was just quarter of one o'clock. The fire for raising steam was kindled, and in one minute and a quarter steam was opened. At thirteen minutes to one the machine was cut loose, and the propellers started. She then rose most gracefully in the air, amid the cheers of the crowd who had gathered to witness the ascension. The machine was guided by cords attached to both ends of the balloon, and in the hands of persons on the ground. She ascended fifty feet, and sailed along about a block, when she was pulled down to have her boiler replenished. Again she rose, this time to a hight of about 200 feet. All the machinery connected with it worked to the perfect satisfaction of the inventor, who intends to place it on exhibition at some place, of which notice will be given. The name given her is "America."

IMPROVED COAL ASH SIFTER.

Our engraving illustrates the form of a new device for sifting coal ashes, by the use of which the inconveniences of dust are wholly obviated.

The sifter is a box of the form shown, with handles at the ends, and divided by a wire screen into an upper and a lower compartment. A door leading from the lower compartment permits the removal of the ashes. Both this door and the top lid are made to fit so tightly as to be impermeable to dust.



The mixed coal and ashes being put into the upper compartment, a rocking motion of the box, or shaking it by means of the handles, separates the ashes from the coal and cinders, and this may be done on the stove or carpet without the escape of dust. The device seems well adapted to the purpose designed, can be furnished cheaply, and will prove a useful household utensil.

Patented through the Scientific American Patent Agency, Nov. 8, 1870. State, county, and manufacturer's rights for sale. Address W. S. Estey and I. S. Clough, patentees, 68 Fulton street, N. Y. B. T. Clough, of Waltham, Mass., may be addressed for rights in Massachusetts.

The Bituminous Coal Trade of 1870.

A Pittsburgh exchange says:—The total production of bituminous coal in this country, in 1870, amounted to fully 18,000,000 tuns. The bituminous trade bids fair to eclipse the anthracite in a few years. The latter amounted last year (as far as reported in Pennsylvania) to only 16,889,505 tuns. In Boston, in 1870, the anthracite trade fell off 36,400 while the bituminous increased 49,709 tuns. During the past year, the Baltimore and Ohio Railroad, with the Chesapeake and Ohio Canal, brought to market 1,717,075 tuns of Cumberland coal, a decrease of 165,000 tuns. The Huntingdon and Broad Top Railroad transported 313,822 tuns, a decrease of 46,850 tuns. The Tyrone and Clearfield branch of the Pennsylvania Central carried 345,000 tuns of the Phœnix Vein, while Alleghany Mountain mines shipped 90,000 tuns, mostly for local consumption. The Blossburg and the Towanda mines, which largely supply New York State and the Lake region, supplied, as near as can be ascertained, 500,000 tuns. Thus, the total consumption of bituminous coal, for iron, steam, and domestic uses, on the seaboard north of Cape Henry, aggregated 3,000,000 tuns. In addition, the gas coals of Western Pennsylvania and Virginia gave 1,500,000 tuns, of which one half was brought eastward by the Pennsylvania Central. The statistics of the western bituminous trade are only approximate.

It is an authenticated fact that Pittsburgh, beside consuming locally 600,000 tuns, shipped 2,000,000 tuns down the Ohio, at $2 each; yet so inadequate was the supply that it commanded $8 a tun at Memphis. Cleveland received, for its own consumption and for transportation on the lakes, nearly 1,000,000 tuns, by the Cleveland and Pittsburgh, and the Cleveland and Mahoning railroads. The great West and Northwest, taking the statistics of the "Panhandle" and the Pittsburgh, Fort Wayne and Chicago Railroads, consumed an additional 2,000,000 tuns. As near as can be ascertained, the Indiana, Illinois, Michigan, and Kentucky mines yielded nearly 4,000,000 tuns; and to these are to be added the productions of the vicinity of Richmond, Va., of Alabama and Tennessee. In view of this great and increasing production, the strikes of the anthracite miners will yearly become of less practical value. A silent revolution is at work in the coal trade. Baltimore seems to be losing the supremacy on the seaboard once held by the Cumberland coal, owing to the valuable tracts opened up in Clearfield county, Pa., during the last three years; but by the completion of the Cumberland Valley Qailroad to the Potomac river, Baltimore retaliates by a sharp competition in the iron manufacturing regions of Central Pennsylvania. And while Philadelphia enjoys the benefits which Baltimore had by her Cumberland mines, Pittsburgh will lose command of the gas coal trade, by the completion of the Pittsburgh and Connellsville Railroad, opening up to Baltimore and the seaboard the rich gas coals of the Youghiogheny Valley. The present year promises to make some other important changes in the coal trade.

COD-LIVER OIL.

In every country on the earth there are to be found sufferers whose chief reliance against the ravages of damp and cold air is found in the oil from the codfish liver (*gecus aselli*). It is not, therefore, surprising that the single port of St. John, Newfoundland, exported last year nearly 350 tuns of this invaluable medicine. The declared value of this quantity is about $110,000. The oil is dissolved from the livers by gentle heat, in a tin vessel placed in boiling water, and filtered twice. The last filtration is made through heavy woolen cloth, and takes from the oil nearly all its odor and color, leaving in it all the iodine to which, in combination with its carbon, its alterative, fattening, and heat-creating properties are due. It is not only in consumption, but in scrofulous affections and diseases wasting the tissues, that its value is felt. The sickly infants of poor mothers, whose atrophy, from bad and insufficient food, commences even before their birth, can be nursed into health and plumpness by its aid. From its first introduction to the world in the year 1782, the use of it has been steadily on the increase; and the recent annual report of one of the largest of the London hospitals shows that 70 per cent of the patients of all classes are largely benefited by its use. It was first introduced into medicine by Dr. Percival.

Death of a Well-known Manufacturer.

Mr. James Albro, a well-known citizen of Elizabeth, who died on Friday, the 27th ult., had, in his special branch of business, a national reputation, as being the first American who had made original designs for oilcloth manufactured in this country. His experiments commenced as early as 1835 or 1836. At that time almost all the oilcloth used in the country was imported from England; the quality of the cloth manufactured here being inferior, and the patterns being copied from English cloths. Taking a national pride in producing, in price and quality, American goods that should give the imported cloths a less brisk market than they were enjoying, he devoted his attention exclusively to the improvement of the American oilcloths, and with such gratifying result that at the World's Fair in London, in 1862, the first prize was awarded to the firm of which he was the head.

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Contents:

(Illustrated articles are marked with an asterisk.)

AN INVENTION WANTED TO CLEAN THE STREETS OF SNOW. SOLUTION OF THE PROBLEM TO BE FOUND IN STEAM.

The municipal government of the city of New York pays, we understand, fifty cents per load of twenty-seven cubic feet for carting away the snow from the streets. During the last few days, heavy snow storms have visited the city, and the bill for street cleaning will amount to a large sum. Besides, the method is a very slow one, and the carts employed increase the blockade of vehicles which any obstruction to travel is sure to cause in our crowded thoroughfares.

On the principal horse railway lines the companies labor, at great expense, and with terrible exactions upon their overworked horses, to maintain their roads in a barely passable condition. As fast as their snowplows throw the slush to the sides of the tracks, it is thrown back again by the constantly plying carts, omnibusses, and other vehicles, and the work has to be repeated over and over again, until such time as sun and south wind shall diminish the volume of impeding snow so much as to render the snowplows superfluous. During the thaws the water runs to the center of the streets (the gutters being obstructed by snow and ice) and, freezing, renders the services of an army of men necessary to clean out, with ice picks and shovels, the obstructed tramways.

In reflecting upon ways and means whereby all this trouble and expense—or at least a great portion of it—might be saved, we have come to the conclusion that steam offers a complete solution of the problem. We shall explain the general principles upon which we base this belief, leaving it for inventors to devise means for their practical application.

Various authorities give as the weight of a cubic foot of snow one eighth to one fourth that of a cubic foot of water. In other words, a cubic foot of snow, melted, will make from one eighth to one quarter its bulk of water. We consider this a large estimate, but, admitting its truth, a fair average of light and heavy snow would give three sixteenths of a cubic foot of water for every cubic foot of snow melted, or 11·72 pounds of water.

To change a pound of ice or snow at 32° Fah., to water at 32° requires an expenditure of 142·4 heat units. To change a cubic foot of snow at 32° Fah. (weight 11·72 pounds) to water at 32° Fah. will require 1668·93 heat units. But as the average temperature of the snow is less than 32° Fah.—say probably about 20°—an addition of 6·1 heat units must be added for each pound melted, or 71·5 heat units for each cubic foot of snow, making the total 1740·43 heat units required to melt a cubic foot of snow at 20° into water at 32°. Probably, also, to secure the fluidity of the water until it could run off into the sewers, the temperature would need to be raised to 40° by the addition of 8 heat units more per pound melted, or 94 heat units per cubic foot of snow, making a total of 1834·43 heat units for every cubic foot of snow run off.

Steam at 212° contains 1178 heat units per pound. A pound of steam condensed to water at 40° would therefore give off 1[illegible]3 heat units, and it would take 1·6 pounds of steam to melt a cubic foot of snow.

The cost of removing the snow by carting is, at present rates, a trifle over 1·85 cents per cubic foot.

A cubic foot of water is, in good steam boilers, converted into steam at 212° by the consumption of ten pounds of coal. Some boilers will do much better than this, and some do worse, but we wish to be within bounds in our calculations. Supposing the cost of the coal to be $6 per ton, the cost of fuel to evaporate a cubic foot of water is 3 cents, but the 62·5 pounds of steam at 212°, thus produced, would, according to our preceding calculations, melt and run off 39 cubic feet of snow, at a cost of .077 of a cent per cubic foot, as against 1·85 cents per cubic foot now paid. The cost of attendance and working of the boiler would, of course, have to be added to the cost of fuel in making a complete comparison of steam with the present system of carting, which would diminish the margin somewhat, but the latter will stand a large percentage of diminution, and still show an enormous saving.

The rapidity with which steam melts snow is only appreciated by those who have tried it. Let any one who is skeptical run a rubber hose from a boiler, and let a jet of steam escape directly into the heart of a huge snow bank, and he will be astonished at the rapid collapse of the drift. Whether it would be better to use hose from boilers in the manner indicated, or in other ways that suggest themselves, we leave to inventors, not doubting that the hints given in this article will open their eyes to a new and profitable field of invention.

The use of steam would get rid of the obstruction at once and permanently; an important consideration to horse-railroad companies, and one they would not be slow to see, should some ingenious engineer put these ideas into a practical form.

THE ADULTERATION OF PETROLEUM.

The systematic adulteration of petroleum is a constantly increasing evil, and one that demands immediate reform. It is high time that the attention of the police, of the fire department, and of the press, was concentrated upon the discovery of a full and speedy remedy. The enormous manufacture of naphtha as an incidental product, for which there is little demand, offers a great temptation to dealers in petroleum to increase their profits by the admixture of the dangerous ether; and the lax state of our laws, and the carelessness of the insurance patrol, tend to perpetuate an evil that ought not to be tolerated for a moment in any well regulated and civilized community.

What can be done to prevent the dangerous adulteration of refined petroleum, is a question of the utmost importance to all who burn it as an illuminating material.

Unfortunately, most of the regulations adopted by the police, or by the legislature, have thrown impediments in the way of trade, without producing any good results. The authorities are in the habit of representing petroleum as a highly inflammable and dangerous substance, when in fact, the refined article, free from naphtha, is scarcely more dangerous than sperm oil. The storage of large quantities of petroleum in the business portions of cities, has been prohibited under severe penalties, and these regulations have been prepared as if petroleum were gunpowder. The idea seems to prevail that the refined article is just as explosive as the crude, while it is really less inflammable than alcohol, about the storage of which no such stringent rules are laid. Alcohol takes fire the moment a burning match is applied to it; properly refined petroleum does not ignite, does not flash, as it is called, until it has been heated up to 100° or 110° Fah. Alcohol more readily evolves combustible vapors; well refined petroleum forms neither gases nor vapors, and evaporates, even when exposed in shallow vessels, very slowly, and in the summer does not occasion the formation of explosive gas mixtures; in fact, it is not nearly so dangerous as we are in the habit of suspecting. Throwing obstacles in the way of its sale does not appear to be the best measure to prevent accidents. If the authorities, in the interest of the public, are willing to take the matter in hand, it will not be difficult to suggest a remedy. It will only be necessary to make a distinction between a safe and a dangerous petroleum, and to publish a single test, by the use of which, this point can be easily settled. The taking of the specific gravity is worthless, because the adulteration by the lighter naphtha can be disguised by the addition of a heavy oil. The color and odor are also not to be relied upon. The only reliable test is the temperature of the flashing point; that is, the temperature at which the petroleum takes fire when a burning match is applied to its surface. The test can be easily applied. Into a flat dish or saucer, pour the oil to be tried, until it is at least half an inch deep; then hold a burning match or taper near the surface. At the point of contact the combustion is often very lively, as the taper draws up some of the liquid, but if the petroleum be safe and free from naphtha, the flame does not spread over the surface. If the petroleum have been adulterated, as soon as the match touches the surface a blue lambent flame flashes across it, and in a few moments the body of the oil will be on fire. Such an oil is dangerous—liable to explode in lamps, and to give off inflammable vapors at all times. Any oil which takes fire when a match is held near its surface, and continues to burn, ought to be condemned at once and thrown into the streets. We lay some stress upon this experiment, because we have actually seen a country merchant pour petroleum into a saucer and ignite it in this way as a proof that it was not dangerous.

There is no doubt whatsoever, that all of the accidents can be traced to adulterated and worthless petroleum. The pure article never explodes in lamps, even when they are filled at night, with a candle by their side; but it is never safe to try this experiment, as we cannot rely upon the quality of the oil we buy. The sale of petroleum containing naphtha ought to be stopped at all hazard, and if a police officer were detailed to walk up and down before the store to warn all customers of danger, and the names of the iniquitous tradesmen were to be publicly posted, and heavy fines were to be imposed, the great loss of life and property that has been occasioned by this nefarious business would justify the severity of the measures adopted to repress the evil. We need some stringent laws on the subject, and after they are passed, let them be enforced without fear or favor.

"AND THERE WERE GIANTS IN THOSE DAYS"—THE LARGEST INVENTOR YET—A MOST REMARKABLE FAMILY OF GIGANTIC TURKS.

On Friday, January 27, the floor of our office trembled under the tread of the largest client that ever pressed its boards since Munn & Co. commenced business. Seating himself at our desk, on a chair (as much out of proportion to his bulk as an ordinary baby's chair would be to a common-sized man) this huge individual explained to us the nature of an invention for which he was desirous to secure a patent. Having transacted his business, and created a very unusual sensation among the numerous attachés of the office, he rose to depart. On his way out, our associate editor adroitly approached him, and succeeded in gaining from him the following statement, the publication of which, in our sober columns, will, we are sure, minister to that love of the marvelous, a trace of which always remains, even in the most philosophic bosom.

The name of the individual referred to is Colonel Ruth Goshen, and he resides at present in Algonquin, Ill. He is a native of Turkey in Asia, and was born among the hills of Palestine. He is the fifteenth, and last child (the baby) of a family of fifteen—ten sons and five daughters—sired by a patriarch now 90 years old, living in the valley of Damascus, and by occupation a coffee planter. This venerable sire weighs, at the present time, 520 pounds avoirdupois, and his wife, aged 67, weighs 560 pounds.

The entire family are living, and not one of them weighs less than 500 pounds. The oldest son weighs 630 pounds, and the youngest, our huge client, outstripping them all, weighs 650 pounds. Not one of the family is less than 7 feet in hight, and the Colonel is a stripling of only 7 feet 8 inches in his stockings. He is not an unduly fat man, is merely what would be called moderately portly, and is 33 years old.

He was a colonel in the Austrian army in 1859, and a colonel commanding in the Mexican army at the battle of Puebla, May 5th, 1862, in which the Mexicans were victorious. His father at one time resided in Leeds, Eng., but returned to Turkey in 1845.

The colonel states that there has never been any sickness in the family to speak of, and that all are—so far as he knows—well and hearty. It was at Leipsic, Germany, that the colonel met his fate in the person of a fair *mädchen*, weighing 190 pounds, and 5 feet 9 inches in hight, and the union has been blessed with two sons, who give promise of rivalling their father in stature.

The colonel is a finely-proportioned man, and walks with a firm and elastic step. He is as straight as an arrow, and has coal-black eyes, hair, and mustache.

He is an actor by profession. He informs us that his last engagement was at Simm's Theater, in Baltimore, and that he expects to play an engagement in New York during the present season.

EXCAVATION AND EMBANKMENT TABLES.

The preparation of these tables, for the use of engineers and contractors, involves an amount of labor, even when worked out by means of differences or increments, which those who have calculated them can well appreciate. The labor in calculating, say a table increasing by one tenth of a foot, up to seventy-five feet in depth or hight, with one hundred feet stations, or less, by the rules of areas and distances, would be immense; and the table liable to errors, there being no general check on its accuracy; and by differences or increments, the labor would still be great, and the liability to error not much decreased.

We have lately been shown a simple, rapid, and correct method for making such tables, discovered by G. R. Nash, C.E., of North Adams, Mass., which we insert for the benefit of engineers and others, whereby much valuable time may be saved. Rule—

1. Arrange the hights or depths for calculation in vertical columns, each of 27 lines.

2. In any three (3) columns, the third column is equal to twice the second, plus 81, minus the first column (where the depths increase by tenths of a foot, with 100 feet stations).

Note—

1. For shorter or longer stations than 100 feet, add the proportional part, or multiple, of the quantity required to be added for 100 feet.

2. For increasing the series of hights and depths, multiply 81 by the square of the increment in tenths, and the product will be the constant number to add.

3. Verify in any table calculated, the last column, which proves the whole, as any error in any of the preceding columns, increases in geometrical progression to that column, and being greatly magnified, is at once discovered.

4. In compiling any table, it is necessary to calculate, by areas and distances, the first two columns, after which the table can be extended to any length by the above process.

If any one knows an easier, more rapid, or more accurate method than this, we should be glad to hear of it.

THE ALLOYS OF COPPER.

From time immemorial, copper has been extensively used for forming compounds with other metals. The ancients whose works of art still remain to us, appear to have wrought it chiefly in combination; and, at the present day, the employment of the pure metal is less general than that of its alloys. It is not improbable that copper will unite with all the metallic elements, but its alloys with zinc, tin, nickel, and the precious metals, are the most valuable and best known. The most useful is "brass," consisting essentially of copper and zinc. It is first mentioned by Aristotle, who states that the people who inhabited a country adjoining the Black Sea, prepared their copper of a beautiful white color by mixing it with an earth found there, and not with tin, as was the custom in other lands. The ancients, however, were not acquainted with the nature of the change that took place; and it is a remarkable example of the slowness by which man arrives at truth when led by experience alone, that brass should have been made during a period of 2,000 years without the metal which brought about the change in the copper being discovered. Brass was made with the utmost secrecy in Germany during several centuries, and some families were raised to great opulence by its manufacture.

The first brass works in England were put into operation in 1649, in the county of Surrey, and the whole of the metal was then made of "rose" copper from Sweden. The first mill for drawing brass wire was erected in 1663. The advantages of brass over copper are its less cost, it being partly composed of a metal cheaper than copper; it is harder, does not oxidize or rust so easily; it melts at a lower temperature, and is hence better for small castings; it has not that tendency to fill with minute bubbles, which property is so disadvantageous in copper founding; it cuts smoother in the lathe, and will bear a higher polish; its color may be made to resemble gold, which adapts it for ornamental purposes; and, lastly, it is more ductile and tenacious. Generally, as the proportion of zinc rises, the hardness and fusibility increases, while the malleability and weight decrease. The brass founder in speaking of his mixtures, specifies the amount of zinc only, it being understood that the ratio is to the pound of copper. The largest consumption of brass is in the manufacture of pins. Brass foil is made from a very thin sheet of brass of 11 copper to 2 zinc.

The next alloy in importance is called "bronze." Tin is now substituted for zinc. Like brass, it is harder and more fusible than copper, and denser than the mean of its constituents. Its color is usually reddish-yellow, but when exposed to the air, a basic carbonate of copper is formed, which furnishes the greenish hue commonly seen on the surface of statues, and by which the alloy is best known. Bronze possesses the singular property of becoming so malleable, that it may be hammered and coined when it is heated and rapidly cooled; and by heating it, and allowing it to cool slowly, it may be made to regain its former hardness and brittleness. Bronze for statuary, for cannon, for bells, and for gongs, is, respectively, of the following proportions of copper and tin: 84 to 11, 89 to 11, 78 to 22, 76 to 22.

Speculum metal is the third alloy in importance, the standard proportions being about 66 copper to 34 tin. The speculum of the great Rosse telescope is composed of copper, with a little less than half its weight of tin, making a composition very hard and brittle, and capable of very fine polish.

German silver is a mixture of copper, 57, nickel, 24, and zinc, 13, and originated in China under the name of "packfong." Large quantities are manufactured at Sheffield, in England, where it is formed into forks, spoons, and vessels for the table, and being plated with silver by the electrotype process, is sold as a substitute for silver. When well made, it cannot be distinguished by an unpractised eye from many of the silver alloys, even when brought on the touchstone; but by dissolving a small piece in nitric acid, and adding a few drops of hydrochloric acid, no milky precipitate is formed, which would be the case were a silver alloy so treated. Good German silver is tougher and harder than brass, and resists the action of air better. Lastly, copper is used, in various proportions, to give the requisite durability to gold and silver coins.

The foregoing are the principal alloys of copper; there are a number of others, the names and properties of which are known to artisans. An alloy of 90 copper to 10 arsenic, is white, slightly ductile, and more fusible than copper, and is not attacked by the atmosphere. This is used for scales of thermometers and barometers, for dials, candlesticks, etc. With iron, copper combines in small proportions; 1 per cent, however, causes iron to weld badly. With aluminum it forms an alloy of considerable malleability and great hardness, capable of taking a very high polish.

THE DOWNFALL OF PARIS.

"Plenty more at the same shop. Country orders executed with neatness and dispatch," exclaimed the renowned Dick Swiveller, after administering a wholesome chastisement to Quilp the Dwarf. The facility with which that well-earned drubbing was administered, and the profound repose with which the chastiser rested upon his laurels, have been, to illustrate great things by small, repeated in the Franco-Prussian war, and in the attitude of Germany toward France, in the hour of her deserved humiliation. France has been whipped as easily as Dick Swiveller punished the dwarf, and her capital has succumbed to a fate that has long been inevitable.

The causes which led to the war have been sufficiently discussed; the causes of the defeat of France, and the effect which the triumph of the German arms will have upon Europe and the world at large, are fruitful themes.

Many will attribute the Prussian success to superiority of numbers. Others will see in it only a triumph of one breech-loading gun over another. Others will see deeper reasons in the difference of the character of the two nations, and, searching for the cause of the difference, will find it in their systems of education, which, on the one hand, has created a nation of educated soldiers, and, on the other, has led to the mental, moral, and physical degeneration of a nation, once the terror of all Europe.

We quote the following eloquent extract from an article written for the London *Fortnightly Review*, by Emile De Laveleye:

The most formidable corps in the French armies was, it used to be said, the Turcos and the Zephyrs. They met men in spectacles, coming from universities, speaking ancient and modern languages, and writing on occasion letters in Hebrew or Sanskrit. The men in spectacles have beaten the wild beasts from Africa. In other words, intelligence has beaten savagery. Are we to be surprised at this, when we know that war, like industry, is becoming more and more an affair of science?

Who does not know the immense sacrifices that Germany has made for the advancement and diffusion of knowledge—spending, for instance, twenty thousand pounds sterling at Bonn in a chemical laboratory, forty thousand at Heidelberg in a physical laboratory? Little Wurtemberg devoted more money to superior instruction than big France. A thing unheard of, France made the very fees of the university students a source of revenue. She gave, without counting it, more than a couple of millions of pounds sterling (between fifty and sixty million francs) for the new opera, and she refused forty thousand pounds for school buildings. Last year, on the deck of the steamer which was conveying us to the inauguration of the Suez Canal, M. Duruy, the one man of merit who ever served under the imperial government, told me the tale of his griefs in the ministry of public instruction. He wanted to introduce compulsory education; the Emperor supported him; he had all the other ministers against him. He had organized fifteen thousand night schools for adults; it was with difficulty that he succeeded in carrying off forty thousand pounds against the fatuous resistance of the Council of State. There was the whole system of public instruction to re-organize, and he could get nothing. They preferred to employ the gold of the country in maintaining the ladies of the ballet, in building barracks and palaces, in gilding monuments, the dome of the Invalides, the roof of the Sainte Chapelle. It was in vain that men like Jules Simon, Pelletan, Duruy, Jules Favre, cried out, year after year, "There must be millions for education, or France is lost." The Government was deaf. It denied nothing to pleasure, to luxury, to ostentation. It denied everything to education.

Again history repeats itself. Again a nation surrendering itself to the utmost refinement of luxury, and disseminating false tastes and demoralizing influences from its Capital to corrupt other nations, has found itself in the hour of peril, unable to resist an attack from a frugal and industrious people, by whom its luxury and pomp has been crushed into the very dust of humiliation.

A daily exchange has asked the question, How much debt can a nation endure and maintain its existence? and thinks the enormous debt of France will throw some light on this question. *We* ask, has it not been demonstrated in this short and decisive struggle, how much luxury a nation can endure and live?

For a long time, Paris has been the fashionable exemplar of the civilized world. What has been done in Paris has been feebly imitated in America, and has more or less influenced the diet, manners, dress, and even the literature of all other nations. The stage has been corrupted by it, and the polished iniquity of the modern Babylon has tainted, more or less, the morals of every capital city in the world. Babylon has fallen. It remains now to be seen whether the seeds of evil which have hitherto emanated from the chastised city, will exert their demoralizing power to the downfall of other nations.

There is no truth more deeply engraved on the pages of history, than that extreme luxury begets a contempt for the homely industries of life, a disregard of a high standard of popular intelligence and the means of maintaining it, a contempt for severe discipline, and rebellion against it, and a general weakness of character that renders a nation powerless against a race of sturdy, intelligent, enduring, and united people.

This war has been a triumph of knowledge and subordination over ignorance and insubordination; of settled earnest principle and purpose over passion and impulse; of thorough organization and fixed policy over incompetency and vacillation of purpose. It teaches a lesson all nations would do well to learn.

In this war the "spectacles" have won 800,000 prisoners, including the Emperor and the Marshals of France, 6,000 cannon, 112 eagles, and a large quantity of stores, munitions, and small arms. And all this has been done in a time so short, that history may be searched in vain for a precedent. The humiliation of the French nation is complete; perhaps the military pride of Germany will be stimulated in equal proportion, but we believe that a nation educated as are the Germans, will know how to use power in a manner that will add to, rather than diminish the glory of their great victory.

BOYNTON'S LIGHTNING SAW.

In another column will be found an advertisement of this saw, to which we would call the attention of those interested in the cutting of timber and cord wood, and in the manufacture of lumber. The teeth of this saw are of even length, double pointed, cutting only with the outside vertical and projecting edges, and clearing simultaneous with the same. All the teeth being M shaped, they are as easy for the unskilled laborer to sharpen and keep in order as the old-fashioned tooth. The two points of the tooth operate as one, preventing gouging out while cutting, and clearing by direct action beneath dust and fiber. These saws are gaining in public favor rapidly. In a trial of a cross-cut, operated by two sawyers, it, in our presence, has repeatedly cut off a beam of white oak, 12 by 6½ inches, in from five to seven seconds, and with from 8 to 10 strokes of the saw. The invention will, we think, greatly lessen the labor of a large class of the most industrious and hard-working men to be found on this continent—the lumbermen—and its use will result in a saving of both wood and labor, in the cutting of cord wood.

THE PRESENT AND THE PAST.

NUMBER III.

Why did mankind for so long a time fail to recognize the existence and the magnitude of the effects produced by these unceasing agencies of destruction? In great measure, because the ideas of civilized men, regarding the earth and its history, were cramped within the narrow scope of each one's limited, individual experience. Men living in temperate climates did not dream that in the circumpolar regions millions of tuns of rocks were annually riven from those frost-bound lands, were borne down to the sea upon the great glacier-rivers, and were set afloat on icebergs, to be finally scattered far and wide over the beds of distant oceans; nor did they ever calculate what would be the effects of a tropical rainfall, two, three, four, or even twenty times heavier than any which they themselves had ever witnessed; much less did they think of multiplying the mass of material removed in a single year by its repetition over a long series of past ages.

What if a village here and there, along the coast, were driven back, step by step, house by house, by the steady encroachment of the sea; what if its ancient church, formerly miles inland, now toppled on the verge of the treacherous cliff, and the bones of the dead in its churchyard, here projected from the topmost layer, there lay fallen on the beach, the prey of the relentless foe? This might be taking place in our village, but which of us reasoned, from these premises, that the whole coast of the British Islands—allowing for the few local exceptions, where sand banks or river rills are slightly encroaching on the sea—was being eaten into at an average rate of perhaps three feet in a century? Ours were clay cliffs, and readily crumbled; but the granite walls of Cornwall, whoever deemed them perishable, much less thought of estimating the rate of their destruction?

But, now-a-days, when each one of us may work the experiences of travelers in all parts of the world into his chain of reasoning, no one has a right to claim ignorance of these truths of nature. Read what Kane and Hayes have written of Greenland glaciers, and of the origin of icebergs; read what other explorers tell of the vast number of icebergs engaged in the unceasing task of burying the remains of the Antarctic continent in the waters of the great Southern Ocean; read what Alpine travelers narrate of the incessant crashing of displaced rocks, and constantly recurring roar of avalanches, laden with the ruins of the mountains, whose cliffs re-echo these, the prophetic sounds of their future doom; read such accounts—and they are at least as interesting to a well-cultivated mind as political diatribes, or sensational novels—and you will form some idea of the grand scale of King Frost's labors, and of the littleness of your own unaided experiences.

We know what heavy summer showers are in New York, where the annual rainfall is double that of damp, foggy London; but our rainfall is only half of the average under the equator, in which zone, moreover, there are vast regions that seldom, or never, receive even a passing shower, thus greatly raising the average of the other portions. In fact, we cannot rightly estimate the force of the rainfalls in the warmer parts of the earth by comparing total averages; the rain in those regions falls in a downpour concentrated into the course of but four or six months; a condition of things admirable described by the Indian lady, bewailing the rain season:

> "They count our rainfall up in grudging measure,
> With gages all too shallow for our woes;
> They talk of inches of the liquid treasure—
> When we have yards with every wind that blows!"

And this is scarcely exaggeration. More rain has been corded as falling in localities in India and Australia in twenty-four hours, than falls in London in the whole year.

We read in Lyell of places where the rainfall amounts to 530 inches in six months, or about eleven times as much as falls in New York in the twelvemonth! No wonder that of such regions he adds: "Numerous landslides, some of them extending three or four thousand feet along the face of the mountains, composed of granite, gneiss and slate, descend into the beds of streams and dam them up for a time, causing temporary lakes, which soon burst their barriers. 'Day and night,' says Dr. Hooker, 'we heard the crashing of falling trees, and the sounds of boulders thrown violently against each other in the beds of torrents. By such wear and tear, rocky fragments, swept down from the hills are in part converted into sand and fine mud; and the turbid Ganges, during its annual inundation, derives more of its sediment from this source than from the waste of the fine clay of the alluvial plains below.'"

You who watch the roadside rill perhaps have never thought what millions of such muddy streamlets are engaged all the land over in Nature's great freight trade; aye, and what millions of tuns of earthy freight they each day transport onwards towards the sea. The Ganges and the Brahmapootra have their sources in such rills, and it has been calculated that these two rivers together carry down from the interior of Southern Asia to their common delta about 2,500,000,000 tuns of solid matter in the course of the year. To modify Lyell's statement, if a fleet of more than 600 Indiamen, "each freighted with about 1,400 tuns weight of mud, were to sail down the river every hour of every day and night for four months continuously they would only transport, from the higher country to the sea, a mass of solid matter equal to that borne down" by these two rivers. Such an accession of earth would cover annually 1,650 square miles of surface—or, in one year, one third more than the dry land of Rhode Island; in three years, nearly the area of Connecticut; and in twenty-eight years, nearly that of the State of New York, with a layer of soil one foot in thickness! And this amount is denuded from the water shed of but two rivers! "But," says the unconvinced reader, "how small is the area of New York State when compared with the vast extent of country drained by these mighty streams! The foot in New York State must be reduced to a fraction of an inch over the slopes of the Himalayas, and of Northern India." To which we reply, how short a time is twenty-eight years compared to the age of these rivers! For on this point other evidence steps in, and we learn that the deposits in their delta, even as far as our limited knowledge of them goes, are sufficient to cover our State with seven hundred feet of earth; or, in other words, that material enough to form a mountain range nine hundred miles in length, twenty-five miles in breadth, and sloping from the plain to a hight of twenty-eight hundred feet, has been in the course of time removed from the basins of the Ganges and the Brahmapootra. Should the reader figure this out he will say, "At this rate you give these rivers an antiquity of twenty thousand years." And why not? Or twice as long, if you will? Lyell, with very good grounds for the statement, says of the Mississippi, that it has been transporting its earthy burden to the ocean during a period far exceeding perhaps one hundred thousand years. Perchance, now, you begin to understand why men remained so long in ignorance of the vast operations of Nature? As long as the world was thought to be but six thousand years old, men saw no purpose in her slow movements, and the results she had already achieved were but so many incomprehensible puzzles.

SCIENTIFIC INTELLIGENCE.

COLORED CEMENTS.

Professor Bottger prepares cement of diverse colors and great hardness by mixing various bases with soluble glass.

Soluble soda glass of 33° B. is to be thoroughly stirred and mixed with fine chalk, and the coloring matter well incorporated. In the course of six or eight hours a hard cement will set, which is capable of a great variety of uses. Bottger recommends the following coloring matters:

1. Well sifted sulphide of antimony gives a black mass, which, after solidifying, can be polished with agate, and then possesses a fine metallic luster.
2. Fine iron dust, which gives a grey black cement.
3. Zinc dust. This makes a grey mass, exceedingly hard, which, on polishing, exhibits a brilliant metallic luster of zinc, so that broken or defective zinc castings can be mended and restored by a cement that might be called a cold zinc casting. It adheres firmly to metal, stone, and wood.
4. Carbonate of copper gives a bright green cement.
5. Sesquioxide of chromium gives a dark green cement.
6. Thénard's blue, a blue cement.
7. Litharge, a yellow.
8. Cinnabar, a bright red.
9. Carmine, a violet-red.

The soluble glass with fine chalk alone gives a white cement of great beauty and hardness.

Sulphide of antimony and iron dust, in equal proportions, stirred in with soluble glass, afford an exceedingly firm, black cement; zinc dust and iron in equal proportions yield a hard, dark grey cement.

As soluble glass can be kept on hand in liquid form, and the chalk and coloring matters are permanent and cheap, the colored cements can be readily prepared when wanted, and the material can be kept in stock, ready for use, at little expense. Soluble glass is fast becoming one of our most important articles of chemical production.

USE OF IODINE IN THE MANUFACTURE OF CHLORAL.

The enormous consumption of the hydrate of chloral as an anodyne and the expense of its manufacture, render any modification of the old process of its preparation very acceptable. F. Springmuhl, assistant in the laboratory of Breslau, proposes the employment of iodine as an improvement. To every half pound of alcohol he adds half a grain of iodine. The alcohol, which is colored brown by the iodine, soon becomes clear on passing chlorine gas through the mixture, and the hydrochloric acid produced by the decomposition of the alcohol is passed through water for its absorption; while the residue of the vapor is removed by sulphuric acid and chloride of calcium. The liquid becomes hot at first, and has to be cooled; it is afterwards heated to ebullition. After passing chlorine gas for twelve hours through the half pound of alcohol contained in a tubulated retort, no more hydrochloric acid is observed, and only pure chlorine gas passes over. The liquid in the retort is neutralized with caustic lime, filtered and distilled. At 161° Fah., all the iodide of ethyl goes over; and between 230° and 240° Fah., the chloral, which is separately condensed, is then mixed with concentrated sulphuric acid, once more distilled, and finally purified by sublimation. The hydrate of chloral obtained in this way amounted, in two experiments, to ninety and ninety-six per cent of the theoretical quantity, and was of the best quality and free from iodine.

It is said that the purification of the hydrate of chloral can be best accomplished by the use of chloroform, benzole, oil of turpentine, or bisulphide of carbon, as solvents.

If 1 part of the hydrate of chloral be dissolved in 5 or 6 parts of the oil of turpentine at between 86° and 104° Fah., and the liquid be slowly cooled, beautiful plates and tables separate. The best solvent is the bisulphide of carbon; at 60° Fah., 1 part of the hydrate of chloral is soluble in 45 parts of the bisulphide; but at temperatures below the boiling point of the solvent, 4 or 5 parts of the bisulphide are sufficient to 1 part of the chloral. By allowing the liquid to cool slowly, large prisms, sometimes an inch long, separate, and in the air rapidly lose all traces of the bisulphide. When prepared in this way, the perfectly pure hydrate of chloral fuses between 120° and 127° Fah.

For medicinal purposes only the pure, crystalline product ought to be employed.

ARTIFICIAL ALIZARINE.

One part of anthracen is boiled for a few minutes with 4 to 10 parts of concentrated sulphuric acid diluted with water, and neutralized with carbonate of lime, or with a carbonate of soda or potash; and the sulphates of these bases removed by filtration or crystalization. The resulting liquid is heated to from 356° to 500° Fah., with caustic potash, to which chlorate of potash or saltpeter in an amount equal to the anthracen employed has been added, so long as a violetble color is produced. From this product the alizarin is thrown down by acids.

RARE MINERALS.

Professor Rammelsberg, of Berlin, has recently analyzed two rare minerals, called Fergusonite and Tyrite, the former from Sweden, and the latter from Norway, the composition of which discloses substances so little known that it is difficult to see to what uses they could be applied, even if we had them in great abundance. It so often happens, however, that elements of rare occurrence eventually become the very corner stone in some new technical discovery, that it is never well to pass over any of them as of no value. We give below the constituents of the minerals, and doubt if many of our readers are familiar with the earths mentioned:

	Fergusonite.	Tyrite.
Tantalic acid	8·73	45·00
Columbic acid	40·16	.....
Stannic acid } Tungstic acid }	0·91	.....
Yttria	30·45	30·00
Ceria }	7·80	5·74
Lanthana } Didymia }		3·51
Iron	4·09	1·48
Urania	1·98	6·52
Lime	3·40	2·36
Alumina	....	1·05
Water	4·47	4·88
	101·39	100·54

The Insulation of Telegraph Wires in Cities.

Glass, when placed in the shade, becomes completely coated with a thin film of water whenever the moisture contained in the atmosphere amounts to above 40 per cent of saturation. During rain the atmosphere sometimes reaches the point of complete saturation, or 100 per cent. When this is the case, any article of glass, even if exposed to the atmosphere alone, and not to the direct action of the rain, is soon completely covered with moisture, and under these circumstances its surface becomes a conductor of electricity.

The atmosphere of all large cities is heavily charged with soot, smoke, and ammoniacal salts, arising from combustion; and these, being taken up by the particles of falling rain and moisture, increase the conducting power of the latter to an enormous extent. Careful experiments made in Manchester, England, where the atmosphere is very impure, showed that the conducting power of the rain water which fell in that city was more than 300 times that of distilled or absolutely pure water. Speaking of this subject, Latimer Clark says: "Pure water offers a very high resistance, but if it contain any acids or saline matters in solution, the resistance is much smaller; hence it is that clear rain in the country does not greatly injure the working of a line, but in towns, where the atmosphere is less pure, the insulation often becomes very imperfect in wet weather."

The comparative insulation of wires, in the city and country, under otherwise similar conditions, may be seen by the following actual measurements, taken at the New York office of the Western Union Company: No 1 wire east showed a mileage insulation, between 145 Broadway and Harlem river, of 66,000 ohms, while from Harlem river to New Haven, Conn., the same wire gave 282,000 ohms per mile No. 3 east, to Harlem, gave 53,500 per mile; Harlem to Hartford, Conn., 218,000. The insulation in the country exceeded that in the city in the proportion of more than 4 to 1.

The European telegraphic engineers have endeavored to surmount this difficulty by changing the insulators at short intervals, as their surfaces became smoked and dirty. This, however, is but a partial remedy, as the trouble arises as much from the great conductivity of rain water, under the conditions referred to, as it does from dirt upon the surface of the insulators. They have also largely resorted to the expedient of running the wires underground, a method involving great expense, and yet of rather questionable benefit, as far as immunity from interruption is concerned. Considerable embarrassment is also occasioned by inductive action, when underground wires are employed, especially in working automatic or printing instruments.

It is to an American inventor that the credit is due of being the first to discover a practical and effectual means of insulating wires in cities; and equal credit should be accorded to the American telegraphic superintendent who had the boldness to put the plan into practice on a large scale, and with the most successful results—we refer to the magnificent lines built by General Anson Stager, of the Western Union Company, in the principal Western cities, which are considered by competent judges to be, perhaps, the finest examples of telegraphic construction in the world.

The hight of the city poles above the ground is sixty-five feet. They carry fifty No. 9 wires, arranged upon nine cross arms, and insulated with the Brooks insulator. A test of these lines in rain, after two years' exposure, shows the insulation, within eight miles from the office, to be so high as to be beyond the range of measurement of either the Siemens universal galvanometer or the Varley differential—the instrument usually employed for these tests. These lines, as specimens of telegraphic engineering, are equally creditable in a mechanical point of view. The massive spars, ranged with mathematical accuracy for miles along the straight and level streets of Chicago, instead of detracting from the appearance of the thoroughfares, are a positive ornament to them. The ordinary sized poles are twenty-one feet in hight, and fitted with similar insulation. These are used on the Central Pacific Railway line, the Michigan Central, and the Philadelphia and Reading Railroad line. The latter, by the way, is a very good specimen of substantial construction, eight wires being carried upon two cross arms, and not high enough from the ground to strain the poles too much upon the sharp curves which abound upon that road. —*The Telegrapher.*

NEW BOOKS AND PUBLICATIONS.

MINES AND MINING OF THE ROCKY MOUNTAINS, THE INLAND BASIN, AND THE PACIFIC SLOPE. Comprising Treatises on Mining Law, Mineral Deposits, Machinery, and Metallurgical Processes. By R. W. Raymond, Ph. Dr., U. S. Commissioner of Mining Statistics. Illustrated with 140 Engravings. Beveled boards, extra English cloth. New York: J. B. Ford & Co. 1871. Price, $4·50.

This volume contains, in a condensed form, a vast amount of information concerning our American mining industry, its condition, prospects, methods, and appliances. It comprises a description of all the gold and silver mining districts of the West; a careful discussion of the laws affecting their titles; a thorough essay on mineral deposits in general, their occurrences, characters, and classification: twenty-seven chapters, profusely illustrated, on the mechanical appliances of mining and on metallurgical processes; and an appendix, with valuable tables of statistical information. Three alphabetically arranged analytical indexes, one of Mines, one of Mining Districts, and one of Subjects, complete the work. With these the vast body of information contained in these 800 octavo pages is remarkably convenient and accessible for purposes of reference. The style of the book is free from obscure technicalities, and eminently adapted to interest and instruct the non-professional reader; while yet it is clear, terse, and accurate enough to satisfy the demand of experts.

VICKS' CATALOGUE AND FLORAL GUIDE.

One of the handsomest illustrated floral catalogues that come annually to our office is Vick's, of Rochester, N. Y. This year it comes to us more beautiful than ever. It is printed on tinted paper, and contains more than 200 engravings of the choicest varieties of flowers and vegetables, two of which occupy full pages, and are finely colored. Any one having a taste for horticulture should inclose 25 cents to James Vick, Rochester, N. Y., and have a copy of his catalogue and guide mailed to him.

HIDE AND SEEK. A Novel. By Wilkie Collins, Author of "Woman in White," "Dead Secret," and many other popular Novels.

Messrs. T. B. Peterson & Brothers, 306 Chestnut street, Philadelphia, have just issued an edition of "Hide and Seek." Price, 75 cents.

A TEXT-BOOK OF ELEMENTARY CHEMISTRY, THEORETICAL AND INORGANIC. By George F. Barker, M. D., Professor of Physiological Chemistry in Yale College. New Haven, Conn.: Charles C. Chatfield & Co.

Prof. Barker has brought to the preparation of this work extensive knowledge of his subject, and, what is perhaps even more important, the fruits of an experience only to be obtained in teaching, through the want of which many able men have failed in their attempts to write good text-books for students. We are, after examination, prepared to give the book hearty commendation. Not that it is wholly without fault in plan and execution, but that these are so few, and the merits of the book are so obvious, as to disarm criticism. Accustomed to different methods of thought, the slight defects referred to may, perhaps, be only such to us, and may appear merits to others. The book is admirably calculated to introduce beginners into the science of chemistry. It is printed and bound in beautiful style.

NOTICES OF MINING MACHINERY, AND VARIOUS APPLIANCES IN USE, CHIEFLY IN THE PACIFIC STATES AND TERRITORIES, FOR MINING, RAISING AND WORKING ORES. With Comparative Notices of Foreign Apparatus for Similar Purposes. By William P. Blake. New Haven, Conn.: Charles C. Chatfield & Co.

This work is a reprint of a part of a report made by its author to the U. S. Commissioner of Mining Statistics, and printed as Part. IV. of the Commissioner's Report to Congress for the year 1870. Since the preparation of the report, there have been important advances in the construction of mining machinery, which have suggested certain modifications in this reprint. The work is replete with important and valuable information.

ST. LOUIS, THE FUTURE GREAT CITY OF THE WORLD. Illustrated with a Map, by L. U. Reavis. Second Edition. St. Louis: Published by order of the St. Louis County Court.

This book contains a large mass of facts, historical, geographical, geological, mineralogical, and statistical, in regard to St. Louis, one of the most important commercial and manufacturing centers of the great West. The whole is arranged in a very readable style, and printed in large pamphlet form.

A CHRONOLOGY OF PAPER AND PAPER MAKING. By Joel Munsell. Fourth Edition. Albany: Joel Munsell, 82 State street.

To those who know with what ability Mr. Munsell can compile, and in what a fine style he can print a work of this character, we need not say one word in regard to the value of the one now announced; and readers of this class are not few. For the benefit of those who are not familiar with Mr. Munsell's works, we will say, however, that the volume opens with a history of paper and paper making, which is followed by a chronology of paper, including improvements in its manufacture, and various industrial applications, arranged as the author so well knows how to do, in admirable form for reference. The work should be in every technical library, and is full of interest to the general reader.

SCIENTIFIC ADDRESSES, by Prof. John Tyndall, LL.D., F.R.S., Royal Institution, on the Methods and Tendencies of Physical Investigation; on Haze and Dust; on the Scientific Use of the Imagination. New Haven, Conn.: Charles C. Chatfield & Co.

WE are indebted to Mr. Dewitt C. Cragier for a copy of the Ninth Annual Report of the Board of Public Works of the City of Chicago, a voluminous and well-prepared document. Mr. Cragier will please accept our acknowledgements.

THE ADVERTISING HANDBOOK for 1871 has been issued in very convenient form, by T. C. Evans, 106 Washington st., Boston, Mass. Advertisers will find it a very useful book of reference.

WE are indebted to Mr. John Eaton, Jr., Commissioner of Education, for a copy of his Annual Report for 1870. We have read a great deal of this most admirable public document. It abounds in valuable information and statistics upon the present condition of education in the various States in the Union, together with instructive papers upon several specific subjects.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

APPLICATIONS FOR LETTERS PATENT.

11.—CARRIAGE LAMPS, BURNERS, AND BRACKETS.—R. Spaulding Merrill, Boston, Mass. January 3, 1871.

21.—TUCK MARKER FOR SEWING MACHINES.—J. F. Kellogg, North Bridgewater, Mass., and E. A. Cutler, Providence, R. I. January 5, 1871.

29.—STEAM BOILERS.—W. B. Mack, Philadelphia, Pa., residing at Glasgow, January 6, 1871.

32.—REPEATING FIRE-ARMS.—Oliver F. Winchester, New Haven, Conn. January 6, 1871.

33.—PLUMBAGO PRESSES.—Hubert R. Ives, New Haven, Conn. January 6, 1871.

Dr. E. P. Miller's work on Dyspepsia—its Varieties, Causes, Symptoms, Effects, and Means of Cure, is sent postpaid on receipt of the price (50 cents). Address Miller, Haynes & Co., 41 West 26th st., New York.

The Interest and Coupons on the First Mortgage 8 per cent Gold Bonds of the St. Joseph and Denver City Railroad Company, due the 15th of this month, are payable at the Farmers' Loan and Trust Company of this city.

The American Newspaper Directory, Published by the New York Advertising Agents, Geo. P. Rowell & Co., is the most complete publication of the kind ever issued. Price $5, bound in cloth.

Business and Personal.

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

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

"507 Mechanical Movements." This book is a complete illustrated table of Mechanical Movements, embracing all departments of Mechanics, and is an invaluable handbook for Mechanics, Inventors, Engineers, Students, etc. Price $1. By mail, $1.12. Address Theo. Tusch, 37 Park Row, New York.

A Book of Simple Rules and Formulæ, for the Solution of all Problems in the Application of Steam. By J. M. Derby, Professor at the Ecole Centrale, Brussels. By mail, $1. A. W. Macdonald, 29 Beekman st., New York.

Apply to J. Dane, Jr., Newark, N.J., for the best hand lathes, slide rests, presses, jewelers' rolls, models, dies, and light machinery to order.

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.

Imp'd presses and dies for tin work; special drilling machinery for hardware manufacturers. Ferracute Machine Works, Bridgeton, N. J.

Lake Huron Grindstones. J. E. Mitchell, Philadelphia, Pa.

Amherst Grindstones. J. E. Mitchell, Philadelphia, Pa.

Wanted.—Machinery for making Cigar Boxes. Address Alfred Savage & Son, Montreal, Quebec.

Wanted.—One of Brown & Sharpe's Universal Milling Machines, in good order. Address McBeth, Bentel & Margedant, Hamilton, O.

Shive's Pat. Governor, with Automatic Safety Check, which prevents the Engine from running away, received three highest premiums. A. B. Lawrence, General Agent, 38 Cortlandt st., New York.

Valuable property and machinery for manufacturing purposes, in Poughkeepsie, N. Y. Apply to Wm. H. Crosby, 261 Mill st., or on the premises, Bayeaux st.

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

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

For small, soft, Gray Iron Castings, Japanned, Tinned, on Bronzed, address Enterprise Manufacturing Company, Philadelphia.

The best place to get Working Models and parts is at T. B. Jeffery's, 160 South Water st., Chicago.

E. Howard & Co., 15 Maiden Lane, New York, and 114 Tremont st., Boston, make the best Stem-winding Watch in the country. Ask for it at all the dealers.

Improved Foot Lathes. Many a reader of this paper has one of them. Selling in all parts of the country, Canada, Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

"Edson's Recording Steam Gage and Alarm," 91 Liberty st., New York. Illustrated in SCIENTIFIC AMERICAN, January 14, 1871.

English and American Cotton Machinery and Yarns, Beam Warps and Machine Tools. Thos. Pray, Jr., 57 Weybosset st., Providence, R.I.

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

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

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

The Merriman Bolt Cutter—the best made. Send for circulars. H. B. Brown & Co., Fair Haven, Conn.

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

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

Glynn's Anti-Incrustator for Steam Boilers—The only reliable preventive. No foaming, and does not attack metals of boilers. Price 25 cents per lb. C. D. Fredricks, 587 Broadway, New York.

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

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

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

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

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

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

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

For the best Self-regulating Windmill in the world, to pump water for residences, farms, city buildings, drainage, and irrigation, address Con. Windmill Co., 5 College Place, New York.

Conklin's Detachable Rubber Lip, for bowls, etc., works like a charm. For Rights, address O. P. Conklin, Worcester, Mass., or A. Daul, Philadelphia, Pa.

Japanese Paper-ware Spittoons, Wash Basins, Bowls, Pails, Milk Pans, Slop Jars, Commode Pails, Trays. Perfectly water-proof. Will not break or rust. Send for circulars. Jennings Brothers, 352 Pearl st., N. Y.

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

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

See how cheap Thomas sells Lathes and Drills, in another column.

Ashcroft's Low Water Detector. $15; former price, $30. Thousands in use. E. H. Ashcroft, sole proprietor of the patent, Boston, Mass.

Steel Castings, of the best quality, made from patterns, at Union Steel and Iron Works, Rhinebeck, N. Y.

Capital wanted to manufacture licensed shuttle Sewing Machines. Address "Inventor," care of S. M. Pettengill & Co, 37 Park Row, N. Y.

A Chemist, Analytical and Manufacturing, of many years' experience in the largest chemical factories in Germany and in this country, wants an engagement. Best references given. P. O. Box 172, Hoboken, N. J.

Wanted.—Partner to take an interest in an established Foundery, Engine and Machine Shop, in the West. Prefer practical mechanic to take charge. Address S. L. McHenry, 355 Liberty st., Pittsburgh, Pa.

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

Answers to Correspondents.

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

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

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

GEARING CIRCULAR SAWS.—In answer to E. O. T.'s inquiry in regard to running a saw by gear direct from engine, I would say that there would be no trouble with the gear, but it would be folly to run a large saw in that way, owing to the great liability of the saw to be instantly stopped by the springing of timber, turning of logs, and other causes that practical sawyers know. My opinion is that if E. O. T. try it he will some day find his mill a wreck. I would also state that I have a gear of his description 2-feet diameter, 5-inch face, run by water power, that often makes 800 turns in a minute, used with belt for driving a 48-inch saw.—A. O. B., of Vt.

CEMENT.—F. P. B. can make a cement for fastening leather to iron or glass, as follows: To 1 quart of glue, after it is dissolved in good cider vinegar, add 1 ounce Venice turpentine; let it cook about half a day, when it is fit for use.—O. L. C., of N. H.

TURNING LATHE.—If M. C. R. will take a light cut from the bottom of the tail-stock, his lathe will turn true. The tail stock is evidently a little too high for the cone.—R. A. B., of Pa.

J. M. D.—The object of our query column, and column of answers to correspondents, is to benefit our readers at large, not individual readers. If you will send the recipes of which you speak we will publish them, but do not intend to make our office a medium of intercommunication on private business matters. The action of a steel magnet or any other magnet, will not render the air magnetic. A machine kept in motion by the attractive force of a permanent magnet would be a perpetual motion in the same sense as one kept in constant motion by the action of gravity. A water wheel placed in a never-failing stream is a perpetual motion in this sense. What is sought for is, however, a machine that will move itself independently of static force. Have you got such a machine? If so, we shall be glad to be introduced to it.

B. M. & Co., of Ind.—You are on the right track. By admitting air behind the bridge wall in the manner proposed, you will probably consume your smoke. We believe that heated air, if forced in under pressure, is better than cold air. If, however, it go in only under ordinary pressure, what you gain by increase of temperature will be, in great measure, lost by expansion, less oxygen entering in proportion to volume than when it enters cold.

J. A. H., of Ga.—There is no such substance as that you seek. The experiment you propose indicates that you do not understand the first principles of electrical science. Better get some good treatise, and inform yourself, than waste time and money in trying experiments which can not by any possibility teach you anything.

M. Y., of Ga.—We shall be glad to hear from you on the subject proposed, but cannot, of course, promise publication till we read your manuscript. The proportions for Babbitt metal, and method of making the alloy are as follows: Melt 4 parts of copper, and add by degrees 12 parts of best Banca tin, and 8 parts of regulus of antimony. When the mass is melted add 12 parts more of tin.

B. J. of Pa.—Rosner, a Danish Astronomer, first determined the velocity of light in 1675, by observing the eclipses of Jupiter's moons. It seems to require no time at all to pass over any distance of earth; the flash seems to be instantaneous.

E. M. F., of N. J.—You may use soda ash in your boiler to remove scale without any danger of hurting the boiler. In some cases it will loosen the scale, in others it will not. It will do no harm to try it.

G. F. C., of ——.—Plaster of Paris is prepared for taking casts by simply mixing it with water to the consistence of cream. The mixing must be done rapidly, or it will set before it can be poured into the mold.

O. W. Y. of Conn.—You will find the information you seek in an article on "Artificial Stone," page 263, Vol. XXIII. of the SCIENTIFIC AMERICAN.

L. R., of N. H.—The motive powers of streams, flowing equal volumes of water, will be directly as their falls. If a stream through which a given volume, at a given point, falls ten feet, produce at that point one hundred horse power, the same volume falling at another point twenty feet would yield two hundred horse power. The horse power of any body of falling water, is the weight in pounds which falls per minute, multiplied into the distance in feet through which it falls, and the product divided by 33,000.

Queries.

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

1.—CEMENT FOR LEATHER THAT WILL RESIST WATER AND HEAT.—I wish a cement for leather that will resist the action of water and moderate heat.—J. A. K.

2.—FILTER FOR CISTERNS.—I see some of your correspondents recommend a wall of soft-burnt bricks for cistern filters. Should the wall be laid up with mortar or cement, or simply with the bricks alone?—J. A. K.

3.—How can I render scrap lead (such as accumulates in a plumber's shop) as soft and tough as pure sheet lead or pig lead? I desire to make castings of a peculiar shape, and can do so with pure sheet or pig lead, but the scrap is too hard and brittle. Cheapness is of course an object.—H. W. J.

4.—HARDENING CAST IRON.—How can cast iron be hardened after it is fitted and finished, without injury to the finished surface, and so as to render it more durable under wear?—C. D. S.

5.—DRESSING FURS.—I wish some cheap way of dressing skins with the fur on, and polishing the hair after the skin is dressed?—J. P. H.

6.—DISTILLING TAR.—How can I distil pine tar so as to separate the grosser parts from the finer? What sort of still should I use, etc?

7.—IMITATION ROSEWOOD MOLDINGS.—How are imitation rosewood moldings made? How is the plaster made to adhere, and how are they finished?—W. S. H.

8.—POTTER'S CLAY.—How is potter's clay mixed and tempered?—G. F. C.

9.—EXPLOSION OF SCRAPPING FURNACE.—An explosion occurred in one of my furnaces recently, which I cannot explain or account for. The furnace is what is known as a cinder bottom scrapping furnace, with water chill inside, built very strongly, in use only two weeks, using mixed hard and soft coal, with blast. It exploded with great violence, just after the heat had been drawn, when the door was open, and when the heater had just taken his rabble out of the water bosh, and thrust it into the furnace, on the cinder bottom. The explosion was similar to the discharge of a cannon, and filled the mill with smoke and steam. The roof of the furnace was lifted, though not blown off, and the nine doors in the boiler wall were all blown open. The heater said no water had been put into the furnace to cool the bottom, as he had been accustomed to do, but explained it as resulting from the contact of a little wet cinder, about the size of a walnut, sticking on to the rabble, and coming in contact with the molten cinder in the furnace. But this explanation did not satisfy me, and as the occurrence was new to me, and very dangerous, and might be very expensive, I desire to ask the cause of the explosion, and the remedy. A similar occurrence happened at one of the large mills here in Reading, on the same day, and a few years since, at Phœnixville, Pa., a furnace was leveled with the ground from the same cause. Water is frequently thrown into the furnace to cool the bottom, without danger, and the heater says an explosion might not happen again in five years with the same treatment. What exploded, and what was the cause?—J. H. S.

10.—SAWING SOFT TIMBER WITH CIRCULAR SAWS.—With what form of teeth—filed square or shearing on top—can the best results be obtained in sawing soft timber with circular saws?—A. O. B.

11.—PRESERVING STARCH AND PASTE.—Is there any substance that, when put into boiled starch and flour paste, will preserve the starch and paste in a perfect state for months? Something that will prevent them from souring or watering?

Recent American and Foreign Patents.

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

COTTON CHOPPER.—Joseph R. Hood, Wedowee, Ala.—This invention consists in providing the frame of a cotton chopper with a hoe, arranged in such manner as to work from the side of the frame, for the purpose of thinning out the cotton crop.

WOOD-SPLITTING MACHINE.—Frank Ficht, Dyckeville, Wis.—This invention has for its object to furnish an improved machine for splitting cord wood, shingle bolts, and other short wood, and which shall be simple in construction, effective in operation, and conveniently operated.

CARTRIDGE BELT.—William B. Hayden, Columbus, Ohio.—This invention has for its object to so improve cartridge belts that the same may be revolved, to bring the filled pouches always to the front, and to improve the pouches so that the wads of the several cartridges will be retained in place.

HOLLOW AUGER.—Aaron Bauman and Orin O. Witherell, Toledo, Ohio.—This invention has for its object to furnish an improved hollow auger, which shall be simple and inexpensive in construction, not liable to get out of order, and which shall require less power to operate it than the hollow augers constructed in the ordinary manner.

SPADE.—Harrison Parkman, Philadelphia, Pa.—This invention consists in a spade whose lower end is beveled downward from each outer corner to a central point; which is wider at the lower than at the upper end; which in cross-section is concave on its front and convex on its rear side; and which longitudinally is straight on its rear side, from top to bottom.

WASHING MACHINE.—A. J. Nave, Columbus, Texas.—This invention has for its object to furnish an improved machine for washing wool, clothes, etc., which shall be simple in construction, convenient in use, and effective in operation, being so constructed as to wash the clothes quickly, thoroughly, and with very little wear.

INVALID BEDSTEAD.—Dr. William O. Reid, Vienna, N. C.—This invention relates to improvement on the bedstead patented to applicant March 1, 1870, and consists in mechanism whereby the patient is enabled to raise his body into a partially erect position, and otherwise assist himself in various ways, without the aid of an attendant.

BIN COVER.—Alonzo S. Maxwell, Dixon, Ill.—This invention relates to improvements in the bin covers made in the form of a segment of a circle, and moving on circular lines in opening and closing, and it consists in providing arms for the said covers, which are pivoted at the axis of the curve of the cover, and have curved heads, by which they are attached to the covers; said heads stretching across the ends of the covers at the inner sides in a way to brace and strengthen the covers; and the covers are supported on the pivots of the arms whereon they swing in opening and closing, so that they are held either open or closed, by gravity. The invention also consists in the application to the bins, of casings to prevent the contents of the bins working between the arms and the walls thereof; also a packing to exclude it from the space between the cover and the top of the case.

DRAWER PULL.—Charles H. Pierpoint, West Meriden, Conn.—This invention relates to improvements in that class of drawer pulls in which a handle is jointed to a shank projecting from the front of the drawer, to hang in a vertical position when not used for pulling the drawer, and it consists in the application to the said handle, of a cushion of india-rubber or other suitable elastic substance, on the part likely to strike against the said drawer front when let fall, to prevent marring or defacing the front, also to prevent noise.

FILE AND BINDER FOR PAPERS, PAMPHLETS, ETC.—J. G. Floyd, Jr., New York city. This invention has for its object to furnish an improved file and binder for filing and binding, temporarily or permanently, papers, pamphlets, and other periodicals, successively, as they are received, and which shall be simple in construction, easily and conveniently manipulated, and will hold the papers securely and without mutilating them, or interfering with their being subsequently bound.

STAMP HOLDER.—Julius Ropes, Ishpeming, Mich.—This invention has for its object to furnish an improved device for holding postage and internal revenue stamps, designed more especially for use in post offices and other places where stamps are sold at retail, which shall be so constructed that the different denominations will be held distinctly in view, and in such a way that they may be easily and quickly detached when required, and which shall be simple in construction and easily and conveniently operated.

WELL AUGER.—Elijah Altman, Hamilton, Mo.—This invention has for its object to furnish an improved well auger, designed more particularly for boring through veins of quicksand, and which shall be simple in construction and effective in operation, taking out the water and dirt much cleaner than augers constructed in the ordinary manner.

SETTING FOR STONES AND JEWELS.—William Riker, Newark, N. J.—The object of this invention is to prepare a setting for precious stones and their imitations, in such manner that the gold plates supporting said stones can be completely finished and polished before receiving them and the projecting pins that hold the same in place. The invention consists in the application, to a perforated setting plate, of separate headed setting pins for holding the stone, said pins being applied only after the plate has been entirely finished and polished.

STAMP.—A. M. Darrell, Washington, D. C.—This invention relates to the class of stamps which indelibly mark an object by burning an impression into it with a heated die; and the object of the invention is to so improve the stamp that it shall be self-heating, and at the same time be neat, durable, cheap, and convenient, the heating apparatus being as capable of adaptation to small hand stamps as to the larger classes of spring stamps, etc.

ROACH AND BUG TRAP.—Thomas Williams, Tompkinsville, N. Y.—This invention consists in applying to the lower edge and outer side of the suspended funnel an annular flange, which constitutes a trough, in which liquid for preventing the escape of the animals may be contained.

FEED-WATER HEATER.—E. L. Jones, Memphis, Tenn.—This invention relates to improvements in feed-water heaters for steam boilers, and consists in a pipe or pipes arranged to traverse the furnace chamber, through which pipes water is supplied to the boiler by a force pump, and in which a current may be maintained when the pump has ceased its operation.

FOLDING DESK.—John Milwain, Nashville, Tenn.—This invention relates to improvements in folding school desks, and it consistsl n a combination with the folding table of the desk, of a strip or plate for closing the opening at the point where the table is folded down, and an arrangement of the pivot points, bracing arms, and guide grooves, for the latter, for operating the table, so as to effect the said closing of the joint, so that when the table is folded down, the book case beneath will be closed dust proof.

WASHING MACHINE.—E. P. Brown, Thomasville, Ga.—This invention relates to improvements in washing machines, and consists of two sets of rollers, each mounted in a frame, with spaces between them, one set arranged above the other, both in a rectangular case, and connected to a vibrating working bar, so that they will move simultaneously in opposite directions, the rollers of the upper set rolling up and down over the lower ones, and acting on the clothes placed between the two sets. The invention also comprises the application to the upper set of a spring for increasing the pressure on the clothes.

SPOKE-TENONING MACHINE.—Godfrey E. Culp and Matthew Flaig, Lockhaven, Pa.—This invention consists in an improved machine for tenoning spokes for wagon wheels; and consists in a peculiar construction and arrangement of parts, for effecting the operation in a rapid, neat, and effective manner.

STUFFING BOX FOR ENGINES.—Joel A. H. Ellis, Springfield, Vt.—This invention has for its object to prevent the escape into the atmosphere of vapor around the piston and valve rods, and the escape of the fluid from which the vapor is produced around the plunger of the force pump that supplies vapor generators.

VAPOR GENERATORS FOR VAPOR ENGINES.—Joel A. H. Ellis, Springfield, Vt.—This invention relates to a new means for utilizing the escape heat of a furnace and steam engine, for the purpose of vaporizing gasoline or other volatile substance used in a vapor engine.

MEDICAL COMPOUND.—Rebecca Gilkinson, New York city.—This invention and discovery relates to a new and useful improvement in a liniment for curing rheumatism and similar diseases.

DUST FLUE DAMPER.—James M. Frear, Pittstown, Pa.—The object of this invention is to obtain convenient and easy access to the bottom flues of stoves and ranges for the purpose of cleaning the same, and also to create an under draft for carrying off the ashes and dust which rise when raking or shaking the grate.

COMPOUND FOR VAPOR GENERATORS.—J. A. H. Ellis, Springfield, Vt.—This invention relates to a new compound fluid to be used in the vapor generators of vapor engines.

SALT CELLAR.—John T. Walker, Brooklyn, N. Y.—This invention relates to a new salt cellar, which is provided with a clamping spring to be readily attached to and detached from the edge of a plate.

GRATE FOR FURNACES.—Alfred Dart, Carbondale, Pa.—In this invention, the fuel is fed upon a grate set at an inclination of about 45 degrees, and provided with a corrugated cover, whereby the fuel is kept in a thin stratum, and in a state of thorough and nearly uniform combustion.

SEWING-MACHINE MOTOR.—William C. Thornton and James D. Cooley, Hillsville, Va.—This invention relates to a stop-mechanism for sewing-machine motors, whereby the motion of the motor may be arrested instantly, and at any desired mon ent.

SOLUTION AND PROCESS FOR EMBALMING.—Dr. Benjamin F. Lyford, San Francisco, Cal.—This invention relates to a new compound for use in embalming, and a peculiar process of preparing and applying the same, whereby animal bodies may be perfectly preserved without appreciable deterioration for an indefinite period.

APPARATUS FOR PRESERVING MEATS, FRUITS, ET icholas H. Shipley, Baltimore, Md.—In this invention an apparatus is provided for simultaneously exhausting the air from any number of vessels, with or without the application of heat thereto, for the purpose of scientific experiments, and for domestic use in preserving meats, fruits, vegetables, etc. The apparatus is also designed for the substitution of gases in place of the air exhausted and for the application of heat or cold to the vessels during the process.

COMBINED TAPE MEASURE AND SCREW DRIVER.—Moses W. Dillingham, Amsterdam, N. Y.—This invention relates to a new and useful improvement in a combination of well-known and useful articles more especially designed for undertaker's use, and it consists in combining with the pocket tape measure a screw driver and an awl, arranged to operate from a tube connected with the case of the tape measure.

DETACHABLE TACKLE BLOCK.—George Stancliff, New York city.—This invention has for its object to so provide tackle blocks that the load suspended from them may be readily detached when desired. The invention is chiefly applicable to davits for suspending boats from the sides of a vessel, and for permitting the rapid detachment of the same, but may also be used for other purposes.

Official List of Patents.

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FOR THE WEEK ENDING JAN. 31, 1871.

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111,296.—ADJUSTABLE REAMER.—Edwin H. Adgate, Mittineague, Mass.
111,297.—FASTENING FOR DOOR-KNOB ROSES.—James M. Adolphus, Philadelphia, Pa. Antedated Jan. 21, 1871.
111,298.—STEAM GENERATOR.—Christopher Ahrens and Frank Kamman, Cincinnati, Ohio.
111,299.—MACHINE FOR WELDING TUBES.—William C. Allison (assignor to W. C. Allison & Sons), Philadelphia, Pa.
111,300.—WELL AUGER.—Elijah Altman, Hamilton, Mo.
111,301.—FODDER STAND.—John Antram and Elwood B. Mullin, Franklin, Ohio.
111,302.—MILK CAN.—Thomas M. Bell, New York city.
111,303.—PNEUMATIC SPRING.—John Bevan, Port Richmond, and Benjamin W. Hitchcock, West Flushing, N. Y.
111,304.—PRINTING PRESS GUIDE.—Alexander L. Bevans, Flushing, N. Y.
111,305.—MANUFACTURE OF COPPERAS.—R. DeWitt Birch, Philadelphia, Pa.
111,306.—APPARATUS FOR OPENING THE EYES OF PICKS.—Robert Blake, Scranton, Pa.
111,307.—METALLIC ROOFING.—George W. Bliss, Springfield, Mass.
111,308.—HORSE HAY RAKE.—Olpha Bonney, Jr., San Francisco, Cal.
111,309.—HAT SUPPORTER AND VENTILATOR COMBINED.—John A. Borthwick (assignor to himself and George W. Hess), Philadelphia, Pa.
111,310.—BEE HIVE.—Arthur Bradshaw, Rantoul, Ill.
111,311.—HEAD STOCK FOR MILLING MACHINES.—Amos H. Brainard, Hyde Park, Mass.
111,312.—WHEEL FOR VEHICLES.—Alexander D. Brown, Sr., Columbus, Ga.
111,313.—WASHING MACHINE.—Edmund P. Brown, Thomasville, Ga.
111,314.—HAY TEDDER.—Ezekiel W. Ballard, Barre, Mass.
111,315.—CRACKER MACHINE.—William Cairns, Jersey City N. J.
111,316.—PUMP.—Herman Camp, Rouseville, Pa.
111,317.—CULINARY VESSEL.—John H. Chappel (assignor to himself and Robert Seaman), New York city.
111,318.—COMPOUND FOR ENAMELING BRICK.—Decius W Clark, Chicago, Ill.
111,319.—CORN POPPER.—William F. Collier, Worcester, Mass.
111,320.—HORSE HAY RAKE.—Isaac N. Condra, Genoa, Iowa.
111,321.—BATH AND WASH STAND.—Royal Cooper, Georgetown, D. C.
111,322.—GATE.—Hosea Ballou Crandall, Brocton, N. Y.
111,323.—GRAIN, COFFEE, AND RICE CLEANER.—Andrew Crawford, Wilkesbarre, Pa., and Iram D. Crawford, Bloomington, Ill.
111,324.—HARNESS OPERATING MECHANISM FOR LOOMS.—George Crompton, Worcester, Mass.
111,325.—CARPET.—George Crompton, Worcester, Mass.
111,326.—PLATFORM HORSE POWER.—Frank J. Culver, Hartford, Vt.
111,327.—SCREW DRIVER.—Moses W. Dillingham, Amsterdam, N. Y.
111,328.—SCROLL SAW.—William H. Dobson (assignor to Henry Lampert), Rochester, N. Y.
111,329.—COMPOUND LIQUID FOR USE IN VAPOR ENGINES.—J A. H. Ellis, Springfield, Vt.
111,330.—STUFFING BOX FOR ENGINES.—J A. H. Ellis, Springfield, Vt.
111,331.—VAPOR GENERATOR FOR VAPOR ENGINES.—J. A. H. Ellis, Springfield, Vt.
111,332.—FLY CATCHER.—Harriet A. Farnam, South Bend, Ind.
111,333.—MACHINE FOR SPLITTING WOOD.—Frank Ficht, Dyckesville, Wis. Antedated Jan. 29, 1871.
111,334.—STEM-WINDING WATCH.—Walter H. Fitz Gerald, Carlstadt, N. J., assignor to Spadone & Fitz Gerald, New York city.
111,335.—PAPER FILE.—John G. Floyd, Jr., New York city.
111,336.—DAMPER.—James M. Frear, Pittstown, Pa.
111,337.—CARPET STRETCHER.—Charles E. Gale, Aurelius, N. Y.
111,338.—ROAD SCRAPER.—George B. Garlinghouse, North Madison, Ind.
111,339.—SASH HOLDER.—Philetus W. Gates (assignor to himself and D. R. Fraser), Chicago, Ill.
111,340.—RAILWAY CAR TRUCK.—Charles Graham, Kingston, Pa.
111,341.—VALVE FOR STEAM PUMPS.—Joseph F. Hamilton, Alliance, Ohio.
111,342.—DOOR HANGER AND RAIL.—Thomas Foster Hamilton, Geneseo, Ill.
111,343.—LOOM.—Emory B. Hastings, Palmer, Mass., assignor to himself, Edwin Sawyer, Daniel L. Thompson, and Charles A. Perley.
111,344.—HARVESTER RAKE.—George W. Hines, Brookfield Wis. Antedated Jan. 28, 1871.
111,345.—REGISTERING TICKET PUNCH.—Austin D. Hoffman, Chicago, Ill., assignor to James H. Small, Buffalo, N. Y.
111,346.—COTTON CHOPPER.—Joseph R. Hood, Weedowee, Ala.
111,347.—GRAIN SEPARATOR FOR THRASHING MACHINES.—James W. Huntoon, St. Louis, Mo.
111,348.—ELECTRO-MOTORS FOR CARS.—Solomon Jones, New Orleans, La.
111,349.—PUMP.—T. O. Jones, Galesburg, Ill.
111,350.—CORN-SHELLING AND CLEANING MACHINE.—Louis Kamp, Vanderburg county, Ind.
111,351.—BUNG EXTRACTOR.—Josiah Kirby, Cincinnati, Ohio.
111,352.—BUNG.—Josiah Kirby, Cincinnati, Ohio.
111,353.—CAR STARTER.—George Byron Kirkham, New York city.
111,354.—PUMP.—T. J. Lapsley, Nashville, Tenn.
111,355.—CARPET CLEANER.—H. H. Lindhorst, St. Louis, Mo.
111,356.—HOISTING APPARATUS.—Andrew B. Lipsey, New York city.
111,357.—FERTILIZING COMPOUND.—J. M. Lowenstein, New Orleans, La.
111,358.—DISINFECTING AND VENTILATING BURIAL VAULTS—B. F. Lyford, San Francisco, Cal.
111,359.—SEWING MACHINE.—William A. Mack, Norwalk, Ohio.
111,360.—LAMP.—C. D. Macqueen, Philadelphia, Pa.
111,361.—HOISTING FORK.—Elias Magruder, Cap Au Gris, Mo.
111,362.—SPRING BED BOTTOM.—Erwin Williams Maxson, Scranton, Pa.
111,363.—COVER FOR BINS.—Alonzo S. Maxwell, Dixon, Ill.
111,364.—BEDSTEAD AND SPRING BED BOTTOM.—William McArthur, Philadelphia, Pa.
111,365.—COMBINED ROCKING SOFA AND BEDSTEAD.—Wm McArthur, Philadelphia, Pa.
111,366.—SULKY PLOW.—Edward Meloy and A. R. Stanley, Shullsburg, Wis.
111,367.—THRASHING MACHINE.—J. H. Miller, Arcadia, N. C Antedated January 23, 1871.
111,368.—LAMP CHIMNEY AND DISH WASHER.—C. S. Moore and Silas A. Moore (assigns his right to Harland Boyd), Worcester Mass.
111,369.—CULINARY VESSEL.—Francis Morandi, Malden Mass.
111,370.—MANUFACTURE OF SUPERPHOSPHATE OF LIME.—Campbell Morfit, Sudbrook Park, England.
111,371.—FOLDING SETTEE.—Henry T. Morse (assignor to L. Morse & Son, Athol), Mass.
111,372.—SEEDER AND CULTIVATOR.—James T. Mott, Postville, Iowa.
111,373.—VALVE.—George Murray, Jr. (assignor to himself, George Murray, Sr., and Henry E. Snow), Cambridgeport, Mass.
111,374.—WASHING MACHINE.—Andrew Jackson Nave, Columbus, Texas.
111,375.—FANNING MILL.—Harrison Ogborn, Richmond, Ind. assignor to S. E. Baker, Osceola, Iowa.
111,376.—PRESERVING COMPOUND FOR THE HANDS, ETC.—J W. Osborne, Brooklyn, N. Y.
111,377.—SHOT CARTRIDGE.—S. White Paine, Williamsport, Pa.
111,378.—LOOM PICKER.—Jerome M. Parker, Leicester Mass.
111,379.—SHINGLE MACHINE.—Willis Porter, Orono, Me.
111,380.—INVALID BEDSTEAD.—William O. Reid, Vienna N. C.
111,381.—WATER WHEEL.—J. B. Reyman (assignor of one half his right to Donald W. Campbell), Springfield, Mo.
111,382.—BALANCE SLIDE-VALVE FOR STEAM ENGINES.—G W. Richardson, Troy, N. Y.
111,383.—MICA FRAME FOR STOVES.—George G. Richmond Peekskill, N. Y.
111,384.—PORTABLE SHELF AND SUPPORT.—Parley D. Root Weston N. Y.

111,385.—POSTAGE-STAMP HOLDER.—Julius Ropes, Ishpenning, Mich.

111,386.—HAND STAMP.—Gottlieb Rost, Union Hill, N. J., assignor to himself, William Austin, Jr., and John Jungermann, New York city.

111,387.—WATER GRATE.—Joseph Ryan, St. Louis, Mo.

111,388.—ROLL FOR HAIR DRESSING.—Elias Schnautz, New York city. Antedated Jan. 21, 1871.

111,389.—BASE-BURNING STOVE.—J. Q. C. Searle, New Albany, Kansas.

111,390.—HEATER FOR PAPER-RULING MACHINES.—Louis Siebert and J. W. Lilley, Columbus, Ohio, assignors to J. R. Hool & Son, New York city.

111,391.—CULTIVATOR PLOW.—Joseph Singer, Mendota, Ill. Antedated Jan. 14, 1871.

111 392.—REGISTERING TICKET PUNCH.—J. H. Small, Buffalo, N. Y.

111,393.—BURIAL CASKET.—E. T. Smith and J. S. Winston (assignors to themselves and C. H. Gwyer), New York city.

111,394.—ELECTRO-MAGNETIC INDICATOR.—W. D. Smith, Washington, D. C.

111,395.—COMPOSITION FOR FLOORS, PAVEMENTS, ETC.—Antonio Solari (assignor of one half his right to Francis Maguet), Louisville, Ky.

111,396.—BENCH VISE FOR WOOD WORK.—Edwin Sprague, Allegheny, assignor to himself and J. R. Blakeslee, Birmingham, Pa.

111,397.—BARK MILL.—Frederick Stamm, East Lampeter, Pa.

111,398.—BOAT-DETACHING APPARATUS.—George Stancliff, New York city.

111,399.—HOLDER FOR PLATES WHILE BEING WARMED.—W. T. Stoutenborough, Brooklyn, N. Y.

111,400.—LAMP BURNER.—F. A. Taber, New Bedford, assignor to T. S. Williams, Newton, and P. S. Page, Malden, Mass.

111,401.—LUBRICATOR.—John Tenwick, Grantham, assignor to R. C. Ransome, Ipswich, England.

111,402.—BED BOTTOM.—E. C. Thompson, New York city, assignor to himself and C. L. O'Brien, Ithaca, N. Y.

111,403.—CLEANING AND POLISHING COFFEE.—William Thompson, New York city, and Samuel Thompson, Baltimore, Md.

111,404.—DIGGING MACHINE.—I. P. Tice, New York city. Antedated Jan. 21, 1871.

111,405.—CURTAIN FIXTURE.—Richard Vose, New York city.

111,406.—COMBINED COFFEE MILL AND APPLE PARER.—D. C. Warner, Chicago, Ill.

111,407.—PRINTING PRESS.—R. C. Warwick, New York city.

111,408.—TELEGRAPHIC PROTECTION FOR SAFES, VAULTS, AND BUILDINGS.—W. B. Watkins, Jersey City, N. J.

111,409.—BURGLAR ALARM AND POLICE TELEGRAPH.—W. B. Watkins, Jersey City, N. J.

111,410.—FIRE-ALARM TELEGRAPH.—W. B. Watkins, Jersey City, N. J.

111,411.—FIRE-ALARM TELEGRAPH.—W. B. Watkins, Jersey City, N. J.

111,412—FIRE-ALARM TELEGRAPH.—W. B. Watkins, Jersey City, N. J.

111,413.—FIRE-ALARM TELEGRAPH.—W. B. Watkins, Jersey City, N. J.

111,414.—STAVE-SAWING MACHINE.—C. T. Watson, Deerfield, Mich.

111,415.—MACHINE FOR DISINTEGRATING WOOD.—Charles Wolff, Sr., and Charles Wolff, Jr., Cincinnati, Ohio.

111,416.—CORN AND PHOSPHATE DRILL.—J. W. Wood, New Leeds Corner, and Gabriel Moore, Fair View School House, Md.

111,417.—BOX-OPERATING MECHANISM FOR LOOMS.—Horace Wyman, Worcester, Mass.

111,418.—TUBE HOLDER.—Thomas Arnold, Petroleum Center, Pa.

111,419.—CAR COUPLING.—D. H. Ball, Sinnamahoning, Pa.

111,420.—ENVELOPE MACHINE.—James Ball, New York city.

111,421.—GRAIN DRILL.—Turner Barns and H. S. Jamison, Greensburg, Ind.

111,422.—PIPE WRENCH.—O. G. Barrett, Boston Highlands, Mass.

111,423.—PAPER-CUTTING MACHINE.—George Bates, Philadelphia, Pa.

111,424.—HARVESTER.—L. M. Batty, Canton, Ohio.

111,425.—WOOD PAVEMENT.—H. M. Beidler, Philadelphia, Pa.

111,426.—STALL FOR HORSES.—S. S. Bent, Port Chester, N. Y. Antedated Jan. 21, 1871.

111,427.—COOKING STOVE.—Samuel Blue, Danville, Pa.

111,428.—COMBINED GANG AND SUBSOIL PLOW.—J. L. Bond, St. Louis, Mo.

111.429.—MODE OF FORMING AIR CHAMBER IN DENTAL PLATES.—Mary Ann Boughton, Norwalk, Conn.

111,430.—CUP FOR KEROSENE LAMPS.—N. L. Bradley (assignor to Bradley & Hubbard), Meriden, Conn.

111,431.—GRAIN THRASHER AND CLEANER.—W. H. Butterworth and John Butterworth, Jr., Trenton, N. J.; said John Butterworth, Jr., assignor to said W. H. Butterworth.

111,432.—CULTIVATOR.—Jarvis Case, La Fayette, Ind.

111,433.—HOT-AIR DISTRIBUTING PIPE.—Horace C. Crehore (assignor to himself and Samuel T. Cushman), Boston, Mass.

111,434.—BEE HIVE.—Samuel Cuplin, Iowa Falls, Iowa.

111,435.—INKSTAND.—Samuel Darling, Providence, R. I.

111,436.—BRANDING STAMP.—Armistead M. Darrell (assignor to himself, Solon C. Kemon, and Lysander Hill), Washington, D. C.

111,437.—POTATO DIGGER.—James Davis, Saratoga, N. Y.

111,438.—COMBINED PNEUMATIC AND RUBBER SPRING.—Patrick S. Delvin, Jersey City, N. J., assignor to himself, I. P. Wendell, and S. P. M. Tasker, Philadelphia, Pa.

111,439.—SEAL FOR DIP-PIPE IN GAS WORKS.—Grafton Douty, Columbus, Ohio.

111,440.—SEAL FOR DIP PIPE IN GAS WORKS.—Grafton Douty, Columbus, Ohio.

111,441.—LUBRICATING COMPOUND.—Elisha Dyer, Jr., Providence, R. I.

111,442.—TUBE CUTTER.—Daniel E. Eaton, assignor to himself and James S. Hanscom, Cambridge, Mass.

111,443.—COMPOUND FOR DRESSING AND COLORING THE HAIR.—John N. Fallis (assignor to himself and Charles Thacker, Sr.,) Newport, Ky.

111,444.—TREATING COTTON-SEED OIL TO RENDER IT DRYING.—Rasselas Farley, Cincinnati, Ohio.

111,445.—HARROW.—August Friedemann, Waverly, Iowa.

111,446.—TEMPERING STEEL.—Geo. B. Garman, Washington township, Ind.

111,447.—SEWING MACHINE.—Thomas Garrick, Providence, R. I.

111,448.—BOOT AND SHOE SOLE.—Benjamin D. Godfrey, Milford, assignor to Wm. Claflin, trustee of the American Wire-Quilted Sole Association, Boston, Mass.

111,449.—MANUFACTURE OF RUBBER ROLLS.—John Greacen, Jr., and Edward L. Perry (assignor to Combination-Rubber Company), New York city.

111,450.—CARTRIDGE BELT.—William B. Hayden, Columbus, Ohio.

111,451.—BEE HIVE.—John H. Hendrick, Clinton, Ill.

111,452.—FEEDING MECHANISM FOR SEWING MACHINES.—Walter B. Higgins, San Francisco, Cal.

111,453.—UMBRELLA.—Mason Hirsh and Leopold Hirsh, Philadelphia, Pa.

111,454.—MANUFACTURE OF SOAP.—James Hoagland and Isaac C. McDonald, Columbus, Ohio.

111,455.—FOLDING CHAIR.—Francis M. Holmes, Boston, Mass.

111,456.—FASTENING FOR EPAULETTES.—Wm. J. Horstmann, Philadelphia, Pa.

111,457.—MACHINE FOR CUTTING STAVES.—A. J. Howell and James Murphy, Spruce Hill, Pa.

111,458.—GATHERING ATTACHMENT FOR SEWING MACHINES.—Allan Johnston and Wm. T. Johnston, Ottumwa, Iowa.

111,459.—COATING AND DECORATING WALLS, CEILINGS, ETC.—Chas. T. Kemmer, Cleveland, Ohio.

111,460.—CANT HOOK.—Amos Kennard, Clearfield, Pa.

111,461.—LETTER BOX.—Cyrus Levis, Philadelphia, Pa.

111,463.—BOX.—Henry Manneck, New York city.

111,464.—MANUFACTURE OF BROOMS.—Ezra P. Marble, Sutton Center, Mass.

111,465.—CARPET LINING.—John C. Mayall, Boston, Mass.

111,466.—BEE HIVE.—John Armstrong McAnulty, Gilpin, Pa.

111,467.—FRUIT DRYER.—John V. R. Miller, Richmond, Ind.

111,468.—SLIDING DOOR.—John More, New York city.

111,469.—COMBINED BAND CUTTER AND FEEDER FOR THRASHING MACHINES.—Samuel S. Myers and James McCauley, McAllisterville, Pa.

111,470.—MACHINE FOR MOLDING KNOBS.—Chas. H. Palmer, Brooklyn, E. D., N. Y.

111,471.—VAPOR BURNER.—Robert W. Park, Philadelphia, Pa.

111,472.—BORING AND MORTISING MACHINE.—Jacob Peters (assignor to Simon J. Stine), Lebanon, Pa.

111,473.—TRACE CARRIER.—Robert Porter, Ottumwa, Iowa.

111,474.—MACHINE FOR DRILLING AND TAPPING WATER AND GAS MAINS.—James Riley and Patrick Riley, New York city.

111,475.—FLUTING TONGS.—Jacob C. Robie, Binghamton, N. Y.

111,476.—APPARATUS FOR PRESERVING MILK.—Even Rönning, Broadhead, Wis.

111,477.—STREET-SWEEPING MACHINE.—E. A. G. Roulstone, Boston, Mass.

111,478.—METHOD OF FLANGING BOILER HEADS.—William B. Scaife, Pittsburgh, Pa.

111,479.—JOURNAL BOX.—John Schieder, New York city.

111,480.—CONCRETE BLOCKS FOR PAVING.—J. J. Schillinger, New York city.

111,481.—LAMP.—Hermann A. Schottky, Stapleton, and Theodore Simendinger, New York city.

111,482.—HARVESTER.—Jacobs W. Schuckers (assignor to to Isaac A. Sheppard), Philadelphia, Pa.

111,483.—HARVESTER REEL AND RAKE.—Wm. H. Seymour, Brockport, N. Y.

111,484.—WRINGING MACHINE.—Albert H. Spencer, Providence, R. I.

111,485.—BASE-BURNING STOVE.—Stephen Spoor, Phelps N. Y.

111,486.—MANUFACTURE OF ILLUMINATING GAS.—Ira N. Stanley, Brooklyn, N. Y.

111,487.—UMBRELLA.—Nicholas Starr, Homer, N. Y.

111,488.—ELECTRO-MAGNETIC SEWING MACHINE.—George Stevens and Joshua Hendy, San Francisco, Cal.

111,489.—GUARD CHAIN FOR BRACELETS.—George D. Stevens, New York city.

111,490.—CHURN.—William W. Stillwell, Oxford, Wis.

111,491.—CARRIAGE BODY.—Chauncey Thomas, Boston, Mass.

111,492.—VEHICLE.—Chauncey Thomas, Boston, Mass.

111,493.—STOVE GRATE.—Wm. S. Thomas, Kendallville, Ind.

111,494.—CHAIR.—Cyrus Tucker, Terre Haute, Ind.

111,495.—TRUSS.—Cornelius C. E. Van Alstine, New Haven, Conn.

111,496.—MACHINE FOR PREPARING WOOD PULP.—Michael Waissnix and Alois Waissnix, Reichenau, and Carl A. Specker, Vienna Austria.

111,497.—FLY EXTERMINATOR.—Amasa K. Walker, Hampden, Me.

111,498.—MODE OF LAYING PIPES ACROSS RIVERS.—John F. Ward, Jersey City, N. J.

111,499.—DOOR LOCK.—John Welsh, Canton, Ohio.

111,500.—REPEATING FIRE-ARM.—Luke Wheelock (assignor to the Winchester Repeating-arms Company), New Haven, Conn.

111,501.—BOLT REEL.—Benjamin C. White, Des Moines, Iowa

111,502.—HARNESS SADDLE TREE.—Philip H. Wiedersum New York city.

111,503.—MECHANICAL MOVEMENT.—Jacob Woolf, Burr Oak Mich.

111,504.—MANUFACTURE OF STEEL, STEELY IRON, AND HOMOGENEOUS OR CRYSTALLINE IRON.—James D. Whelpley and Jacob J Storer, Boston, Mass.

REISSUES.

4,242.—REFRIGERATOR.—Joseph H. Fisher, Chicago, Ill.—Patent No. 49,098, dated Aug. 1, 1865.

4,243.—RUBBER ROLL FOR CLOTHES WRINGERS.—James B. Forsyth, Boston, Mass.—Patent No. 59,798, dated November 20, 1866.

4,244.—MANUFACTURE OF INDIA-RUBBER ROLLERS.—James B. Forsyth, Boston, Mass.—Patent No. 59,580, dated November 13, 1866; reissue No. 2,589, dated May 7, 1867.

4,245.—THRASHING MACHINE.—Hugh Hanna, Pittsburgh, Pa.—Patent No. 84,546, dated December 1, 1868.

4,246.—REGISTERING TICKET PUNCH.—Austin D. Hoffman, Chicago, Ill., assignor, by mesne assignments, to James H. Small, Buffalo, N. Y.—Patent No. 100,036, dated February 22, 1870.

4,247.—Division A.—CENTRIFUGAL SUGAR-DRAINING MACHINE.—Hugh W. Lafferty and Robert Lafferty, Gloucester City N. J.—Patent No. 88,185, dated March 23, 1869.

4,248.—Division B.—CENTRIFUGAL SUGAR-DRAINING MACHINE.—Hugh W. Lafferty and Robert Lafferty, Gloucester City, N. J.—Patent No. 88,185, dated March 23, 1869.

4,249.—SHAWL.—Martin Landenberger, Philadelphia, Pa.—Design No. 4,233, dated July 19, 1870.

4,250.—SLIDING STOP VALVE.—Henry G. Ludlow, 2d, (assignor to Ludlow Valve-manufacturing Company), Troy, N. Y.—Patent No. 33,309, dated September 17, 1861.

4,251.—HARVESTER.—Henry Waterman, Williamsburgh, N. Y.—Patent No. 13,512, dated August 28, 1855; extended seven years.

DESIGNS.

4,613 and 4,614.—DESSERT SET.—Charles Casper (assignor to the Meriden Silver-plate Company), Meriden, Conn. Two patents.

4,615.—PLOW CLEVIS.—John M. Cook, Marion, Ind.

4,616.—SEWING MACHINE SAMPLE TRUNK.—Frederick S. Fahnestock, Chicago, Ill.

4,617.—CORSET.—David H. Fanning, Worcester, Mass.

4,618.—CASTER BOTTLE.—Joshua B. Graves, New York city.

4,619.—BOTTLE STAND.—Cyrus H. Latham and George D. Dudley (assignors to Woods, Sherwood & Latham), Lowell, Mass.

4,620.—SODA FOUNTAIN.—George F. Meacham, Newton, assignor to James W. Tufts, Medford, Mass.

4,621.—SUSPENDER LINK.—Edwin Oldfield, Norwich, Conn.

4,622.—THREAD AND NEEDLE CASE.—Theodore R. Timby Saratoga, N. Y.

TRADE-MARKS.

146.—MOLASSES GATE.—George S. Lincoln & Co., Hartford, Conn.

147.—MEN'S CLOTHING.—Edward T. Steel & Co., Philadelphia, Pa.

EXTENSIONS.

CULTIVATOR TEETH.—James P. Cramer, Schuylerville, N. Y.—Letters Patent No. 16,364, dated January 6, 1857.

MACHINE FOR FORMING HAT BODIES.—Ira Gill, Walpole, Mass.—Letters Patent No. 16,426, dated January 13, 1857.

MODE OF LATHING AND PLASTERING.—John G. Vaughan, Middleborough, Mass.—Letters Patent No. 16,425, dated January 13, 1857.

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SCIENTIFIC AMERICAN

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

Vol. XXIV.--No. 8. [NEW SERIES.] | NEW YORK, FEBRUARY 18, 1871. | $3 per Annum. [IN ADVANCE.]

Improved Water Grate and Steam Generator.

Water grates are not, by any means, a novel idea. It was seen long ago that if water could be introduced into the hollow bars used in grates, that it would not only prove a protection to the bars from the effects of heat, but would also render the grate a more or less effective heating appendage.

The invention delineated in the accompanying engraving, it is claimed, is much more effective than those which have preceded it, and testimonials from those who have employed the device in connection with the boilers of stationary engines and locomotives, certify to its durability, and also to large saving of fuel through its use.

It is claimed—and these claims are sustained by the testimonials referred to—that the economy of fuel secured is more than 15 per cent where the grate alone is used, and from 25 to 30 per cent when both the grate and generators are used together.

Fig. 1 is a perspective view of a boiler with the improvement attached, in which A is the grate and B the steam generators. A top view of the grate is shown in Fig. 2, portions being broken away to show the tubular form of the grate.

Water enters the grate through the pipes, C, Figs. 1 and 2, the direction of the flow being indicated by arrows, and finally emerges in the form of steam through the pipe, D, Fig. 1, which conveys it to the steam space of the boiler.

The generators, B, Fig. 1, are corrugated cast-iron boxes, having connection at the bottom with one end of the outside grate bars, and being connected at the top with the steam space of the boiler through the pipes, E. The generators have also rectangular openings, as shown, through which the heated gases of combustion pass, so that both sides become effective heating surfaces.

Blow-off cocks, F, are supplied to both the grate and the generators, by which the sediment may be removed as often as necessary.

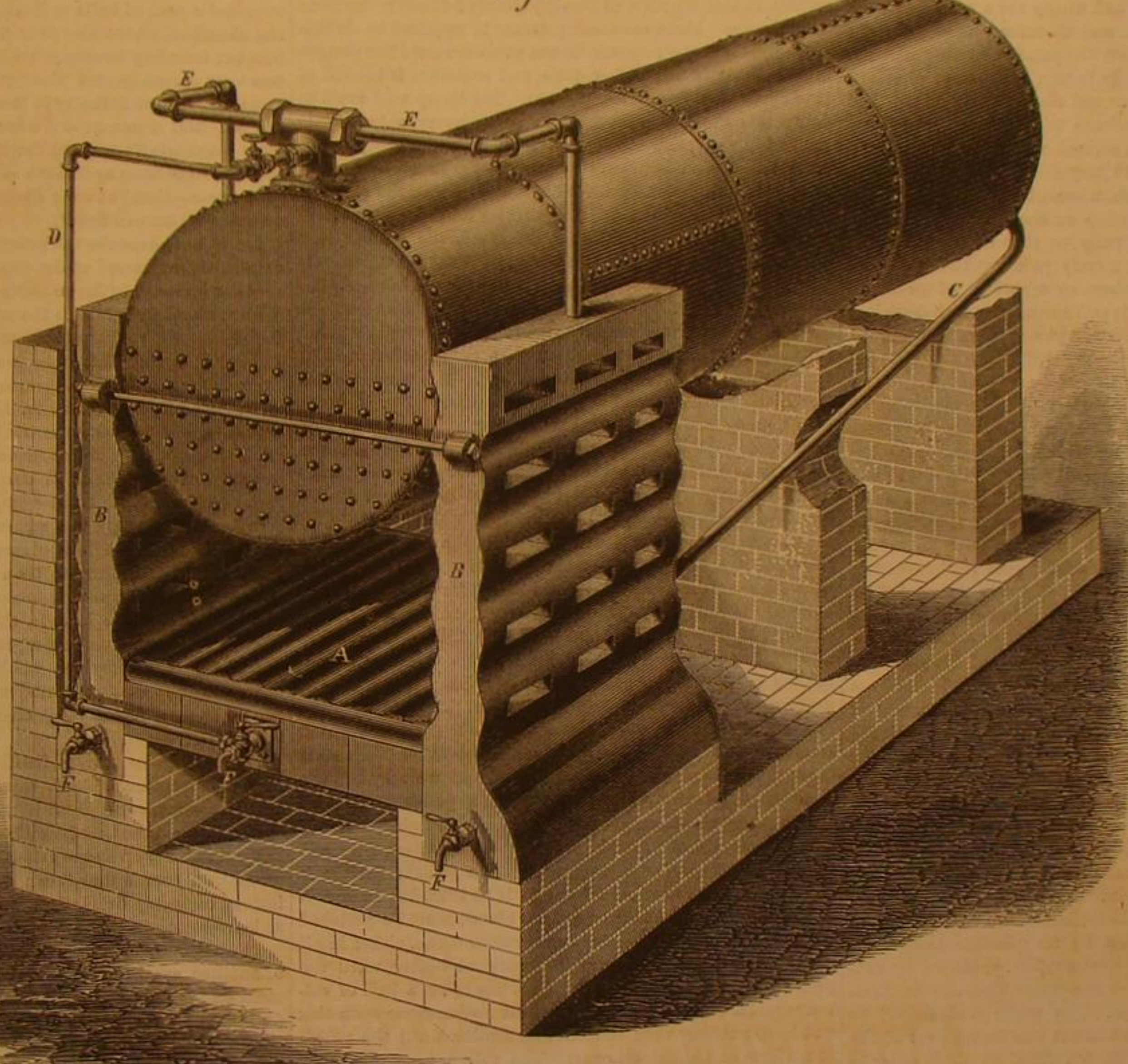
It is said that by making sections of the pipes, D and E, of glass, the circulation is shown to be perfect.

It is claimed that besides the durability and economy above mentioned as being secured by this construction, the following advantages are also attained, viz., increased heating surface; impossibility of cracking by expansion, as the grate and generators are only attached to the boiler by the pipes: the grate being fed from the bottom of the boiler, receives water constantly, as fast as the external heat converts the water into steam: also the grate is always kept so cool that no clinkers can adhere to its surface.

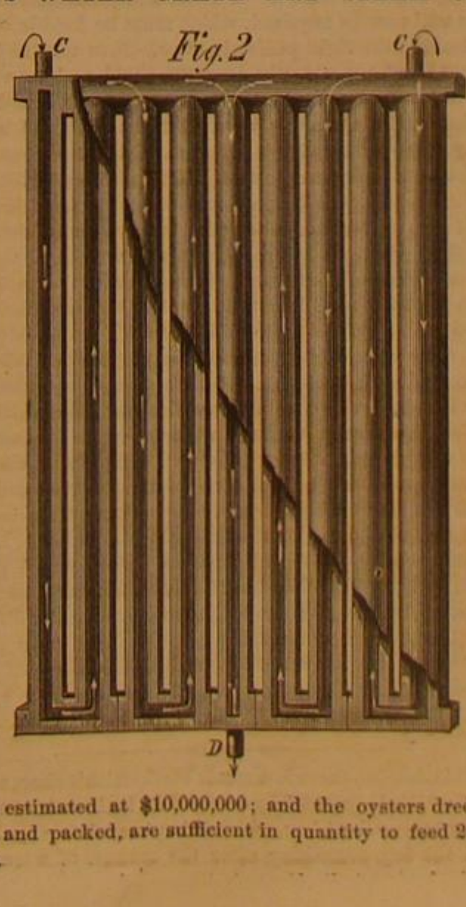
The grate is cast by a peculiar method which secures uniformity of thickness. The generators are also cast in single piece, and their use obviates the necessity of fire-bricks.

The patent on the water grate bears date Nov. 19, 1867, and that on the steam generator is dated March 24, 1868. Portions or the whole of these patents will be sold. For further information address R. L. Walker & Co., Globe Village, Mass.

Fig. 1



WALKER & CO.'S WATER GRATE AND STEAM GENERATOR.



THE BALTIMORE OYSTER INDUSTRY.—In no country in the world is the oyster so popular an article of food as in ours; and our large inland states and territories are populated with men of like passions with ourselves of the seaboard States. What wonder, then, that the packing of this most nutritious of shell fish is a large and important industry, indeed one of the largest, in Baltimore? The oyster beds are chiefly in the Chesapeake river and its tributaries, and the annual crop is about 25,000,000 bushels, taken from beds covering 3,000 acres. The capital employed in the canning and preserving trade is estimated at $10,000,000; and the oysters dredged, canned, and packed, are sufficient in quantity to feed 20,000 persons.

How Eyes are Made.

"What do we think of this fellow?" asks the oculist of his client. "Study his features, his look, and say frankly what you think." "He looks well enough," answers the other, laboring usually under some little emotion. "Well, Jean, reveal your secret to this gentleman." Whereupon Jean introduces a knitting needle under his eyelid, removes his eye, places it in the hand of the astonished spectator as unconcernedly as though it were a shirt stud. How is it possible to resist such a demonstration? These gentlemen charge from forty to fifty francs for an eye. The manufacturer of the Rue du Temple has an entirely different way of doing business. He is generally a man pretty well informed; simple, polite, a little of an artist, a little of a workman, and a little of a tradesman. He scarcely employs either apprentice or assistant, except when he receives a good order from some naturalist for animals' eyes for his collection. All day long, seated at a table at one end of his workroom, he works by the light of a spirit lamp. Before him are arranged, in either cakes or sticks, the materials used by him in his profession. He takes a little enamel, melts it, and, by the aid of a blow-pipe, blows it until it becomes a small ball at the end of the instrument. This ball is destined to represent the white of the eye. He next takes some more enamel, which is colored this time, and lets a drop of it fall upon the summit of the *cornea*.

Gently heating it at the flame, it spreads out in a round spot, and eventually becomes flat, and resembles the iris. A darker drop of enamel placed in the same manner in the center of the iris imitates the pupil. The ball is now detached from the blow-pipe, cut to an oval shape, and smoothed at the edges, so that on introducing it beneath the eyelid it may not wound any of the smaller nerves. These eyes cost no more than from twenty to twenty-five francs, which one can quite comprehend, as there is neither heavy rent to pay, nor the wages of a liveried cyclops.

The manufacture of artificial eyes is both difficult and tedious. It suits alike both men and women, and many of the latter succeed well in it; it is, moreover, one of the best remunerated of art industries. Most of the work-people are paid by piece-work; that is, so much per eye, varying from ten to fifteen francs, and a clever workman will turn out his eye per diem. Others receive from the large manufacturers a share of the proceeds arising from the sales of eyes manufactured by them, and have to take back any eyes not approved of by the customers. These they put on one side to serve for their stock in trade when they commence business on their own account.

One of these collections furnishes a somewhat curious sight. Reposing upon wadding at the bottom of a drawer are several scores of eyes, ranged side by side, and exhibiting a singular variety of expression. Some are small, others large; some black, others blue, hazel brown, light brown, bluish, and greenish gray: nearly all are brilliant; all have a fixed stare—all are, in fact, looking you through. On one side are laughing children's eyes, next to them the liquid-looking eyes of young girls, the languid eyes of middle-aged women, eyes with an amiable or sinister expression, severe official eyes; then come the old men's eyes, slightly filmy; and in a corner are the worn-out eyes—eyes that have been already used, and have been returned by the customers as models to make other eyes by. The enamel eye, after being exposed to the action of the atmosphere for some months, loses alike its color and its luster, and becomes opaque-looking; a thick, dingy coating of solidified humors spreads over its polished surface, and it has a glassy look, like the eye of a dead person. "Touch them, you will do no harm," says the oculist to visitors, just as though it was a collection of coins or minerals they were inspecting.

ENAMELING WOOD WORK.

[From The Building News.]

We have very considerable doubts as to whether polished paint may be considered in good taste when used for the interiors of drawing rooms, or, in fact, of any room. There is a want of repose, and a garishness about gloss colors, which are scarcely compatible with that quietness and repose so necessary to the perfect satisfaction of the educated eye. Polished glass is beautiful, and never out of place; the same may be said of marble, of gems, and of all steel work or instruments. With all these, polish is the one thing needful to develope their beauty and finish, and, in fact, is a necessity of the material. This is so self-evident that we never for a moment doubt its propriety or imagine it would be better otherwise. Fitness, beauty, and utility are a consequence of the polish in all these cases, and therefor proper and right from every point of view; but the same reasoning will not apply to polished paint, that is to say, plain tints of colors. Of course, imitations of woods and marbles may be polished with propriety and without offense to good taste, simply because we expect to see them so, and they would not be finished if left unvarnished and unpolished. But it is otherwise with plain colors, which, when glossy, have too much the look of the japanner's shop or the tea tray business. These remarks apply principally to that so-called enamel work which is produced by merely painting the work and finishing it with varnish, when, as a matter of course, it very soon becomes discolored; and even when first done it is a mistake in name and execution, and a gross offense against good taste. The best enamel work—of which there is but little done in consequence of its great cost—is free, in some measure, from the objections urged against the common work. Its manipulation requires so much patience and care that it is a very difficult matter to find men who have the qualifications requisite for preparing such fine work, and therefore it is very rare to see a really good job. In getting up enamel work, much care is requisite in the selection and use of the material required. The filling-up color, which forms the body of the enamel, is of the greatest importance to the ultimate success of the work. Of this material there are several kinds manufactured—black, brown, and yellow, for coach painters, japanners, and others; but for use in interior decoration we prefer to use the white lead filling, as we can, by adding the necessary staining colors (which do not affect the properties of the enamel), form a solid body of color of the same tint, or nearly so, as that with which the work is required to be finished, and thus do away with the objections which may be urged against the black or dark-colored filling. For it will be evident to the plainest comprehension that if work which has to be finished white, or with very light tints of color, be filled-up with dark-colored filling, that the number of coats of paint which will be required to obscure or kill the dark color will be so many that there will be danger of the work becoming rough and uneven in parts—at all events there can be no question that work which is left with a smooth, even surface, produced by rubbing alone, must be much finer in texture than any that can possibly be left by the brush. The white lead should be ground stiff in turpentine, and about one fourth part of the ordinary white lead, ground in oil, added to it, in order to prevent the enamel cracking, which it has a tendency to do, except there be some little oil mixed with it. A sufficient quantity of polishing copal or best carriage varnish should now be added to bind it so that it will rub down easily, which fact cannot be properly ascertained except by actual trial, inasmuch as the drying properties of varnishes vary, and other causes influence the matter. If there be too much varnish in the stuff the work will be exceedingly difficult to cut down, and if too little, it is apt to break up in rubbing, so that it is always the safest plan to try the enamel color before commencing anything important. The color, being properly mixed, should be laid on the work in the ordinary manner, using it rather freely. It may be as well to state here that no filling should be put upon new work without the same having had two or three coats of ordinary oil paint, nor on old work without its having one coat. This gives a key for the filling to bind to. Successive coats of the filling should now be laid on the work until there is a sufficient thickness to cut down to a level surface, filling up the whole of the indentations and undulations of the panel. One day should intervene between each coat, in order to allow it to harden in some degree. When a sufficient number of coats is put on (which number will, of course, depend upon the state of the work to be filled up), it should stand for a fortnight or three weeks, until it is thoroughly hard; it will then be ready for cutting down, which is to be done with felt, ground pumice-stone, and water. The felt used should be such as the marble masons use for polishing marble, which varies in thickness from one eighth to half an inch, and about three inches square. This should be fastened by the aid of patent knotting or other resinous gum, to square pieces of wood of the same size, but one inch thick, so as to give a good hold for the hand in using. These pieces of wood, covered with felt, may be made of any size or shape, to fit molded surfaces or other inequalities. The pumice-stone to be used should be of different degrees of fineness, and should be carefully selected, so as to be sure that it is free from any foreign substance. It is sold ready ground, but in situations where it cannot be conveniently got, it may be prepared from the lump, by grinding or crushing with a stone and muller, and then passed through fine sieves or muslin; by using these of different degrees of texture the ground pumice may be produced of different degrees of fineness. Except great care be exercised in this matter, it will be found that particles of grit will be mixed with it, which in using, get on to the work, and make deep scratches, thus causing endless trouble and annoyance, besides spoiling the work. The greatest care is also required in keeping the felt clean and free from grit. Many workmen are careless in this matter, and when working set down the felt on the step-ladder or floor, and thus particles of sand or grit get upon it, and so mischief is done.

In cutting down, it is best to use a piece of soft lump pumice stone to take off the rough parts. The felt and ground pumice should now be used with water, the work should be wet with a sponge, and the felt soaked in water, and then into the powdered pumice, and the work rubbed with it, keeping it moderately wet, and rubbing with a circular motion, and not straight up and down and across, with a light touch, using only just as much pressure as will cause the pumice to bite, which will be very clearly felt while the hand is in motion. Much care and patience is required to do this properly, for if the pressure be too great it forces the pumice into the body of the filling color, and scratches it instead of cutting or grinding it fairly down. No hurry will avail in doing this work, it must have its time; hurry only defeats the end in view, and often causes much unnecessary labor. A scratch, caused by want of care and too much haste, will often throw the work back for days, and involve the cost and labor of refilling. We find in practice that the purpose is best answered by using the pumice stone, the coarser kind first, then the medium, and finishing with the finest last. It will be found advantageous to let a day elapse between the rubbing, for when the surface is cut down the filling will in all cases be softer underneath, and if it be allowed to stand for a day, the newly exposed surface gets harder, and of course rubs down better in consequence. The pumice stone should be well washed off the work occasionally, in order that we may see what progress is being made, and if it require more rubbing or not. If, while in progress, it be found not to be sufficiently filled up, it may have one or more coats of filling after it has been roughly cut down, and before much labor has been spent upon it.

When sufficiently rubbed down with the pumice stone—that is to say, when it has been cut down to a fine, level, and uniform surface, the work should stand for a day or two to harden. It will now depend entirely upon the work, as to whether it must be polished upon the filling, or whether it will have to be varnished and polished. If the filling be of the right color, and has rubbed down of one uniform tint, we prefer it to be finished in this state, because, in the first place, it will have a surface and texture which cannot be got by any other means. Finished in this state there is an absence of that glare-polish—if we may use the term—which is inseparable from varnish polish. It has all the uniformity of surface and evidence of finish, without that appearance of varnish which is so objectionable, and therefore we prefer it to any varnish polish. After it has stood a day or two, the work, if it be intended to be left in the state we have been speaking about, must be polished in this wise: Take a clean felt and rotten stone, either in oil or water, and with this rub the work as before, until the polish begins to appear; then take a boss (*i. e.* a ball of cotton wool inclosed in fine silk), put the rotten stone upon this and keep rubbing with the circular motion until the polish is uniform and equal all over. The rotten stone must now be carefully cleaned off; if it be in oil, clean off with fine flour; if in water, with sponge and wash leather and water, taking care not to scratch. A clean damp chamois or wash leather will now be required, which must be held in the left hand, leaving the right perfectly clear. Now use the ball of the right hand, press gently upon the panel, and draw it forwards or towards you. If this be done properly, it will bring up a clear polish upon the work. The hand should be kept slightly damp by drawing it across the leather almost every time the hand is drawn forward. If this be done effectually, a rustling sound will be produced while the hand is in motion; if this be so, the polish will be sure to follow. The polish thus produced on the filling alone will be of the kind we have spoken of above, and will not be at all objectionable to even the most fastidious taste; but if the work has to be finished with a brilliant luster and to a high degree of polish, it will, after being cut down with the pumice and felt, have to be coated with two or more coats of the best polishing copal varnish, having a quantity of the best flake white from the tube; this should be mixed with the varnish in sufficient quantity to form a creamy mixture, with which the work must be coated—one, two, or three coats, as may be desirable. This should stand for three or four weeks, until it becomes hard, for the harder it is, the better it will polish. It must then be cut down with felt and the finest ground pumice stone in water, and polished with the rotten stone, as before described. By this means a bright and brilliant polish may be obtained, of a very enduring nature. The same process will of course answer for all varnished imitations of woods and marbles, and all work which will admit of the application of oil varnishes.

IN Philadelphia there is a small blacksmith's shop, the bellows of which is operated by dogs. The bellows is connected with a wooden wheel box, which is kept revolving by the motion of the dog, something after the manner of a treadmill.

Birmingham Bell-Making.

In medieval times it was accounted a less difficult matter to cast a church bell than to convey it any long distance from the foundery to the steeple; and it was a common practice to cast these cumbrous articles in the immediate neighborhood of the church or cathedral in which they were intended to be hung. So late, indeed, as the year 1762, the great clock bell at Canterbury was re-cast in the cathedral yard. The early bell-founders were consequently an itinerant fraternity, roving through the length and breadth of the country, but seldom failing to pitch their tent in or near some cathedral town. That they were well skilled in their craft the Sunday chimes in many an antique temple bear ample witness, and a leading bell-founder of the present day does them the justice to remark: "One law of nature, indeed, they were acquainted with, which modern bell-founders in too many cases ignore—that a given weight of bell metal can only sound a very narrow range of notes with good effect, and that if bells are cast thinner to produce deeper notes, the quality of tone must suffer."

The commencement of bell founding as a staple of Birmingham industry appears to have dated from the middle of the last century. It is at least recorded in the local annals that "a foundery opposite the Swan at Good Knaves' End" supplied a peal of bells to Harborne and two other neighboring churches, about the year 1760. "Chimes" were cast at another foundery twenty years later, but from that time down to a very recent period the production of church bells became an obsolete industry in the "hardware village." Within the last half dozen years, however, Messrs. Blews and Sons have successfully revived the trade, and Birmingham bells promise to become as famous in the future as they have been in the past—thanks to the liberal and progressive enterprise of this well known firm.

Let us now describe the process of casting a peal of bells, as recently witnessed at the establishment referred to. The peal comprised six large bells for a church in New South Wales, which were cast in the same pit with three other bells for Mexico, the weight of the entire casting being about three and a half tuns. Bell metal is compounded of three parts of copper to one of tin, this proportion giving the greatest density of metal. Mr. Blews is, however, of opinion that the true chemical combination would be six atoms of copper to one in tin, or in weight three and one fourth to one. A less quantity of metal than is due to the caliber of the bell, though giving the same note, produces a meager, harsh sound; consequently, the superior dignity of tone in some old bells is ascribed to a greater weight of metal being allowed for the same note than would accord with modern ideas of economic production. Four tuns of bell metal is seething at a white heat in the furnace when the process of casting commences. At a given signal, an aperture at the end of the furnace, which had been stopped with fire clay, is opened by a workman armed with a long tamping bar, and the white fluid flows along channels of sand to the pit containing the molds.

There are two ways, Mr. Blew tells us, of making bell molds. The core in both cases is made of a brickwork or cast-iron cone, covered with molding clay, "swept" into the shape of the interior of the bell by a wooden "crook" fixed to a spindle set up in the middle of the core. The advantage of an iron core is that it can be lifted into a furnace to dry, instead of being dried by the application of internal heat, as is necessary in the case of the brickwork core.

The old method is to make a clay bell on the core by means of another crook, and when this is dry, to make the outside mold on the top of it. This mold has hair and hay bands, or (in large castings) bands of iron intersected to make it hold together, and lift off when dry. The clay bell is then knocked to pieces, the mold dropped down again over the core, and weighted with earth in the pit in which the bell is cast. The metal is then poured in at one hole at the top, another aperture being left for the escape of air. In the newer process no clay bell is made. The mold is an iron case lined with clay, and swept out internally to the outside shape of the bell. The "wires," or ornamental rings round the bell, are made in both cases by the second sweep, the letters and devices being stamped in the soft clay. These iron copes can be bolted down to a plate under the core, and need not, therefore, be sunk so deep in the ground, if sufficient care be taken to get an adequate "head" of metal above the bell, which is a very essential consideration. The process of casting in the case under review occupied about ten minutes, but a couple of days at the least would be required for cooling. The tenor bell of the peal for New South Wales had a happily chosen legend: "We sing the Lord's song in a strange land."

Church, school, plantation, factory, and ship bells, still closely adhere to the medieval type, and they vary in weight from fifty-six pounds upward. Other descriptions of bells are made very largely in Birmingham, by a goodly number of bell founders. Railway and dinner bells, from four to seven inches wide at the mouth, with wooden handles attached, musical hand bells for village ringing clubs, cattle, horse and sheep bells, with the ordinary house bells, are among the principal varieties, and the number produced is simply prodigious.

Some curiosities in bells are reported by the manufacturers, of which a few may be briefly noticed. Tiny house bells, $\frac{5}{8}$ in. to $1\frac{1}{2}$ in., are largely made for the African market, where they are used for purposes of barter. Sleigh, dray, and caparison bells—which are small circular articles, with an iron ball cast inside—are extensively produced for Canada and the East India market. An order was not long since executed for 10,000 green, bronzed, and lacquered house bells, which now adorn the iron palace of a West African prince.

Another potentate of ebony hue ordered a number of polished ship bells in elegant brass frames, and mounted on mahogany stands, engraved with the assumed name of the sable prince, "Yellow Duke, Esq." The number of workpeople directly engaged in this branch of Birmingham industry, is estimated at about two hundred and fifty, and the increasing use of bells, both for outdoor and indoor purposes, promises to augment the number at no distant date.—*Mechanics' Magazine.*

A NEW STONE.

Architects have for some years past been indebted to Mr. Frederick Ransome for providing them with a constructive material of very great value, a stone which can be molded into any form, which can be produced in blocks of any size, and which, when made, is as durable as the best kind of natural stone known. The production of this material—the "patent concrete stone" as it is termed by Mr. Ransome—was the result of many years of persevering labor and struggles against difficulties; but we now find that Mr. Ransome, not content with what he had already accomplished, has succeeded in producing another new stone, which is in many respects as superior to its predecessor as the latter was to all other artificial stones produced before or since.

Before describing the process by which this new stone is made, it may be desirable that we should recall to the minds of our readers the method of manufacturing the artificial stone generally known by Mr. Ransome's name, as this will enable us to speak of the steps which led to the production of the new material. The ordinary "Ransome stone," then, is composed of particles of sand, mixed, in some cases, with a little ground carbonate of lime, the whole being incorporated into a solid mass by the formation in the interstices of a silicate of lime. After many fruitless searches after a method of procuring silicate of soda on a commercial scale, and at a moderate cost, Mr. Ransome hit upon the plan of boiling flints in a solution of caustic soda *under steam pressure*, and it is the silicate of soda thus obtained that Mr. Ransome employs to bring the materials we have mentioned into a plastic state, in which they can be molded to any desired form. This being done, the block produced is treated with a solution of chloride of calcium, when a double decomposition takes place, the silicic acid and the oxygen of the silicate of soda combining with the calcium of the chloride of calcium, and thus forming silicate of lime, while the sodium unites with the chlorine of the chloride of calcium, thus forming chloride of sodium. The silicate of lime produced in this way unites the particles of sand, etc., into a hard and perfectly durable mass, while the chloride of calcium remains diffused throughout the block, and has to be removed by washing.

Now, regarded from a manufacturing point of view, this washing process is rather a nuisance, particularly where large blocks are being made. If performed thoroughly, it occupies very considerable time, and, consequently, delays the turning out of the work; while, if not performed properly, there eventually takes place a greater or less efflorescence of the chloride of sodium, which, although not affecting the strength or durability of the stone, spoils its appearance. Under these circumstances, Mr. Ransome was led to endeavor to so modify his process as to render this final washing unnecessary, or, at all events, to reduce its amount, and, step by step, he arrived at the new method of manufacture, which we shall now describe. In carrying out these new plans, Mr. Ransome makes a mixture of certain proportions of ordinary sand, Portland cement, ground carbonate of lime, and some silica, readily soluble in caustic soda at ordinary temperatures, such, for instance, as the stone found in the neighborhood of Farnham and other places, and these materials he makes into a plastic mass by the addition of the silicate of soda already mentioned. The mass thus formed remains plastic a sufficient length of time to allow of its being rammed readily into molds of any desired form; but it gradually hardens, and ultimately becomes thoroughly indurated, and converted without any further treatment, into a hard stone, capable of resisting heat and cold, perfectly impermeable to moisture, and which, as far as can be judged from the experience hitherto obtained, goes on increasing in hardness, and bids fair to be thoroughly durable.

The chemical actions by which this wonderful result is produced are very curious, and Mr. Ransome's explanation of them is as follows: The Portland cement consists, as is well known, of silicate of alumina and lime; and when the materials are mixed up with the silicate of soda, the latter is decomposed, the silicic acid combining with the lime of the Portland cement, and forming silicate of lime and alumina, while caustic soda is set free. This caustic soda, however, immediately seizes upon the soluble silica, which constitutes one of the ingredients, and thus forms a fresh supply of silicate of soda, which is in its turn decomposed by a further quantity of the lime in the Portland cement, and so on. If each decomposition of silicate of soda resulted in the setting free of the whole of the caustic soda, the processes we have mentioned would go on as long as there was any soluble silica present with which the caustic soda could combine, or until there ceased to be any uncombined lime to decompose the silicate of soda produced, the termination of the action being marked by the presence in the pores of the stone of the excess of caustic soda in the one case, or of silicate of soda in the other. In reality, however, the whole of the caustic soda does not appear to be set free each time the silicate of soda is decomposed by the lime, there appearing to be formed a compound silicate of lime and soda, a small portion of the latter being fixed at each decomposition. The result thus is that the caustic soda is gradually all fixed, and none remains to be removed by washing or other process.

By his new process Mr. Ransome is enabled to produce admirable artificial marbles, while, by introducing amongst the materials fragments of quartz and a small proportion of oxide of iron, he obtains a stone of rich color, and hardly distinguishable from Peterhead granite. Like the natural granites and marbles, the artificial substitutes are capable of taking an excellent polish, while they possess the great advantage over the natural products of being capable of being molded in the course of manufacture into any form at a trifling cost. It would be idle for us to attempt here to enumerate the uses to which the new stone can be applied, for they are practically numberless. For decorative purposes it will be invaluable, and Mr. Ransome deserves the best thanks of architects, and we may add, of engineers, also, for having furnished them with a new constructive material at once so cheap and good.—*Engineering.*

Boiler Explosions.

The explosion of a steam boiler is *primâ facie* evidence of carelessness in its construction, or in its maintenance, or in its use. It is so regarded by the engineers, and ought so to be regarded by the law. It will be easy to convince any one who will examine the records of boiler explosions and inquire into the means of preventing them, that no injustice would be done to the owners of boilers by indicting them for criminal carelessness in all cases of explosion.

The history of boiler explosions is authentic and definite. The boiler has usually been erected under the full light of modern science. All the attending circumstances of the explosion have been immediately communicated to the public; curiosity has aided science in making every man an investigator of these circumstances and a searcher after causes; public and private commissions have been appointed to examine the subject generally; numerous legal tribunals have gone to the bottom of special cases, and innumerable private professional observers have witnessed results, searched records, weighed evidence, and arrived at general conclusions. All the plausible theories of explosions have been not only looked into, but worked out, in many cases, experimentally or theoretically, to their ultimate limits.

Now the remarkable and unprecedented result of all this investigation is, not the division of any large body of experts into schools; not the building up of rival theories, but the universal conviction of all concerned, that boiler explosions are certainly in most, and probably in all cases, the result of malconstruction or maltreatment, and of nothing else, and that the usual immediate cause is the unchecked deterioration of the boiler in service. In the great majority of cases the evidences of carelessness are as plain as the time of day on the face of a clock—a sheet furrowed nearly through; a stay bolt rusted off; a crown-sheet insufficiently supported; expansion and contraction unprovided for; water connections stopped up; bad material—some one of the many obvious and certain conditions of rupture. In a few cases the immediate causes are not apparent, and then the electricity theorists, and the gas people, and the mystery men fight over the remains in the newspapers; and the only reason why simple neglect is not discovered to be the cause, is that the parts of the boiler which would otherwise reveal it, are blown away, or are too much mutilated or obstructed to be legible. Simple bad treatment by the maker or user will account for the original rupture which ends in any explosion, however terrific may be its effects. There is force enough restrained within every steam boiler running to-day to perform the most terrible work of ruin that any similar boiler ever performed in exploding. When this force is once released, the amount of destruction depends on the point of rupture, the resistance, the surroundings, and on an infinite number of circumstances, mostly outside of our control. The only thing we can do, and it is enough, is to keep the resistance superior to the normal pressure.

Now that the causes of boiler explosions are so well understood as to be a matter of commercial calculation—where companies make money by insuring such boilers as are constructed and maintained according to established professional rules—it is to be regretted that the Government should stand helplessly by, and see scores of people scalded to death every few weeks, for the want of an adequate law and a system of inspection. Boiler insurance and inspection companies—and they are no new or experimental thing—simply prove that boilers constructed and maintained according to certain well known rules, are practically safe; that the chances of explosion, even with ordinary water-tending, are very remote, and they stake their money on this knowledge; and yet the United States Government has been unable to even check the increase of these disasters. If Congress cannot at once provide for the security of the public against boiler explosions, it had better let out the job of protecting its citizens to some insurance company, and then it will be done on scientific principles, and by competent men.—*N. Y. Times.*

The Domestic Silk Trade.

The interruption to the Lyons silk manufactories, naturally resulting from the Franco-Prussian war, has proved, according to the *Chicago Bureau*, of very material benefit to the producers of silk fabrics in this country. The sales of the principal makes of American silks have, we are informed, increased fully 100 per cent since the outbreak of the foreign war. Our manufacturers were competing successfully with foreigners in the production of colored silks, while the trade, though taking all the black goods manufactured here, manifested a decided preference for those of foreign make. The war has had the effect of increasing the demand for both black and colored domestic silks, though this is more noticeable in the former. Another result of the foreign disturbances—a result equally gratifying and unexpected—is the decline in the price of American goods. It seemed natural to believe, at the beginning of the war, that the inevitable result would be an advance in prices, consequent upon the increased demand and in sympathy with a rise in foreign goods. This, however, has not been the fact. Our manufacturers, like their Lyons competitors, always depended chiefly upon Italy and France for their raw silk, the California production not having become sufficiently well developed to furnish a supply anything like adequate to their demands. Now that the Lyons manufacturers are forced, by reason of the war, to suspend operations to a great extent, the Italian and French growers, especially the former, are looking to America for buyers of their staple, and finding our dealers ready to buy for cash, their desire to realize quickly induces them to make liberal concessions from current prices, which are, in fact, no higher than before the war. To this we owe—what must have been remarked by every silk buyer—the fact that American silks are now selling at lower prices than when brought into more active competition with the products of the principal silk-manufacturing districts of the world.

Extract from the Diary of Isambard Kingdom Brunel, in 1835.

53 Parliament street, Dec. 20.

What a blank in my journal (the last entry is dated January, 1834), and during the most eventful part of my life! When last I wrote in this book I was just emerging from obscurity. I had been toiling most unprofitably at numerous things: unprofitably, at least, at the moment. The railway was certainly being thought of, but still being uncertain. What a change! The railway is now in progress. I am the engineer to the finest work in England. A handsome salary, on excellent terms with my directors, and all going smoothly. But what a fight we have had, and how near defeat, and what a ruinous defeat it would have been! It is like looking back upon a fearful pass; but we have succeeded.

And it is not this alone, but everything I have been engaged in has been successful. Clifton Bridge, my first child, my darling, is actually going on; recommenced work last Monday—glorious!! [Here follows a list of the undertakings in which he was then engaged.] I think this forms a pretty list of real sound professional work, unsought for on my part, that is, given to me fairly by the respective parties—all, except the Wear Docks, resulting from the Clifton Bridge, which I fought hard for, and gained only by persevering struggles. . . . And this at the age of twenty-nine. I really can hardly believe it when I think of it. I am just leaving 53 Parliament street, where I may say I have just made my fortune, or rather the foundation of it, and I have taken 18 Duke street.

Remarkable Cave in Thomas County, Georgia.

We find the following interesting account in the Thomasville *Enterprise*:

Near the line of Brooks and Thomas counties, there has long been known an opening or cave in the earth, called "Devil's Hopper." Many persons residing in the neighborhood had visited it, but not one of these attempted a real exploration. We have before us, however, a letter written two months ago by a young gentleman in this city, to his father, describing an exploration of this cave by himself and a physician friend of his, residing in Boston. The writer says it was the most beautiful place he ever saw in his life, and he would not have missed seeing it on any account. He says that, after creeping through a narrow entrance at the surface, they descended to the depth of two hundred feet, winding about in the narrow path walled with solid flint rock, until they came to a well, which they descended by means of a rope, and found it to be forty-five feet deep, without water. At the bottom of this well they found the narrow passage leading off from the first, in a tortuous course, still walled with flint rock; they continued to follow it, and at some distance from the wall entered a large room or hall, walled with the same impenetrable flint rock, but jagged and pointed in a thousand fantastic shapes. The writer declares his inability to describe the grandeur and beauty of this hall by torchlight, but says he found himself in a large room walled with flint rock so jagged that a fall against it would cut one to pieces, and beautifully hung with stalactites that reflected the light in a thousand forms and sparkled with diamond brilliancy in the nooks and corners of the hall.

Manufacture of Glycerin in Cincinnati.

In Cincinnati, two million hogs are annually slaughtered for pork, bacon, and lard. The average weight of the heavier animals is 400 pounds. In former years, the chief attention was bestowed upon the manufacture of stearin candles and soap grease, in addition to salting and smoking meats, but latterly, since the demand for glycerin has called it into notice, more attention has been given to its preservation. For this purpose the lard is treated with water at 662° to 720° Fah., by which the glycerin is separated from the fatty acids, and freed from the disagreeable odor that characterizes glycerin made in the process of soap manufacture. Two or three large establishments manufacture annually 500,000 pounds, valued at $200,000 for the crude article. As there is an average of one hog to each individual in the United States (nothing personal intended), the forty million porkers can supply us with all the glycerin we are likely to want for an unlimited amount of artificial champagne, doctored cider, and rectified beer, not to speak of sirups and candy.

The Public Printing Office, in Washington, is to be connected with the Capitol, by telegraph, and a pneumatic tube is talked of for carrying messages, proofs, etc.

EXERCISING CLUB.

This club, invented by John L. Dibble, of New York city, consists of a hollow metallic cylindrical shell, as shown in the annexed engraving. In the interior of the shell there is arranged a system of adjustable cylindrical sliding weights, by which the muscular exertion necessary to handle the clubs, may be increased or diminished to suit the power of endurance of the exerciser. Such clubs can be used by per-

sons varying greatly in muscular strength, as by placing the weights near the hand, the power necessary to manipulate the clubs in the usual manner is much lessened, and *vice versa*. Patented in May, 1867.

THE PRESENT AND THE PAST.

NUMBER IV.

Fierce have been the contests waged among scientific men in their well-meant endeavors to assign true causes to natural phenomena. In these, as in other controversies, one side must be, on some points at least, in the wrong; while, as frequently happens, neither may be altogether in the right; and such errors, supported by great authorities, argued with surprising one-sidedness and prejudice, and too frequently interlarded with disgraceful personalities, would necessarily, it might seem, retard the advance of science. The evil, however, is most frequently brought about by too hasty generalizations upon insufficient data, and fortunately, sooner or later, corrects itself; and the accurate investigations and cautious experiments, and the acute and exhaustive criticisms, that the very acrimony of the contest calls forth, effectually winnow the truth from the falsehood, and determine the former sooner and upon a firmer basis than might otherwise have been done.

Several such contests are at the present day in progress, and notably one regarding the mode of origin of valleys. Lyell, who was very largely indebted for the groundwork of his great work, the "Principles of Geology," to Playfair's "Illustrations of Hutton," on this point discarded the older opinion that valleys were the result of atmospheric destruction and of river erosion, and substituted a theory of his own, that they were largely due to the action of the sea, operating on lines of faults, prior to the emergence of the land from its waters.

Of late years, this submarine theory has been violently attacked by many British geologists, and as energetically defended by others. The "sub-ærials" have, however, had decidedly the best of the argument; it is in vain that the "submarines" point to inland escarpments, as ancient sea-cliffs, and to many other phenomena that seem to support their cause; general principles are against them, and the logic of their own favorite facts is turned upon them.

The action of breakers does not extend to any great depth beneath the surface of the ocean, even in the heaviest gales, and all their work tends to straighten coast lines and to make even plains, and not to indent the shore or to excavate deep valleys in the bed of the sea.

Lay off upon paper a section of a sea bed as marked by soundings in its true proportions, and you will be astonished to find that the elevations and depressions of its surface are scarcely noticeable, save in very exceptional instances, and even these prove the rule; for if we find a mountain on the sea bed, it is a mass which the waves have not had time to remove, and a hollow is a pre-existing valley that they have not had time to fill up. The sea rough-hews the block and squares it off, but it is atmospheric agency and its consequents, running water and moving ice, that carve anew all the details upon the upheaved and dry land surfaces. Perhaps nowhere on the earth are such convincing proofs given of this truth, as on this continent, on either side of the Rocky Mountains.

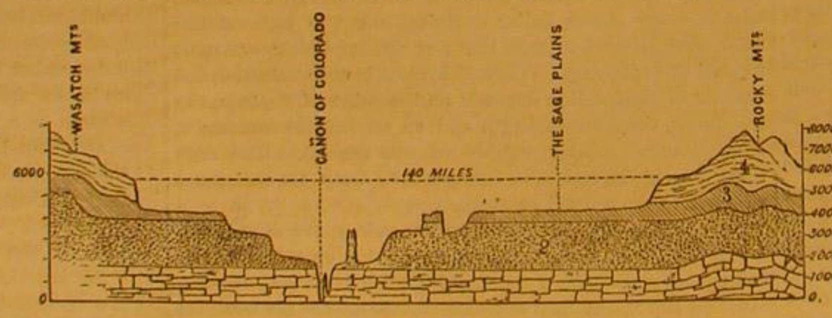
Let us confine ourselves to a few remarks upon only one district, and we shall not only elucidate this point but shall also enable the reader to recognize more clearly than ever the wondrous results that are achieved by the air, the rain, drop, the rill, and the river.

The great region of the Colorado of the West and its tributaries has not been beneath the ocean since the latter laid down the cretaceous deposit; that is, it has, during the entire tertiary period, been subjected to atmospheric agencies of destruction; and if we study out the lesson afforded by the accompanying diagramatic section, given us by Dr. J. S. Newbern, the well-known geologist, of a part of this region which he explored, we may well pause astonished at the conclusions to which it points. On the line where this section is taken, crossing the junction of the Grand and Green rivers, at the head of the Grand Cañon of the Colorado, the Rocky Mountains on the east are distant some 140 miles, more or less, from the Wasatch Mountains on the west. Above this line, the cretaceous sea laid down its final loads of deposit in an even though slightly inclined plain, at what is now at the very least 6,000 feet and upwards above the level of the river's rocky bed, and fully 8,000 feet above the present sea level. In other words, when rain first began to fall upon the gradually emerging cretaceous strata, when rills first threaded their way down the slight incline, seeking the sea, the rocks which now are washed by the waters of the Colorado, were then buried under upwards of six thousand feet of newer strata. As the land gradually emerged more and more from the waves, and exposed a constantly increasing and more elevated surface to the rain fall, the rills became noisy brooks, hollowing out and widening their channels, and boisterously rolling the fragments they detached downwards, wearing them away, in their sport, to pebbles, and to sand, and to fine-grained mud; the brooks in turn became rivers, and the rivers grew more and more powerful and impetuous.

These rivers of the past cut their way into the higher rocks over which they then flowed, just as their descendants of the present are eating into their more deep-seated rocky beds; when an obstacle, such as a stratum of harder rock, for a time arrested their progress in one direction, they exerted themselves laterally, spread out their forces, widened their banks, altered their channels, but all the time kept on bearing away the millions of tuns of *débris* that the rain and the rill rolled into them. By and by the barrier gave way, their outfall was lowered, and they soon set to work on a lower and older series of rocks, while the higher plain was drained more effectually than ever; and rapid drainage of a district implies also its more rapid superficial destruction. The more steep the hill, the more bare its sides.

The brooks had settled tens of feet into the cretaceous rocks, and their channels already coursed through narrow valleys or coombs; the rivers had eaten down hundreds of feet, and their valleys had broadened into plains bounded by ever-deepening escarpments; they sank thousands of feet, and valleys had been formed within valleys, and the remains of the old valley beds were now wide plateaus bordering the new excavations. The work of the water was easier and more rapid in the more recently formed and softer cretaceous and triassic strata, than in the ancient metamorphosed and crystalline rocks, through which they are now running; and, moreover, during all the vast time that has elapsed between now and then, rain and rills have been incessantly eroding and widening the original watercourses, and bringing down more and more of the bounding escarpments. We thus see how the upper and primitive valleys (now plateaus) have been widened so much above—in places it is estimated to 180 miles; while those at present being scored out are to be measured by but hundreds of yards.

Section to illustrate the denudation of the region of the "Colorado of the West."



1. Palæozoic. 2. Triassic. 3. Lower Cretaceous. 4. Upper Cretaceous.

Aerial Temperature.—As a large portion of the traveling public is now interested in balloon voyages, it is interesting to know that the generally received opinion, that the temperature of the air decreases uniformly with increase of altitude, is a fallacy. We have Mr. Glaisher's authority for stating that the mean temperature in summer, at 50 feet from the surface of the earth, is, during evening and night, higher than at 4 feet, and in winter the same relative temperature is always preserved, both by day and night. At sunset, in summer, the temperature is nearly the same for the first 2000 feet of ascent; but at night and in winter, it increases with the altitude. Thus the phenomena observed near the earth's surface are at variance with those of the etherial atmosphere beyond.

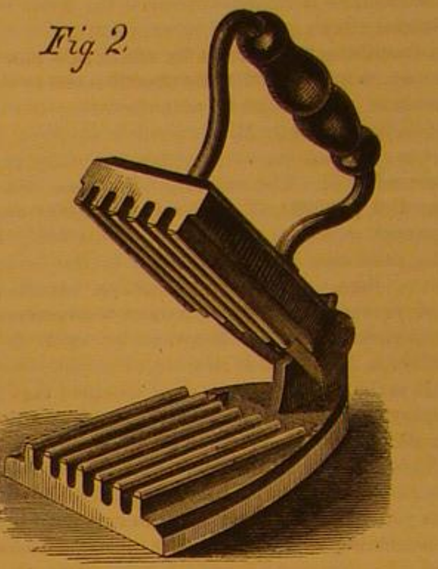
Black Copper.—The beautiful enameled surface possessed by paintings on copper, may be produced, on a black ground, by the following process: Clean the copper with sand and sulphuric acid, and then apply the following mixture: 2 parts of white arsenic, 4 parts of hydrochloric acid, 1 of sulphuric acid, and 24 of water.

KNAPP'S FLUTING AND FLAT IRON.

The annexed engraving is a representation of a combined fluting and sadiron, invented and patented August 2, 1870 by M. H. Knapp, of Fulton, N. Y. The demand for fluting irons and machines for fluting has latterly been on the in-

Fig. 1

Fig. 2



crease, and this invention is designed to supply a convenient apparatus at a much cheaper rate than fluting machines can be afforded.

It will be seen that the iron is made in two parts, pivoted together at A. When closed, these parts are held together by a button and catch; shown at B, Fig. 1. To insert the cloth for fluting, the upper part of the iron is raised, as shown in Fig. 2, and when closed, the cloth is pressed into the grooves in the lower part, and thus fluted.

For light laundry purposes this implement will answer a good purpose, and take the place of expensive machines, where rapidity in the performance of the work is not a desideratum.

Persons wanting these articles, desiring rights to manufacture, or agencies to sell them, may address for further information Knapp and York, Fulton, N. Y.

Polishing Collars and Shirts.

Put a little common white wax in your starch, say two ounces to the pound; then if you use any thin patent starch, be sure you use it warm, otherwise the wax will get cold and gritty, and spot your linen, giving it the appearance of being stained with grease: it is different with collar starch, it can be used quite cold; however, of that anon. Now then, about polishing shirts: starch the fronts and wristbands as stiff as you can. Always starch twice, that is, starch and dry, then starch again. Iron your shirt in the usual way, making the linen nice and firm, but without any attempt at a good finish; don't lift the plaits; your shirt is now ready for polishing, but you ought to have a board the same size as a common shirt board, made of hard wood, and covered with only one ply of plain cotton cloth. Put this board into the breast of your shirt, damp the front very lightly with a wet sponge, then take a polishing iron, which is flat and beveled a little at one end—polish gently with the beveled part, taking care not to drive the linen up into wave-like blisters; of course this requires a little practice, but if you are careful and persevere, in a short time you will be able to give that enamel-like finish which seems to be so much wanted.

To Dress Collars—For this purpose use the best starch, say 2 lbs., and 4 oz. of wax and $6\frac{1}{2}$ pints of water; first dissolve the wax in the boiling water, take the vessel off the fire and allow it to stand for five minutes; during this time dissolve the starch in the smallest possible quantity of cold water, then pour it gradually into the vessel and boil for 25 minutes—keep stirring all the time; this starch can be used quite cold; rub it well into the collars, wring as tight as you can, finish by wringing in a cloth, then iron; thus you will have them stiff without being hard, and when well dressed will have that beautiful elastic finish so much admired in new collars.

Not a Bad Idea.—It is said of a shrewd merchant that he has his bill heads printed upon paper of three different colors—red, green, and white. When the bill is made out upon a red paper it denotes "danger," and the messenger is not to leave the goods without the cash; if on green paper, it means "caution," as the customer is doubtful, and the man is to get the money if he can; if on white, it is safe to leave any quantity of goods on credit.

AGRICULTURAL PATENTS OF THE YEAR.

There is no object of more interest in Washington than the United States Patent Office, the repository of all the silent but eloquent memorials of the genius and efforts of our inventors, and there is no department of this vast institution more pleasing to the general visitor than that devoted to agriculture. The models are generally so simple in structure as to suggest their purpose without reflection or conjecture, as many of the more complicated machines do not. The hall containing the agricultural models is about two hundred and seventy feet long, and is provided with sixty cases (exclusive of those in the galleries), each case being about twenty-five feet long by five feet wide, and provided with four shelves, upon which the models are arranged as closely as they can be made to stand. Of these sixty cases, thirty-one are devoted to agricultural models, systematically arranged in classes, each class being subdivided into years, and every model bearing a card having the subject of invention, the name and residence of the inventor, and the date of the patent on it.

During the year 1869, nineteen hundred patents were issued, in this department, which may be classified as follows:

Bee hives, houses, traps, etc.	62
Butter workers, tubs, etc.	20
Cattle ties, slaughterers, catchers, etc., chicken coops, nests, etc.	35
Churns and churning	130
Corn shellers, huskers, etc.	40
Cotton gins, pickers, etc.	30
Cultivators	150
Diggers and spaders	30
Drills	30
Egg carriers, detectors, etc	8
Fertilizers	6
Forks—hay, manure, pitch, etc.	100
Fruit boxes, crates, pickers, etc.	20
Garden implements	5
Grain bins, granaries, etc.	10
Grain cleaners	20
Harrows, drags, pulverizers, etc.	80
Harvesters and attachments	195
Hay spreaders	25
Hay tedders	10
Hedge trimmers, setters, etc.	6
Hoes	25
Markers	12
Milk coolers, safes, pails, and dairy apparatus	45
Mowing and reaping machines	30
Planters	150
Plows and attachments	252
Pruning	15
Racks	6
Rakes	90
Rollers	15
Sap spiles	5
Scythes	5
Seeding and sowing machines	80
Separators and smut machines	50
Stalk cutters	7
Straw, hay, and fodder cutters	30
Thrashing machines	35
Yokes	15
Miscellaneous	18

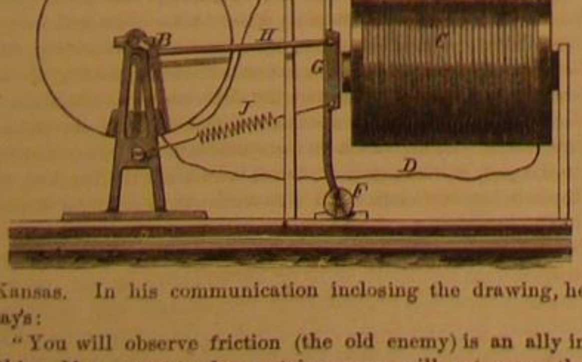
It will be observed that the plow takes front rank in numbers, as it does in point of importance. It is, of course, understood that a patent is not granted on every application as all inventions are not novel, and it is safe to say that applications for patents for improvements on the plow average one for each day. Notwithstanding this rapid increase, there is, apparently, as much room for improvement as ever. One of the examiners states that when he first entered the Patent Office, he considered the field of invention nearly closed; so much had been done that he could see little room for further improvements; but after an experience of nearly seven years, he concludes that there is no limit to inventive genius. Though a thousand improvements have been patented, the field is still open; and there are as many applications for improvements now as when there had been but five hundred patents issued.—*Commissioner Capron's Report.*

PERPETUAL MOTION.

NUMBER X.

Fig. 26 is an attempt to secure a perpetual motion by the application of electricity. It is the invention of a citizen of

FIG. 26.



Kansas. In his communication inclosing the drawing, he says:

"You will observe friction (the old enemy) is an ally in this. If a magnet of a certain power will not move the electric plate, the power could be increased without perceptible loss of tension, by decreasing the resistance which the magnet and conductor offer."

In the engraving, A represents a frictional electrical machine; B, a crank; C, an electro magnet; D, wire conductors; F, a trunnion; G, an armature; E, a circuit closer; H, a pitman; I, an insulating substance, and J, a spiral spring.

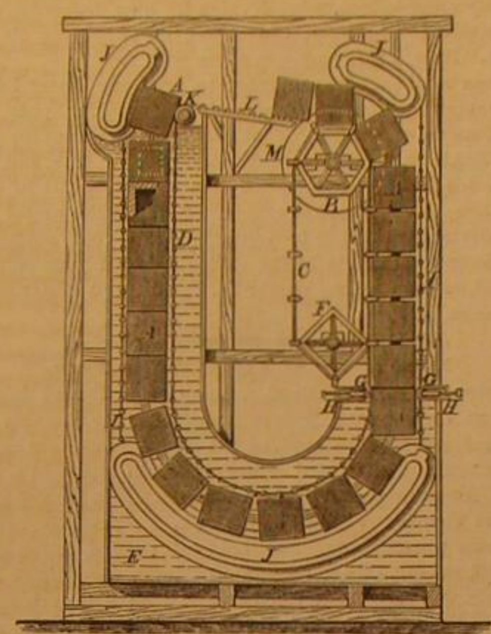
The device is expected to operate as follows:

The frictional electrical machine is started, which magnetizes the temporary magnet and draws the armature towards it. This breaks the circuit at the point, I, E, which demagnetizes the temporary magnet and allows the spring, J, to again close the circuit. By this means a continued motion is expected to be kept up.

To those not familiar with the science of molecular physics, this device may appear very plausible; a little reading, however, upon the subject of the correlation of forces, will serve to show its utter fallacy.

Fig. 27 is the invention of Jean Clunet, of Lyons, France, patented in England, 1869, under the name of "A New and Improved Motive power." It is thus described.

FIG. 27.



The invention relates to a new and improved motive power operating without noise and without expense. It consists in giving a rotary motion to a wheel, which is destined to transfer, by the ordinary means, the power obtained by the employment of any even, smooth blocks of stone, petrified mortar, iron, cast or wrought, or other heavy materials, in the form of cubes preferred, and of which the number and volume are governed by the amount of power desired, and causing them to descend in the ordinary atmospheric air, but to ascend in a liquid whose density is equal to their density, by which means their weight is annulled. For this purpose these blocks, when descending, are hung to hooks fixed to an endless chain turning upon the wheel receiving the motive power, which is of a shape of a hexagon, and placed on the top of a suitable framework, and upon another wheel of the shape of a square, which is placed at the bottom of said framework, and partially in a receptacle or tank of water, or any other liquid. When these blocks have arrived at the lower portion of their course, they detach themselves from the hooks on which hitherto they hung attached to the chain, which latter continues its ascending and rotary motion, and the said blocks descend and re-ascend within the tank, confined to their place and guided by an endless band and conducting wires stretched from supports for that purpose fixed on the top and bottom of the framework. They now, being thus guided, and following one upon another, find their way into another species of tank, placed vertically, likewise filled with a liquid similar to that in the first mentioned tank, and when arrived at the top of this second tank they tilt and slide along upon a horizontal shelf of rollers until they reach the hexagon-shaped wheel and the endless chain, when they recommence their descent. In order to prevent the liquid from running or descending from the second tank into the first, the blocks enter from one tank to the other between rollers and grooved pulleys pressed against the blocks by springs so as to shut off all way to the water. The detaching of the blocks from the endless chain takes place of itself, so to speak, from the position they find themselves in, in consequence of the rotary movement and of the turning over the said chain upon the lower wheel in the shape of a square. The endless band receives a continuous descending and rising motion from the weight of the blocks, which give every motion that the apparatus possesses, and which motion would be perpetual, if, upon the axle of the hexagon-shaped wheel transmitting the force obtained to the machinery by means of a driving pulley keyed to one of its ends, there were not keyed to the other end a break wheel with a hand crank, by means of which the movement may be stopped or modified. Instead of two receptacles it would perhaps often be better to have but one, the rollers and grooved pulleys already alluded to being placed at the entrance of the single tank instead of the second, the blocks acting in the same manner.

The engraving is a side section, in elevation, of the whole apparatus.

A represents the blocks; B is the hexagon-shaped wheel; C is the endless chain, which remains attached to the said wheel by means of its pointed hooks, which successively enter similar recesses made in the circumference of the wheel, the other end of said hooks being square, serving to keep the blocks in their place while descending in conjunction with the conducting wires, D, placed two in front and two behind each block, and one at each side; E is the receptacle; F is the square wheel from which the chain, C, at the bottom of its course is detached to re-ascend round the wheel, B; G, rollers, of which there are four, made of india rubber or other elastic material, placed at the entrance of the receptacle, E; and H is the india rubber or other suitable angle pieces, also placed at the entrance, between which rollers, G, and angle pieces, H, pass with slight friction the said blocks, after being disengaged from the chain, C. These blocks, A, angle pieces, H, and rollers, G, being in close contact, form a permanent stoppage, so that the water cannot issue, and said blocks, when in the receptacle, are placed in the middle of the same, where they are kept in equilibrium by the water, and are pushed and moved forward by the blocks which descend after them. I is the endless band, resting on supports, J, fixed to the inside of the receptacle, supporting the blocks and moving with them. The blocks, when in the vertical part of the receptacle, are conducted by four wires, one on each of their four sides. K is a roller upon which tilt the blocks, guided by the endless band when on the top of the receptacle to leave the same; L, friction rollers, on which fall and roll the blocks after having tilted, in order to reach the hexagon wheel, B; M, M, are the two pulleys on each side of the hexagon-shaped wheel, for applying the break and for transmitting the power obtained to other machinery. The equality in the density of the liquid and the blocks is obtained by hollowing the blocks so that they may easily rise to the top of the receptacle when therein. The desired result is obtained by the use of any other liquid, the volume of the blocks being proportionate to their density; also the weight of the blocks may be more or less than that of the liquid, but equality in weight is preferable.

Correspondence.

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

Ingrowing Toe Nails.

MESSRS. EDITORS:—The trouble and pain from this cause can be immediately and permanently relieved, without pain, in the following simple manner: Take a file, some four inches in length, bastard cut, flat on one side and round on the other, new and sharp. File down thin all the exposed part of the nail, till it is soft and pliable. This will immediately relieve the part pressing into the flesh, which need not be cut or extracted. The filing is not in the least painful, as the file will not take hold of the skin or flesh. In the course of several months, the nail will grow out thick again, when the filing should be repeated. The edges of the nail will never grow into the flesh so long as the top of the nail is soft and pliable; and there is nothing so simple, convenient, safe, and painless for keeping it so as a file.

Philadelphia, Pa. D. S.

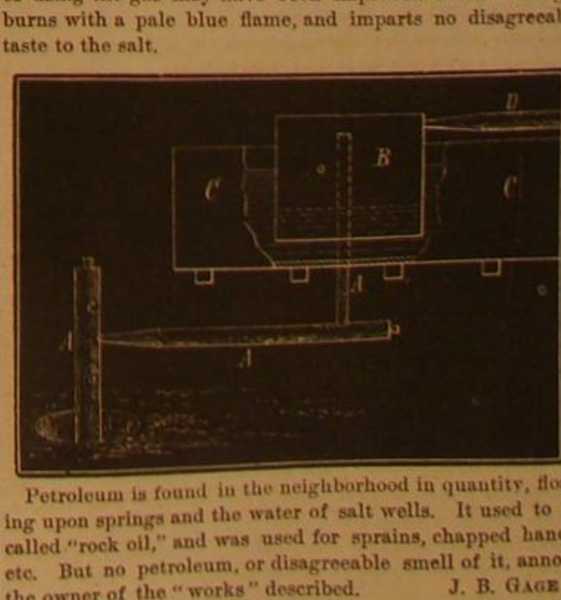
American Gas Wells.

MESSRS. EDITORS:—I have seen no account in any paper of one of the oldest and most remarkable oil wells there is in the United States, and will therefore write a short notice of it for the SCIENTIFIC AMERICAN. It was sunk in the winter of 1828-9, by Col. Rufus Stone, opposite McConnellsville, Morgan county, Ohio. The boring was for salt water, and when he found it he obtained all he needed to make salt, except "elbow, and a pinch of coal;" for, in drilling through a stratum of rock or clay, he not only found salt water, but hydrogen gas under pressure sufficient to lift the salt water to the surface. The well is, we believe, some three hundred feet deep, and has never ceased to furnish gas enough to lift water and evaporate it during the forty-two years of its existence.

The brine is lifted at irregular intervals into a large tank, whence it is drawn as needed. At times, it will rush through the pipes for a minute or more, but usually only flows for a few seconds at a time.

In the accompanying sketch, A A are the pipes, terminating at the top of the gas chamber, B. The brine falls to the bottom of the chamber, filling the tank, C, while the gas is carried away by the pipe, D, to the furnace, where a small coal fire is kept burning, to relight the gas in case the supply should cease during a long flow of water from the well.

It is seventeen years since I examined it, and the method of using the gas may have been improved since. The gas burns with a pale blue flame, and imparts no disagreeable taste to the salt.



Petroleum is found in the neighborhood in quantity, floating upon springs and the water of salt wells. It used to be called "rock oil," and was used for sprains, chapped hands etc. But no petroleum, or disagreeable smell of it, annoys the owner of the "works" described. J. B. GAGE

36 W. 16th st., New York city.

[In connection with the above statement, we will add tha

Mr. C. C. Peck, of Chicago, sends us an account of a remarkable gas well in West Bloomfield, Ontario county, N.Y. The well was sunk about three years since, for oil, a smell of petroleum and appearance of gas having manifested themselves on the banks of a small stream. The boring was stopped at a depth of 500 or 600 feet, for want of funds; but there has issued ever since a large volume of gas, having the odor of petroleum. Our correspondent states that the flow of gas is, by actual measurement, more than enough to supply the city of Rochester, and a company is now organized to supply the town of Lima, preparatory to supplying the city of Rochester, from this source. The illuminating quality of the gas is said to be superior to gas made from coal.

Another correspondent, Mr. George L. Benton, writing from Shambury, Venango county, Pa., states that about ten miles from where Oil Creek empties into the Alleghany river, at a place called East Sandy, there is a remarkable gas well. The gas from this well is conveyed 1800 feet, through a two-inch pipe, and then employed to drive three engines, of from ten to twelve horse power, the gas being used *in the cylinders, like steam*, instead of being burned to generate steam. The surplus gas burned would, it is stated, more than make steam for the engines. When the engines are running the gage shows a pressure of 80 lbs. Under this pressure the amount of gas delivered must be very great.—EDS.

What a Woman thinks of Modern Microscopists.

MESSRS. EDITORS:—Among the whole tribe of your scientific men, there are none who trouble me so much as your microscopists. I am a faithful reader of your paper, taken by my son, Dr. S P. Duffield, and rejoice in the modern improvements of machinery of all kinds; but this microscopic information about what I eat and drink is most appalling to my sensibilities.

I have not a *modern* stomach, *that* having performed its duty for seventy-one years; consequently, cannot *imagine* (in these days when imagination does such wonders), that I have in it some patent filter that might catch the horrid creatures which these gentlemen say we take in by the wholesale.

How sweet was the recollection in former days that "a cup of cold water" presented to a good individual entitled us to "a reward" by a kind Providence! Now, alas! that pleasant idea is abandoned; as, according to these wise men, we may give him a horrid worm which may be his death—consequently, we deserve no reward—to say nothing of those creatures which accompany said worm. After reading one of your late numbers I was reduced to despair; as my last refuge of pure things in the eating line is swept away by these unmerciful microscopists.

Oysters—the pure delicious oyster, so nice when eaten fresh from the shell—we are informed, very coolly, have in them multitudes of small oysters swimming nimbly about in the juice "covered with shells;" and not content with making us put up with swallowing oysters, shells and all, they unmercifully add that the liquor contains a "variety" (listen to their audacity in telling us of *a variety*) of animalculæ; and, in their benevolent (?) love of modern science, they go on to say, "there are three species of worm also."

Were it not for my belief in Job's words, (poor Job would be informed in these days that he had a thousand worms in each of his boils) "After my skin, worms shall destroy this body," I should, I fear, die of inanition, as I never would be able to take the "food convenient for me," that the happy ignorant Agur prayed for.

Then, too, these amiable *savants* tell us, by way of reward for gulping down this nauseous dose, that if we take our oyster into a dark room we will see a "luminous star;" verily, I should rather do without the luminary than have it shine from such a verminose panorama.

I have tried to find relief from the old adage, "Where ignorance is bliss, 'tis folly to be wise," but having a learned professor for a son, of course I have acquired a little science myself, and find it more difficult to do so.

I look to these wise men for some relief. Cannot they make their "luminous star" less of a "blue" one?

ANTI-VERMICULE.

The Manufacture of Irish Poplin.

MESSRS. EDITORS:—Every civilized nation has some specialty of manufacture, Ireland being famous for poplins and linen. When in Dublin I visited the well-known establishment of Pim Brothers, the most extensive poplin manufacturers of the kingdom. The spinning is the only part of the work that is done by machinery. Every other part is performed in the most primitive manner by hand labor. Almost the first thing that meets your eye on entering is a number of old women sitting beside old-fashioned flax spinning wheels propelled by the foot, and winding the thread on spools.

In this establishment there are employed two hundred and thirty looms, of the rudest possible construction, in appearance resembling those of our great-grandmothers, manufactured during our colonial struggles. Every thread is put through with the old-fashioned shuttle by hand; and the treadles are worked by the operator's feet. The looms are all operated by men, ten yards being an average day's work, and fifteen yards the largest ever known to have been woven in one day. The greatest skill seems to be displayed in producing the colors, and their power of retaining their richness for an indefinite length of time.

Any one who will take the trouble of examining a piece of Irish poplin, will notice the irregularity in the size of the threads, and the imperfections in weaving. I asked one of the managers if he did not think that power looms could be used for weaving; his reply was that it was possible, but not practical, as labor was so cheap with them that it would probably cost more than to do the work by hand. Nearly all other parts of the work except weaving is done by female labor.

That the far-famed Irish poplins should be manufactured in so simple and primitive a manner was to me a matter of surprise.

J. E. E.

Industrial Competition.

MESSRS. EDITORS:—I have read your notice, in No. 5, of my paper upon "International Industrial Competition," concerning which I beg to say that I by no means wish, as you express it, to "deal a death blow to commerce and trade."

It is very true that I prefer domestic commerce and trade to the comparatively insignificant foreign commerce, which arrogates to itself the exclusive right to be called commerce. The former is a sure indication of prosperity; the latter is far from being so, and may be the direct cause of national impoverishment.

What I insist upon is, that each nation which intends to be truly independent, must develop its own resources, so as to contain within itself the means of supplying its own wants. Here, I feel sure you agree with me.

If you would do me the honor to read the latter half of my pamphlet, you might probably reconsider your view that I am an extremist. That I love my own country more than England, Germany, or France, is most true, and I desire to see it resist successfully the trade assaults of those countries; to equal and to excel them in all the useful arts. That desire is shared in by yourselves and your readers; it may, in fact, be said to be the *raison d'être* of your valuable journal, as it was of my pamphlet.

JOSEPH WHARTON.

Camden, N. J.

Luminosity of Cloth When Torn.

MESSRS. EDITORS:—About a month ago I read in your paper an extract from *Nature* mentioning the singular phenomenon, recently observed, of the evolution of light caused by the tearing of twilled cotton cloth into strips in a dark room. About seven or eight years ago, while in the dry goods trade at Victoria, Vancouver's Island, I repeatedly noticed this same phenomenon. Not only soft twilled cotton cloth, but stiff, smooth calico, containing a large quantity of lime dressing, will emit light when torn in a dark or even dimly-lighted room. In cold, dry weather the phenomenon is more noticeable than in warm or damp weather. In Montana, during an extraordinary cold spell in the winter of 1867–68, the thermometer ranging from ten to thirty-two degrees below zero, I noticed that common printing paper, when torn in a cold dark room, will emit light. I have always attributed the evolution of light in these cases to electricity. At the time I noticed the so-called phenomenon in Montana, the amount of electricity "knocking around loose" was really astonishing. One day, presenting my knuckle to the tip of a cat's tail, a spark flew out of it (the cat's tail) as large as that which comes out of a twelve or fifteen-inch electrical machine. Often, at night, when undressing for bed, as I was pulling off my woolen overshirt, I would hear a crackling noise, like that made by the breaking of thin glass stems, and while extracting my head and arms from it, I would see hundreds of little flashes at the points where the over-shirt and under-shirt were parting. In violently shaking my over-shirt, after taking it off, I would see innumerable flashes of light, and hear a continuous crackling sound. When the cold spell was over, the pyrotechnics on my shirt ceased, the cat no longer gave forth sparks, and no matter how luminous the articles were in the newspapers which I tore, light refused to issue from them.

G.

San Francisco, Cal.

Illustrious Inventors.

MESSRS. EDITORS:—It is with pleasure that I acknowledge the receipt of the beautiful engraving, "Men of Progress." You will please accept my grateful thanks, and rest assured that I shall use what influence I may have in presenting the claims of the SCIENTIFIC AMERICAN to my friends and to the public, not simply for the reward that I have received, but from my appreciation of a paper so full of useful information.

J. F. LESLIE.

Haverhill, Mass.

[Concerning this group of illustrious inventors, whose portraits are faithfully represented in this picture, the following are among the dead: Thomas Blanchard, Samuel Colt, Charles Goodyear, Joseph Saxton, Isaiah Jennings, Henry Burden, and Wm. T. G. Morton.

We shall continue to give a copy of this superb work of art to any one who will send us ten new subscribers, at our club rates—twenty-five dollars.

J. F. Kingsley, Owego, N. Y., writes that he has received the engraving, and feels well paid for the trouble he has been to, in getting up the club.

JEWELLER'S CEMENT.—The following is a recipe for a strong cement, used by some oriental nations, for the purpose of attaching precious stones to metallic surfaces: Take six pieces of gum mastic, the size of peas, and dissolve in the smallest possible quantity of alcohol. Soften some isinglass in water, and saturate strong brandy with it, till you have two ounces of glue; then rub in two small pieces of sal ammoniac. Mix the two preparations at a heat. Keep well stoppered. Set the bottle in hot water before using. It is said by the Turks that this preparation will unite two metallic surfaces, even polished steel.

There has never been a successful advertising agency south of Baltimore. Several have been started in New Orleans, but proved failures.

The Old Confidence in Superstition.

That prosaic and coldly rational temper with which modern men are wont to regard natural phenomena was in early times unknown. We have come to regard all events as taking place regularly, in strict conformity to law; whatever our official theories may be, we instinctively take this view of things. But our primitive ancestors knew nothing about laws of nature, nothing about physical forces, nothing about the relations of cause and effect, nothing about the necessary regularity of things. There was a time in the history of mankind when these things had never been inquired into, and when no generalizations about them had been framed, tested, or established. There was no conception of an order of nature, and therefore no distinct conception of a supernatural order of things. There was no belief in miracles as infractions of natural laws, but there was a belief in the occurrence of wonderful events, too mighty to have been brought about by ordinary means. There was an unlimited capacity for believing and fancying, because fancy and belief had not yet been checked and headed off in various directions by established rules of experience.

Physical science is a very late acquisition of the human mind, but we are already sufficiently imbued with it to be almost completely disabled from comprehending the thoughts of our ancestors. "How Finn cosmogonists could have believed the earth and heaven to be made out of a severed egg, the upper concave shell representing heaven, the yolk being earth, and the crystal surrounding fluid the circumambient ocean, is to us incomprehensible; and yet it remains a fact that they did so regard them. How the Scandinavians could have supposed the mountains to be the moldering bones of a mighty Jötun, and the earth to be his festering flesh, we can not conceive; yet such a theory was solemnly taught and accepted. How the ancient Indians could regard the rain clouds as cows, with full udders milked by the winds of heaven, is beyond our comprehension; and yet their Veda contains indisputable testimony to the fact that they were so regarded."

We have only to read Mr. Baring-Gould's book of "Curious Myths," from which we have just quoted, or dip into Mr. Thorpe's great treatise on "Northern Mythology," to realize how vast is the difference between our standpoint and that from which, in the later Middle Ages, our immediate forefathers regarded things. The frightful superstition of were-wolves is a good instance. In those days it was firmly believed that men could be, and were in the habit of being, transformed into wolves. It was believed that women might bring forth snakes or poodle dogs. It was believed that if a man had his side pierced in battle, you could cure him by nursing the sword which inflicted the wound. "As late as 1600, a German writer would illustrate a thunder storm destroying a crop of corn by a picture of a dragon devouring the produce of the field with his flaming tongue and iron teeth."—*John Fiske, in Atlantic Monthly for February.*

The Hartford Steam Boiler Inspection and Insurance Company.

The Hartford Steam Boiler Inspection and Insurance Company makes the following report of its inspections for December, 1870:

During the month 457 visits of inspection have been made, and 866 boilers examined—845 externally and 274 internally, while 87 have been tested by hydraulic pressure. Number of defects in all discovered, 486, of which 88 were regarded as dangerous. These defects were as follows: Furnaces out of shape, 22; fractures, 30—14 dangerous; burned plates, 22—3 dangerous; blistered plates, 63—12 dangerous; cases of sediment and deposit, 78—14 dangerous; cases of incrustation and scale, 83—9 dangerous; cases of external corrosion, 23—2 dangerous; cases of internal corrosion, 20—5 dangerous; cases of internal grooving, 15—4 dangerous; water gages out of order, 22—2 dangerous; blow-out apparatus out of order, 22—12 dangerous; safety valves overloaded, 25—2 dangerous; pressure gages out of order, 50—2 dangerous; cases of deficiency of water, 3—2 dangerous; broken braces and stays, 9—4 dangerous; boilers condemned, 3—all dangerous.

During the month there have been seven explosions in the United States, namely: Locomotive, tug boat, pile driver, grist mill, brass foundery, iron foundery, and steamboat, one each. By these explosions 12 persons were killed, 14 severely wounded, and many thousands of dollars worth of property destroyed. It is safe to say that the greater part of these explosions, and the consequent loss of life and property, would have been avoided by a proper inspection of the boilers.

What an easy thing it is to drive a locomotive, says the *National Car Builder*. Pull a lever, away she goes; push it, she slacks up and stops. That's all. The quick eye, firm hand, prompt courage, the knowledge of every furlong of the road, the putting on steam on an ascent, or the shutting off on a down grade, the difference of expansion in the rails between hot and cold, wet and dry, and the perpetual risk of life and limb and property are matters unknown to the people who pay their fares, take their tickets, and get to their journey's end. All the while their lives have been in the hands of a grimy looking man, at the end of the train, whom, if they meet him on the platform, they avoid, lest they should soil their silks or kerseymeres by the contact. These men should be, and often are, scientifically educated; but they have no social position, and their wages are absolutely inadequate to their responsibilities. The gentlemanly conductor is a personage of consideration, the petted of passengers, and the respected of directors. The engineer is a mere mechanic. The world is full of irregularities and injustice.

Cement from Gas Lime.

We gave, a short time since, a description of a new English process for making cement from gas lime, invented by Mr. Prideaux. Of this new cement, a correspondent of the London *Builder* says: It bids fair to become an important manufacture. In Sheffield upwards of 700 tons of gas lime have been worked up. The larger part has been applied to walls and floors, hearths and mantelpieces. Of the latter, about 200 have been moulded and sent out. In four of the busiest parts of the town, causeways have been paved by laying the cement with a certain proportion of broken slags from the neighboring furnaces. These have stood the late rains very well, and are likely to come into close competition with the asphalte usually employed. Perhaps the most happy application of this new material is for floors and roofs. Old boarded floors of warehouses have been covered with about an inch layer, and even in workshops, where polishing machinery keeps everything in vibration, the Prideaux cement stands intact. I have daily inspected the roof of a shed which had been covered with the cement. Upon a light frame of wood the material was laid on and troweled to a smooth face, and in the space of twelve hours it was hard enough to bear standing upon. The rain water now washes over it without the slightest trace of white particles, nor is there any alkaline reaction to be discovered on the hardened surface. The smoothness of walls and plinths molded with the Prideaux cement is very striking, and must recommend it strongly to builders.

Now, it may be asked, what is the composition of a cement which possesses these useful properties? It is not a Portland or a Roman cement, although some hydraulic characters are very distinct. It does not set so quickly, but allows more time for finishing up the faces of molded work. It is far from common mortar; for without any sand it can be formed into blocks which set hard throughout. A piece of a mantelpiece, which had been made some six months, gave the following results upon analysis:

Carbonate of lime	69·08
Sulphate of lime (hydrated)	22·63
Calcic hydrate	1·36
Calcic sulphide	*trace*
Insoluble matter	6·50
Alumina and oxide of iron	·45

It is obvious, from the above, that the setting must at first be due to the combination of water with the dehydrated calcic sulphate, or, in other words, the plaster of Paris formed by the calcination of the cement. The quantity of caustic lime which is present in the cement, keeps the plaster of Paris always fresh, that is, dehydrated, until mixed with excess of water employed at the moment of using it. This will account for the fact that the cement does not lose its quality by keeping, as the hydraulic cements do. After the plaster of Paris is set, the caustic lime goes on absorbing carbonic acid, and thus indurating the mass in the ordinary manner of lime mortars.

This will be better understood by the following partial analysis of a sample of the cement ready for use:

Sulphate of lime (dehydrated)	17·46
Caustic lime	54·00
Alumina and oxide of iron	5·00
Insoluble residue	4·15
Hygroscopic water	·24

Now, when it is considered that such a material is made from a waste product of a most offensive kind, this invention deserves every fair trial of its merits. Gas lime is a necessity, if the best and purest gas be wanted. Only the expense and annoyance of its removal drove London gas companies unwillingly to replace it partly by the ferric hydrates. It is pretty certain that with a market for the waste product they would gladly return to lime purifiers, and it may be predicted that the Prideaux cement manufacture will surely bring on this revolution.

Fortunes in Scraps.

The "old junk" business is much more extensive than most people suppose. It includes refuse of all kinds, cotton waste, woolen rags, old newspapers, iron, tin, lead, etc., patiently gathered from all quarters, insignificant in detail, but valuable in the aggregate. It is believed that over $15,000,000 worth of old material is annually worked over in New England, and that at least $5,000,000 worth of this peculiar stock could at any time be thrown upon the market by the Boston dealers. The amount consumed by the mills is astonishing, especially of shoddy. Woolen mills could be named that purchase each year from $3,000 to $4,000 worth of the above stock, and this, too, in addition to flocks. Very many paper mills have standing orders with the largest paper dealers for thirty and fifty tons of stock per week. The Kingsley iron and machine company receive and consume from sixty to seventy five tons of scrap iron each week, and the Old Colony and Ames' shovel companies stand ready to take all the old wrought iron offered in the market. The war in Europe seems to have closed up the avenues for using a large percentage of the Mediterranean rags, and as a natural consequence, they have all drifted here. The immediate effect on our market is to put foreign stocks at the lowest quotable figure, while domestics are, and are likely to be for some little time a drug. There are firms in Boston each holding $100,000 worth of foreign and domestic, patiently awaiting a rising and a favorable market. The importation of old junk grows in importance each year. Old newspapers are brought from England and find a ready sale at remunerative rates; the rags from London and the Mediterranean average more in quantity and better in quality each succeeding year. It has been supposed that imported rags have been a source of epidemic diseases in many instances, but one of the largest dealers in Boston, who has been in the trade fifteen years, states that he has yet to learn of a single case of sickness occasioned by the opening or bundling of a bale of foreign rags. New England rags are worth more and will readily bring from one to three cents per pound more than those from any other section, the reason being that an almost universal custom prevails there, among the housewives, of washing the rags before putting them in their rag bags—so that time, labor and shrinkage are directly saved to the mills. One firm in Boston receives over $300,000 worth of paper stock per month from the South, New Orleans being the chief point of collection.

Steam Boiler Legislation.

The Manchester (England) Steam Users Association held a conference January 13th, to consider the subject of steam boiler legislation. Sir William Fairbairn presided, and the following resolutions were adopted:

1. "That the use of steam, as at present conducted, entails great suffering from the destruction of life and property occasioned by the constant recurrence of boiler explosions. That boilers are now to be found under the pavements over which the public walk, behind walls close to which they pass, in the basement of buildings crowded with busy workpeople, and that, in short, they are to be found everywhere. That many of such boilers have given rise to the most disastrous explosions, so that the lives of all those living near so dangerous an instrument as a boiler, or even casually passing by, are seriously jeopardized unless suitable precautions are adopted to ascertain whether the boiler be safe and trustworthy, and if not, to render it so. That most of those who have suffered from these explosions have had no voice in the management of the boilers, and thus were helplessly victimized, some being women in their own houses and others children at play. Further, that in the generality of cases those injured by the explosions of boilers at the works at which they earn their livelihood are in a similarly helpless position, and, as a rule, too poor and too ignorant to defend themselves. That the subject, therefore, becomes one of general and public interest, demanding immediate investigation, more especially as the use of steam is daily on the increase, and, notwithstanding any precautionary measures at present adopted, explosions still recur with the most persistent regularity and frequency."

2. "That boiler explosions are not a necessary consequence of the use of steam, but that they are, as a rule, preventible. That though complicated in result they are simple in cause, arising, in the main, from bad boilers—bad either in construction or bad in condition. That six explosions are due to bad boilers, through neglect of the boiler maker or boiler master, for every one due to the neglect of the boiler minder. That competent inspection is adequate to detect the badness of the boiler, and thus to prevent by far the greater number of the explosions now occurring."

3. "That notwithstanding the proved efficiency of competent boiler inspection and the publicity constantly given to the subject, yet that steam users refuse to protect the lives of their workpeople, or those residing near to their works, by having their boilers inspected. That it appears approximately that out of about 100,000 boilers in the country only 20,000 are enrolled either with the inspecting associations or insurance companies, so that out of every five boilers one only is enrolled. That a great number of boiler owners are totally ignorant of the risk to which they expose their own lives and those around them, and in many cases are undeceived only by the shock of explosion. That, judging from experience, there can be no doubt that there are now a number of dangerous boilers on the very verge of explosion, being worked on at the risk of all those living near them. That under these circumstances the public safety demands that competent periodical inspection should be enforced by law."

4. "That, although it is necessary in the interest of the public that inspection should be enforced by law, it is not advisable either in the interest of the steam user or the public at large that inspection should be undertaken by the Board of Trade, or any other department of the Imperial Government, as such a course would, it is feared, harass the steam user and hamper progress."

5. "That while the administration of a system of enforced inspection should not be committed to the Imperial Government, neither should it be committed to local authorities, nor to private inspecting associations, nor to insurance companies."

6. "To secure the purity of the inspection let the administration be above all local, party, or private interests, and let it be undertaken, not for profit, but to promote the public safety. To prevent the administration becoming arbitrary, stereotyped, and old-fashioned, and to render it capable of adaptation to the constantly altering and growing requirements of the boiler owner, let it be administered by district boards, constituted partly of gentlemen elected by the steam users themselves, and partly of ex-officio members to be chosen on behalf of the public, the boards having the power of making such laws, rules, and regulations from time to time as might be found necessary for the conduct of the service."

INSULATING COVERING FOR STEAM BOILERS.—The radiation of heat from steam boilers and engine cylinders may be effectually reduced to a minimum by the employment of a jacket of wood, and filling the space between the boiler and the jacket with gypsum. This plan deserves the suffrages of boiler tenders, whose health and comfort suffer so severely from overheated engine rooms. The gypsum (plaster of Paris) will harden in time, and can easily be removed. This material will be found superior to cork or felt, and can be universally applied.

The Use of Glue.

A correspondent writes to the *Coachmakers' Journal* as follows:

"To do good gluing, the work must be well fitted. We use a scratch plane and file, in fitting work for gluing. The shop must be warm, the parts to be glued well warmed, and a kettle of good glue in readiness, well cooked, and brought to the proper consistency. Badly tempered glue is one great point of failure. If the glue be too thick or too thin the work is ill done. It is most frequently used too thick. In gluing panels for carriage work, etc., the work should be well run over a few times with the glue brush, until the pores of each part are well filled, and if the work be well warmed, the glue hot and of the right thickness, the first coatings will frequently strike in, or be absorbed by the pores of the wood. This striking into the pores is what gives a glue joint its great strength and durability. Now, having clamps, hand screws, etc., ready, put together immediately, bringing the parts firmly together, leaving no *body* of glue between, but do not get in a hurry. If you wish to hurry, do it in getting everything ready and at hand before you put on your glue. Use nothing but the best glue. If we do a bad job of gluing, screws will not cure it; it is a bad job at best, and will give out sooner or later. When glue joints open they begin at corners or ends, and work in by degrees. Screws at those points may stop the openings for a while, which is the most they can do. They are of but little use in panels to carriage bodies.

A California Railroad Pier.

The Central Pacific Railroad has erected at Oakland, on the east side of San Francisco Bay, a wharf 11,000 feet long, running out to a depth of 24 feet at low tide, and of 31 feet at high tide, having twelve railroad tracks upon its last 1,000 feet, a wide carriage way, a passenger depot and railroad offices, warehouses, and outside storage for 40,000 tuns of grain or other merchandise, and three large docks, one of which affords ample space for five of the largest steamers or clippers afloat. The extreme end of the main wharf is only three miles from the foot of Second street, where freight is landed in San Francisco, and is less than two and a half miles from the foot of Pacific street, where passengers are set down. The piles used, where the water deepens, are 65 feet long, and are 42 to 54 inches in circumference. The main wharf is 800 feet wide at the extreme or western end, and on it are pens for 500 cattle, two immense warehouses (one 50 by 500, another 50 by 600), and the passenger depot, 75 by 305 in size.

Obituary--The Late Henry Steinway.

Henry Steinway, the head of the well known firm of piano manufacturers, Steinway & Sons, died in this city on Tuesday, the 7th instant.

He was born in Brunswick, Germany, in 1797, and learned the business of piano-making thoroughly. He was a successful manufacturer long before he came to this country, which was in 1850. In this city he began business in Varick street, and then moved to Walker street, near Broadway, where, in a little old-fashioned house, formerly a dwelling, he won for his pianofortes the reputation which has made the Steinway pianos celebrated all over the United States. At the Crystal Palace in this city, in 1855, one of his instruments took the first prize. In 1860, the large up-town manufactory was built, and soon after, the splendid warerooms on Fourteenth street. Of late years, Mr. Steinway, Sr., has lived in retirement.

THE HUDSON RIVER RAILROAD ACCIDENT.—The daily papers have carried to every corner of the land, the news of the disaster which occurred at New Hamburgh on the night of the 6th inst. We need not, therefore, dwell upon its horrible details. An inquest is now in progress, and no doubt the blame, if any attach to the employés on the trains which collided, will be fixed upon the right persons. We shall defer further comment till the evidence is all taken.

SCIENTIFIC PERSONAL.—Baron Liebig writes to a friend in this city that his health is so far restored as to admit of his conducting the usual course of lectures at the University of Munich. Since he broke his leg, he has not been able to take as much exercise as usual, and the severe labors of the laboratory more readily tell upon him. We must also recollect that he is fast approaching the three score years and ten, which, the Psalmist tells us, is all that is allowed to man, unless by reason of unusual strength.

MANUFACTURE OF MUSTARD.—W. G. Dean, of New York, has obtained a patent for improvement in the manufacture of mustard flour, by which, it is stated, the unpleasant taste and smell of turmeric, as well as the natural bitterness of mustard, is entirely removed. The process completely destroys the disagreeable properties of the turmeric, and at the same time gives a sweetness to the flour, besides changing almost instantly the natural gray color of the mustard to a rich and beautiful yellow.

WE are in receipt of the annual report of Commissioner Capron, for 1869, upon the subject of Agriculture, which embodies much valuable information to our farmers. We intend to make several extracts from this report, such as exhibit the progress of inventions designed for agricultural purposes. These extracts will guide the minds of inventors into safe channels, upon which they may venture to push their ingenuity in search of other improvements.

Savannah has $20,115·15 worth of wooden pavements.

Improved Ore Washer.

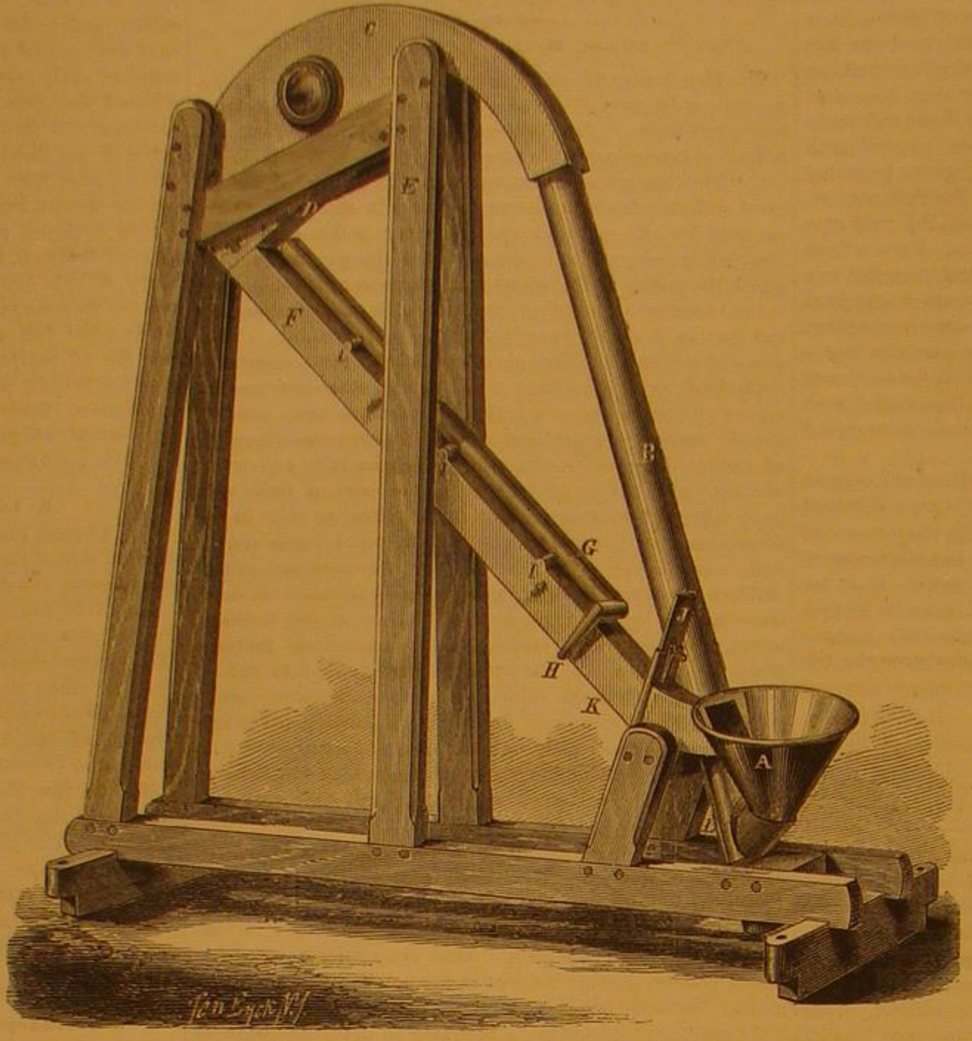
The device illustrated herewith is an apparatus for washing ores. In its use, ore previously pulverized is thrown into a receiver, A, and falls thence into an inclined pipe, B. Here the ore is caught by jets of water forced upward into the pipe, B, through nozzles placed just below the juncture of A and B (not shown in the engraving), by means of a powerful steam pump.

The water jets carry the ore upward into a chamber, C, which is supported by the frame, E, and which has an inclined bottom, D. In the chamber, C, there is placed a perforated barrier (not shown in the engraving), extending downward from the arched roof of the chamber, and against which the mixed ore and water is forcibly dashed.

The perforated barrier does not extend entirely down to the bottom floor, D, of the chamber, C, but has beneath it a space left, through which the ore, after falling down the side of the perforated barrier, passes. A portion of the water, also, with some of the dirt, rushes through the perforations of the barrier, and the whole mass flows onward to the inclined trough, F, the upper end of which opens into the lower corner of the chamber, C.

The water now escapes through perforations in the bottom of the trough F, while the ore falls to its lower end, and is removed, if cleaned, through a gate placed at K, formed in the bottom of the lower end of the trough, F, and not shown in the engraving. If not sufficiently cleaned, which is ascertained by examining a small sample, the vertical gate, J, is raised, and the ore then falls through into the receiver, A, for a repetition of the process, or it may be passed through a suitable channel into another machine, for a second washing.

During its passage down the trough F, the ore is met by small jets of water from apertures, I, in the pipe, G, the water being forced in at H by a steam pump. Under each aperture, I, on the inside of the trough, F, there are formed lips which direct the jets upward against the descending stream of ore. The ore is by this means kept constantly agitated, and every part is acted upon by forcible jets of water.



PLATT'S ORE-WASHING MACHINE.

A sliding gate, L, is used to remove the clogged ore or to relieve the pipe from a surplus of water.

Patented through the Scientific American Patent Agency, Oct. 4, 1870, by Edwin Platt, whom address for further information Charleston, S. C.

Patent Weatherboard Bracket.

The operation of weather-boarding is tedious, and attended with many practical difficulties. The spaces for the lap of boards are generally taken with compasses, or some kind of marking gage, a mark made, and nails driven in to support the board, which must be held in place with one hand, while the workman clambers from end to end of the staging, scribing and handling tools with the other. The board must always be taken down to be sawed, and replaced to be nailed on, and the supporting nails must then be worked out with the fingers, or drawn with the claw hammer, more or less defacing the work.

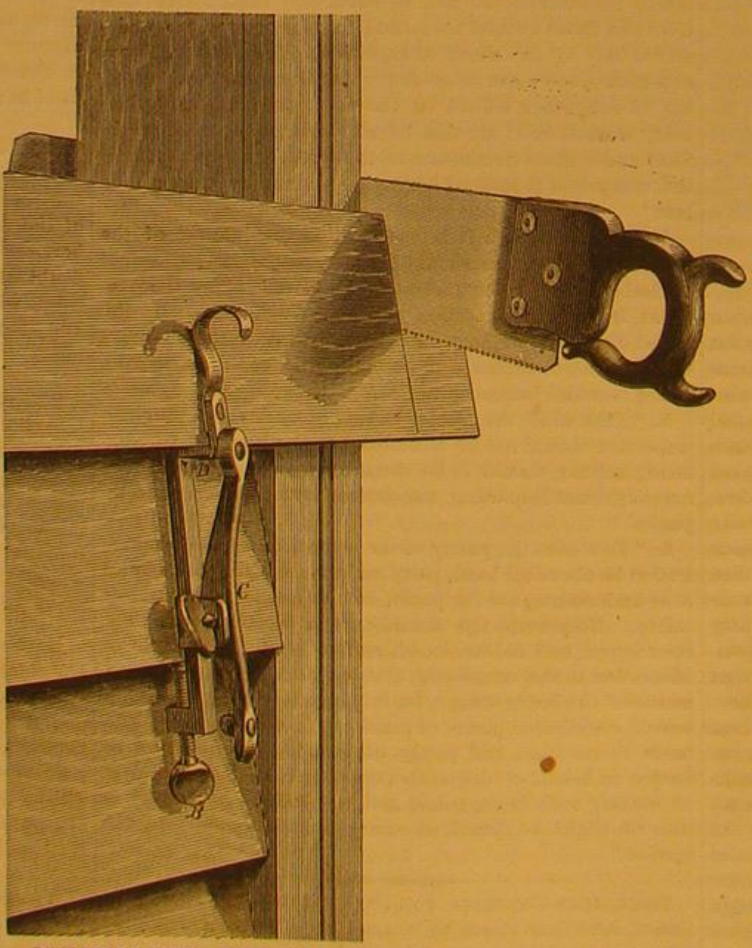
Very often, when a board extends past a corner board to be scribed, a wind whisks it off the nails, tumbling tools and nails to the ground.

The simple and efficient implement, herewith presented, effectually obviates all these difficulties, and greatly shortens the work.

It takes the space, and, at the same time, offers a secure bracket, to receive the next board and hold it firmly, in exactly the right position, while it is scribed, sawn off (without taking it down), and nailed on, leaving both hands free to handle nails and tools throughout the operation.

It consists of an elbowed spacing bar, A, carrying at its lower end an adjusting screw, B, which travels over a graduated scale, cut on the face of the bar, and terminating at its upper end in a bracket carrying a light holding spring, to keep the board upright against the studs or sheathing boards.

The bar carries ears near its middle point, in which is pivoted the middle point of an oscillating lever, C, the upper end of which carries a spike, D, by which the tool is fastened to the wall. One bracket is used to support each end of the board.



MILHOLLIN'S PATENT WEATHERBOARD BRACKET.

The adjusting screw being turned to the proper division on the scale to allow for any required lap of boards, the tool is slid upwards across the last board nailed on, till the end of the adjusting screw hitches on its lower edge; then a tap with the hammer on the upper end of the lever secures the tool to the wall in exactly the right position. The board is then dropped vertically behind the springs and scribed, then drawn past the casing or corner board and sawn off; then slid back to place and nailed on. One tap of the hammer on the lower end of the lever disengages the tool, when it is slid upwards and driven fast to the wall as before.

It will be seen that this tool is not one that must be put away and picked up again every time it is used. It is only a moment in the hand at each operation, and when not in the hand, is doing duty in its place on the wall. The utility of this bracket as a time and labor-saving implement is obvious.

Patented through the Scientific American Patent Agency, October 18, 1870. The patent is for sale. For the entire right, or right to manufacture on royalty address the inventor, J. M. Milhollin, Champlin, Hennepin Co., Minnesota.

To Prevent the Adhesion of Gold Leaf.

Painters and decorators will find the following plan a good one to simplify a most troublesome part of their work: A small piece of ball liquorice, dissolved in water, applied with a flat camel's hair brush to the place intended to be left ungilt, will prevent the leaf adhering. The solution must be weak. Made thick and gummy, it is very useful to protect ornamental parts of work that is to be repainted. We have the authority of the *Coachmakers' International Journal* for the above facts.

Improvements of Plows.

In the matter of swing plows, it can scarcely be said that any decided and unusual stride has been made during the year; nor has any strikingly unique form of mold board, landside, standard, brace, colter, or clevis been patented in that period. Applications have been chiefly for improvements in those devices.

Quite a competition has sprung up in an attachment of plows known as a "fender," which, although invented years ago, has received, until recently, but little attention. While the position of the fender is about the same in all plows to which it is applied, viz: pendent from the beam, and slightly in advance of and removed from the mold board: its purposes differ according to the style of the plow with which it is employed. Thus, on a breaking plow, one intended for raising and turning over the unbroken sod, it is used for bending the weeds and other trash away from the mold board when likely to interfere with the plowing, or being down in such a way of to fall beneath the ridge of soil turned over by the plow. The fender is also used on cultivators, for the purpose of protecting the growing corn and preventing the heavy clods from falling on the young plants.

The majority of plows patented are those known as swing plows, by which is to be understood a plow unsupported by wheels, and the chief aim of the inventors has been, while otherwise improving their efficiency for general and specific purposes, to make them lighter and cheaper. In this respect, our American inventors have good reason to boast over their competitors in other lands, as may be readily appreciated by a comparison with foreign implements, of our light and jaunty-looking plows.

There is a strong tendency toward wheel plows, "gang" and "sulky," in the prairie country west. By "wheel plows," are meant those in which the plows are carried between a frame supported on two wheels, and having a seat for the driver. There seems to be no diminution of interest in this class of plows in any section where they have been introduced.

The points to which attention has been directed by inventors of wheeled plows, are various. They have mostly reference to the frame and its appurtenances, and rarely concern the construction of the mold board, or parts which have to deal directly with opening the furrow. Either lateral or vertical adjustability has generally been kept in view, while much has been done with reference to a diminution of the draft, and to a construction that will keep the plow in the ground firmly and uniformly, while permitting it to be readily raised above the surface.

It is worthy of note, that the patents granted on wheel plows, in 1869, to residents of California and Oregon, largely exceed in number those granted for inventions of a like character from all the other States of the Union.

The Curled Hair Trade.

This article, which to almost any casual observer would be of small moment, is, says the *Trade Journal*, really of very great importance to the nation, as, with all our ingenuity, we have never yet been able to find a substitute for it in the manufacture of bedding, furniture, and many articles of use which contribute to our comforts. The amount of business done in this article is something really astonishing when reduced to figures. We imported into this country, from the various ports in South America, during the past year, a little over 3,000,000 pounds, amounting to about $960,000. When imported, it is not curled, but in the natural state, just as it is taken from the horses, of which many thousands are killed every year on the vast pampas in Central South America, and it is made up into robes here, and afterwards picked by machinery and by hand, when it is ready for use. The business in curled hair is increasing every year, and although the manufacture of hair cloth has, in a great measure, died out, there is still a very great increase in the amount of hair imported each year for this one purpose of curling. Two or three large houses in this country do most of the business, and are situated in New York, Boston, and Baltimore. The raw material is worth from 32 to 34 cents gold, and, after manufacture, brings from 50 to 70 cents currency, but the cost of manufacture is a very large item, and employs a large amount of capital, and a great deal of skilled labor. The imports of hair into this country, this year, in the opinion of parties in the business, will be from one to two thirds larger than last year.

OF the 7,391 residents of New Orleans who died last year twelve were over 100 years old.

Scientific American.

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Contents:

(Illustrated articles are marked with an asterisk.)

KEROSENE MURDER.

It is a matter of growing astonishment that the almost daily record of loss of life and property, through kerosene explosions, does not provoke some sort of special legislation upon the sale of dangerous fluids vended under different names throughout the length and breadth of the land. Petroleum has proved to be of vast and varied importance in the arts, but its more volatile products, have been made the instrument of the most heartless and wicked frauds; and these frauds are still daily perpetrated, and their authors go unhung, though their victims—called to meet the most horrible death known to man—constantly increase in number.

These victims are for the most part women, who, if they escape death, are obliged to undergo what is hardly less cruel to a young and beautiful woman, disfigurement for life.

It would seem in this case that the pecuniary risks involved would stimulate the fire insurance companies to action, though the public at large remain indifferent.

Our readers may recollect the case of Mary Gibson, who, only a short time since was burned to death by an explosion, of Danforth's (so-called) "Non-explosive Oil." This same material has figured before in other disasters. Its dangerous character was exposed in a former issue of this paper, yet still its sale is unblushingly continued.

We are now struck with horror at the disaster at Kenosha, in which the Halliday Hotel was destroyed, seven persons burned to death, and others fatally injured, the fire originating in a kerosene explosion; while from Baltimore comes another sad story of the burning to death of a child six years old, from the same cause.

If we chose, we might fill this column with the list of disasters which occurred last year from the explosions of petroleum fluids.

The public ought to know (surely it has been often enough told) that there is such a thing as safe kerosene, and that the dangerous fluids are either more volatile liquids, or kerosene mixed with more volatile liquids to increase the profits on its sale.

Most of these mixtures are sold under fanciful names, and are recommended by their manufacturers as better than kerosene. Now, when any manufacturer or dealer makes such a recommendation, he utters knowingly a wilful falsehood, to cheat innocent customers into buying a spurious dangerous article. No petroleum fluid more volatile than kerosene is a safe article for promiscuous and general use, and the man who sells it, is as criminal in so doing as a man who should knowingly introduced arsenic into table salt and sell it to his customers as an improved article. Let purchasers beware of these fancy names. In nine cases out of ten they are adopted as a cloak to cover cheating.

As to legislation upon this subject, it is perhaps not our province to propose measures to reach the root of the evil, but it certainly is a fact that the scoundrels who peddle death in the shape of burning fluids, are neither imprisoned nor hung. It would seem not a very difficult thing to frame a law that should bring to condign punishment such offenders.

ORGANIC MATTER IN WATER.

A very interesting paper touching upon a sanitary question of the first importance, was recently read before the Chemical Society, London, by Charles Heisch, of the Middlesex Hospital Medical College. Our views have long coincided with those of Mr. Heisch and many other chemists, viz., that "the deleterious nature of organic matter is dependent upon its containing living germs, which grow and set up a fermentative action within the body," so that the quantity of such matter which may exist in the water we drink, is not of so much importance as hitherto supposed. If the germs be present in any sensible quantity, the water must prove more or less deleterious. It is in the nature of this class of poisons that the quantity entering into the system does not greatly influence the result, as witness the effects of poison received in wounds in the dissecting room, the poison of rabies, vaccine virus, etc.

Although, as we have said, many have for some time held the belief that organic poison in water was no exception to the above rule, there perhaps existed no very firm grounds upon which these convictions rested. They were arrived at more from theory than from demonstrated facts. But Mr. Heisch has been applying the test of elaborate experiment to the theory, and hence the results of these experiments are of more than ordinary scientific interest.

In his paper, Mr. Heisch says he was first led to a means of determining the characteristic properties and appearances of such germs by being called on to assist a large manufacturer of lemonade, who, some years ago, almost suddenly found it impossible to make lemonade that would keep. After a day or two it became turbid, and its odor anything but agreeable. On examining the liquid under the microscope, he found it full of small, spherical cells, with, in most cases, a very bright nucleus, and after a few days the odor of butyric acid was unmistakable. After examining all the materials employed, he found that the water was in fault. On putting a few grains of the purest crystalline sugar he could procure into some of the water, it became turbid in a few hours, and the same cells were distinctly to be seen with an one-eighth inch object glass; but the butyric odor did not come on for some days. This water was procured from a deepish well; it was hard, and contained a considerable amount of nitrates, but not any unusual quantity of ammonia, or unoxidized organic matter. On inquiry, he found some digging had been going on near the well, and it appeared that some drainage must have got in, though at the moment so small in amount as to be hardly appreciable. When water from the water works was substituted, everything got right again. This led him to try all the samples of water he could procure in the same manner, and in every case where diarrhea or other mischief could with any kind of certainty be traced to the use of a certain water, when that was treated with sugar these same smells made their appearance, usually within twenty-four hours, if the temperature were kept up to between 60° and 70°, and plenty of light admitted to the bottle in which the sample was contained.

During the past year he has been trying what substances contain these particular germs, which are so peculiar as to be quite unmistakable when the observer is once familiar with them. By permitting the action of these germs on sugar to go on, they present uniformly the following appearances: The cells gradually group together in bunches something like grapes, quite differently from the ordinary yeast globules; they next spread out into strings, with a wall surrounding and connecting the cells; the original cell-walls then seem to break, and leave apparently a tubular sort of threads branched together. The strong resemblance of these to, if not identity with, the sewage fungus, coupled with the almost universal properties of water which produced them, led Mr. Heisch to look to sewage as their source, and he found that the smallest quantity of sewage, mixed with a water which might be treated with sugar and remain clear and sweet for weeks, at once produced these germs, or rather set them growing. Water was procured from various sewers, and after standing a few days to settle, six drops of clear water were mixed with 10,000 grains of West Middlesex and New River water. To six ounces of this mixture ten grains of pure sugar were added, a like quantity being mixed with six ounces of the water without the sewage. All these samples were placed in stoppered bottles in a window, where plenty of light could reach them. The water and sugar remained clear and sweet. The water with this trace of sewage did the same. The water, sewage, and sugar became turbid, in times varying from twenty-four to sixty hours, and exhibited the cells and strings before spoken of, and ultimately the odor of butyric acid was always perceptible. One drop of fresh urine in 10,000 grains of water, a mixture which may be kept for weeks without showing any sign of turbidity, produced in twenty-four hours, abundance of cells, and in forty-eight hours, branched strings.

No other substances tried produced the same result, although urea, albumen, nitrates, milk, and other substances of unstable character, were experimented upon. Some of these produced growths of some sort, but none resembled the peculiar and unmistakable cells and strings referred to.

Mr. Heisch asserts that filtering the water through the finest Swedish paper does not remove the germs, as on the addition of sugar they grow as fast as ever. Boiling for half an hour in no way destroys their vitality. Filtration through a good bed of animal charcoal is, as far as he can find at present, effectual in removing them, and if the charcoal be well aired from time to time, it retains its power for several months; but if the water be passed continually through it without this precaution, it soon loses it, and the filtered water is as bad as the unfiltered. The softer the water the faster the germs grow.

In conclusion the author remarks, that he does not think these germs are the only unwholesome kind of organic matter that exists in water, or that water containing small numbers of them might not sometimes be taken with impunity; but he regards with great suspicion any water in which they exist, even in the smallest number, as they increase and multiply with great rapidity. The fact that in multitudes of cases increase of health and comfort has resulted from giving up the use of water in which they could be found, even where its use had not produced positive disease, confirms this opinion.

STONE CUTTING BY MACHINERY.

All materials except stone are now successfully worked by machinery. We do not, of course, mean to say that stone is not so worked to a limited extent, but, in general, hand work of this material still maintains itself, against all the innovations of inventors.

The general reason for this is, undoubtedly, the abrading action upon tools which do their work by scraping, or by continuous cutting. Steel tools thus used soon wear out, and require a great deal of attention to keep them in working order. There are some kinds of soft stone which may be planed or turned by steel tools to advantage; but with the harder varieties, chipping with hand tools is the only method extensively employed.

A glance at some of the attempts hitherto made at substituting machinery for manual labor in this field, may not be unprofitable in this connection.

One method consists in the employment of a sliding eccentric, connected with a bar, in which a series of chisels is fitted; the chisels being made to adapt themselves to the surface by suitable mechanism, and being forced into the surface of the stone by the revolution of the eccentric.

Another method consists in the employment of rocking beams, carrying tools with serrated edges bearing upon the surface of the stone to be cut, and acting upon it by virtue of the rocking motion of the beams. Disks with serrated edges have also been used, which were caused to press upon and roll backward and forward over the stone, abrading it, and reducing it approximately to the form required. Rolling edges not serrated have also been tried.

Another plan is that of weighted cutters, actuated by wipers, cutting the stone by the force of their fall.

Rotating cutters, operating on the principle of drills worked in gangs, have also been used. To make a long story short, it may be said that scarcely any conceivable form of steel tool, or method of applying it, has not been tried, but without any marked success.

The introduction of the black diamond, or carbon points, as stone-cutting tools, however, seems to re-open the entire field again. In this material we have a substance harder than the hardest flint, and if properly applied to its work, capable of sustaining a vast amount of wear. It can be applied on the principle of either chipping or grinding. Drills pointed by it penetrate the hardest materials with astonishing facility.

Already several important machines for rock drilling, dressing millstones, etc., in which these points are employed, have been invented, patented, and successfully worked. It now remains for some enterprising genius to demonstrate that, by the use of these points, stone moldings may be cut as wood moldings now are, entirely by machinery.

A description of a new English machine, somewhat enthusiastically praised in the London *Builder*, will remind our readers of many attempts unsuccessfully made in this country, and the *Builder's* encomiums will therefore be received with some grains of allowance.

The machine is at work at Battersea, England. It consists of a bed made to travel longitudinally, with a shaft mounted over it for receiving the revolving cutting or molding head. So far, the machinery resembles that used for sawing; the head, however, instead of being a plain disk, with cutters, is shaped to the profile of the required molding, and has the cutters fixed in it according to that outline. The rough block being fixed on the bed, which is made to advance while the head revolves, the upper face of the stone is cut very nearly to the shape of the desired molding; the edges, however, are rather blunt, and the surface shows the tool marks. When this operation has been performed, a scraping tool, formed exactly to the molding, is fixed over the block; and the block being made to traverse several times under this scraper, has its face finished true and smooth, with sharp, clean edges, and the perfect profile required.

The *Builder* says that, by this machine, strings and molded steps are well worked in a remarkably short time. The cutters being built up, as it were, can be made to give any required outline, and their form is such that they work a considerable time without needing grinding. A large amount of work for St. Thomas's Hospital has been done by one of these machines.

The journal referred to also asserts that great saving of money and time is effected by this improvement, and it thinks the machinery can scarcely fail to come extensively into use.

Possibly it may, but we do not share our cotemporary's hopes in regard to it.

THE ELECTRO DEPOSITION OF COPPER AND BRASS.

The above is the title of a paper recently read before the British Association by W. H. Walenn. As we cannot give place for the whole of this paper in our columns, and as a review may be made to contain such portions as are not of purely theoretical interest, we shall endeavor to compress into the present article the practical information contained in it, abstracting perhaps some portions which may be of such a character as to be only properly given in the language of the author.

The commencement of the paper is devoted to a review of Smee's work on Electro-Metallurgy, published in 1851, in so far as it relates to the subject under discussion. Much attention is given by Smee to the electro deposition of copper, from acid as well as neutral solutions, and he alludes to the cyanide of potassium as a menstruum for dissolving copper when articles of iron are to be coated with the first-named metal; but he omits to notice the evolutions of hydrogen during the deposition of the copper. He also gives five pages of his work to the discussion of the reduction of alloys in which, among other things, he mentions that zinc and copper have been deposited simultaneously by galvanic action, and afterwards alloyed by heat.

Mr. Walenn remarks that Smee was evidently not informed of Professor E. Davy's discoveries in 1830 (see "Phil. Trans," Vol. cxxi., pp. 147-164) or of the labors of M. de Ruolz in 1841, or of Mr. C. Walker in 1845. Certain patented inventions also refer to electro-brassing at this early date, *e.g.*, Fontaine Moreau's invention, No. 10,282, A.D. 1844; De la Salzède's process, No. 11,878, A.D. 1847; Fontaine Moreau's plan, No. 12,523, A.D. 1849; Russell & Woolrich's discoveries embodied in No. 12,526, A.D. 1849; and Steele's patent, No. 13,216, A.D. 1850.

Smee undoubtedly believed that the evolution of hydrogen gas was evidence of the existence of the metal in the non-reguline form. At the present time, however, it is well known that there are solutions which deposit reguline metal during the copious evolution of hydrogen, and this generally takes place during the deposition of alloys. The views of Smee will not stand the test of vigorous experiment when alkaline solutions are employed.

In regard to alkaline solutions, Mr. Walenn remarks that if first principles be consulted, it will appear that, in alkaline solutions, the proneness to evolve hydrogen gas during deposition, arises from the joint actiot. of two causes, one electrical, classified as such by Mr. Smee, the other chemical. The electrical cause is the small quantity of metal in solution in comparison to the electric power employed; this cause can be lessened or removed by using a solution that contains a greater percentage of metal than that usually employed. The chemical cause is the disposition of the metal of the alkali to go to the negative pole along with the heavy metal or metals, and thus, by being electro-deposited for an infinitely small space of time in contact with them, decomposing the water, thereby getting oxidized and setting free the hydrogen as a secondary effect; this cause can be eradicated by providing in excess a decomposable compound radical that will take a certain amount of combined oxygen with it to the cathode, and thus, when decomposed, will enable the hydrogen that would otherwise be evolved to be oxidized into water.

In the case of brass, a solution containing the cyanides of the component metals dissolved in excess of potassic cyanide, possesses the remarkable property of furnishing the copper and zinc to the cathode in such a form that, during during deposition, they unite and form a true alloy; this tendency to form a true alloy is increased by the presence of a salt of ammonium, for in connection with copper the gas that would otherwise be given off is replaced by metal, this result being secondary, and, in so far, a chemical reaction. It is usually deemed sufficient to charge the solvent solution (the potassic cyanide and ammoniacal salt solution) with brass by electrolysis, but this will be found on trial to evolve gas, and to be only workable by two Grove's cells. The author finds that it is practically serviceable to add to a solution that is charged with not less than two ounces of brass per gallon, as much of the metallic cyanides as it will take up, and then it will probably take still more of the copper and zinc oxides respectively. Should this treatment not perfectly prevent the evolution of gas, the ammonide of copper is added—about two or three ounces per gallon.

In treating the ordinary cyanide copper solution for the prevention of the evolution of hydrogen, the zinc cyanides and oxides, mentioned in the instance of the brass solution, are left out. When the evolution of hydrogen gas has been stopped by the means above set forth, a single Smee's cell is sufficient to deposit the alloy, thus showing that an intense voltaic current is not absolutely necessary, but that the process requires a certain condition of solution to give a perfect result.

The author prefers to use a menstruum containing potassic cyanide and neutral ammonium tartrate in equal parts, and dissolved in five times their weight of water, to dissolve the brass in. This is then treated, as explained above, to prevent the evolution of hydrogen. This solution is employed in conjunction with heat, and a single Maynooth cell or a magneto-electric machine of suitable power. It has been found, with some electro-brassing solutions, difficult to deposit continuously a given quality of brass; with this solution, the regulation of the proportions of copper and zinc in the alloy is made by altering the heat accordingly. If the solution be kept uniform, as shown by a ready test, it is very easy to deposit a given alloy at all times.

In coating wrought or cast-iron work, it is often advisable to coat with copper prior to electro-brassing; the alkaline bath should be employed at above the temperature of the air, sometimes 160° Fah.; this method of working promotes the contact of the coating. The article should be well cleaned, so as to have a metallic appearance, with a pickle of weak sulphuric acid, scrubbed with sharp sand, washed, scrubbed with a portion of the depositing solution, and then placed in the depositing trough. The electrical connections may then be made, and the coating allowed to form for two hours or more. When a sufficient thickness had been obtained, the article is washed, and dried in hot mahogany sawdust. The "tarnishing" of the coating increases its beauty, and does not impair the article, for the tarnish is not corrosive rust, like the oxide of iron, but is a protective film. Two hours' coating will protect from rust in ordinary indoor work, but the best protection from rust (and this is serviceable even in damp air) is to give two hours' coating in an alkaline bath, and then let the article remain all night in an ordinary acid sulphate of copper bath. If desired, a brass coating may be given over the last-mentioned copper coating. By suitable mechanical arrangements, the articles in the acid bath, and the dissolving plates therein, may be moved—preferably by a to-and-fro movement—during deposition. This treatment shortens the time of the deposit, and makes the deposit uniform.

The uses to which electro-brassing may be applied have yet to be greatly developed; among the rest may be mentioned: the prevention of rust; the giving of an improved printing surface to type and electro-types; coating the poles of electro-magnets for the prevention of the "residual charge" therein; covering rams, plungers, piston rods, rollers, etc., with an adhesive and endurable coating; also lining cylinders, pumps, and iron vessels with copper or brass. The application of the processes that have been described to many purposes of ordinary life, such as railings, architectural ornaments, etc., will exemplify the good results to be obtained by the union of the strength of iron with the beauty of copper or brass.

THE USES OF APATITE.

Since the discovery of phosphate of lime in South Carolina, considerable attention has been bestowed upon the importance of working all similar deposits that may be found in any part of the country, and much inquiry has been made in consequence for mines of apatite, or mineral phosphate of lime. We understand that this mineral has been found in the neighborhood of Crown Point, in this State, also at some point on the Hudson, and quite extensively in Canada. As it is likely to become an important article of commerce, we propose to give some account of its properties and uses. In its crystalline form, the mineral closely resembles the beryl, or emerald; so slight is the difference that mineralogists have been constantly deceived by it, and it early received the name "apatite" from a Greek word signifying "to deceive." It occurs occasionally on our island of New York, in six-sided prisms, and we hear that it has also been met with massive, and in considerable quantity. It is one of our most valuable rocks, very little known to unprofessional men, and yet capable of extensive use in agriculture and the arts. It occurs in altered crystalline rocks, especially in granular limestone, and ores of tin, iron, and other metals, and with gneiss, syenite, and mica rocks. The color is not always the same, but the prevailing shade is green; we have also blue, grayish green, grayish white, and brown.

The Canada deposit is an extensive bed ten feet broad, three feet of which are pure, sea-green apatite. At Crown Point, the deposit is fibrous; in New Jersey, shafts have been sunk, and the apatite brought out in masses weighing occasionally 200 pounds.

The composition of apatite varies almost as much as its color, but it is essentially composed of phosphoric acid, 42·00; lime, 54·00; fluorine, chlorine, etc., 4·00. Many specimens, however, do not have more than 90 per cent of phosphate of lime. The occurrence of phosphorus in association with iron renders the ore useless for metallurgical purposes, but if the apatite be in sufficient quantity, it might be worked for superphosphates and fertilizers.

The uses of apatite are not many, but they are important. It has been proposed and used as a substitute for bone ash, and in the manufacture of porcelain and milk glass, and in England, the apatite from Estremadura is taken for this purpose.

In the manufacture of phosphorus, the pulverized mineral is mixed with twice its weight of silica, in the form of sand or ground quartz, and 25 per cent. of charcoal, in a closed vessel, or peculiarly constructed furnace, and the whole heated to approaching white heat. The phosphate of lime is decomposed, and silicate of lime produced, and the phosphoric acid is reduced by the charcoal to the vapor of phosphorus, which passes into proper coolers, where it is condensed. The latest improvement is to add some soda to the quartz, thus producing a silicate of lime and soda, which is more readily fusible and more easily handled than the simple silicate.

The operation is carried on in France in something like a blast furnace, and is made continual by feeding with alternate layers of ore and fuel. In England, a native phosphate from the West Indies, called sombrerite, is somewhat used in the manufacture of phosphorus; and as this material, together with the South Carolina deposits and the mines of apatite of Canada, is much nearer us, we ought to make an effort to introduce this industry among ourselves. At the present time, very little, if any, phosphorus is made in this country.

The acid phosphate of lime can be made, according to Horsford's patent, from native phosphates. The mineral phosphate is dissolved in nitric acid, of specific gravity 1·23, in the proportion of two nitric acid, by weight, to three of phosphate of lime; and to the filtered solution is added two parts, by weight, of oil of vitriol, diluted with water, for the purpose of removing the lime and other impurities. This process furnishes the acid phosphate of lime in superior condition, for medicinal and culinary purposes.

This use of apatite alone would be of the utmost importance, could it be carried out economically and on a large scale, as chemistry has introduced no compound of greater value in medicine and in food than Horsford's acid phosphate. But the use to which phosphorus has been applied more extensively than to any other, is in the manufacture of a fertilizer known as the superphosphate of lime. The manufacture of this article is carried on in England and Canada, and in some parts of the United States, and is of the utmost importance to our agriculture.

We find in the *American Chemist*, for February, an article by Mr. Gordon Broome, giving the methods employed in Canada for the manufacture of superphosphates from apatite. The mineral is ground by an engine of fifteen horse power, which also turns the agitators during the treatment of the mineral by acid, and supplies steam to the sulphuric acid chambers adjacent to the mill. After the apatite is well pulverized, it is thoroughly mixed with oil of vitriol of the strength known as pan acid, in a suitable vat or tub, where it is thoroughly agitated until the conversion is deemed to be complete. The pasty mass is allowed to flow out of the bottom of the converter over the floor, where it soon becomes sufficiently dry to be fit for transportation in barrels, each containing about 286 pounds. It is, in this condition, only suited for agricultural purposes, as it is very impure. In a sample analyzed by Mr. Broome, there were found: Superphosphate of lime, 20·33; sulphate of lime (gypsum), 63·84; water, 5·50; other constituents, 10·33. The soluble phosphoric acid amounted to 12·33 per cent.

It is evident that this manufacture cannot be carried on profitably unless the same establishment manufactures its own sulphuric acid. As pan acid can be used, the expense of concentrating in glass or platinum vessels is saved, and the cost of packing and transportation avoided.

There is one serious difficulty encountered in the fumes of hydrofluoric acid that come off during the digestion of the mineral. These are very suffocating and dangerous, and it would be a valuable improvement if they could be condensed and made use of in the arts. This is done where fluor spar is employed as a flux in blast furnaces, and important applications are made of the acid thus economized.

In countries where hydrochloric acid is very abundant and cheap, it is substituted for sulphuric acid in the decomposition of apatite; but the resulting chloride of calcium absorbs water so rapidly, and keeps the mass so wet, that it is difficult to handle, and objectionable in every way. Manufacturers of artificial fertilizers sometimes remedy this evil by mixing various refuse animal matters with the mass, and then drying it, and at the same time adding to its value.

The chief importance of apatite is as a manure upon our crops. The strength of lands in the Eastern States has deteriorated so much that few crops can be profitably raised upon them, and it is becoming a serious question to decide what fertilizers are best adapted to remedy the evil. There seems to be no doubt that the phosphates are among the best enrichers of soil, and it is, therefore, important to have this industry more fully developed. To sum up the case for apatite, it will be seen that it has the following important uses;

1. In the manufacture of phosphorus.
2. Acid phosphate of lime.
3. Superphosphate of lime for manure.
4. Manufacture of porcelain.
5. Manufacture of milk glass.
6. Hydrofluoric acid, as an incidental product.

THE AVERAGE CITY DWELLING HOUSE.

The average city dwelling house of 1871 is not what it ought to be, when contrasted with the vast improvements made in all other departments of construction. Built to make as much show as possible with the least expenditure, it is a delusion to the inexperienced buyer, and a snare to the tenant, who has not yet learned the defects that a year or two of use will be sure to develop.

A young couple beginning their experience in house hunting and house keeping, after spending a week or two in discouraging search, at last find a tenement which seems adapted to their wants, at a rent which does not, perhaps, greatly exceed what they can afford to pay; or the house is, perhaps, purchased at what seems a reasonable price. The house is prettily painted, the walls are clean, white, and unbroken (being new), the modern improvements—including bath room, water closets, and gas fixtures—are seemingly convenient and substantial, and the courtyard is laid out with some show of taste. But ere long the walls show ugly seams and cracks; the doors shrink incontinently; the water fixtures obstinately refuse to be kept in order; the floor planking begins to creak, and the entire structure shows decided evidences of weak constitution.

The boiler which supplies hot water to the bath begins to develop troublesome leaks. The plumber is called to the rescue, and loads it with unsightly heaps of solder, which might almost be silver at the prices charged. It is astonishing how the specific gravity of solder increases in this sort of patching.

Then, by and by, the water is drawn off, and the goddess of the kitchen, through ignorance or neglect, lets the boiler collapse. The plumber is again called, who gives the comforting information that its thinness will not permit it to be re-rolled, at an expense of ten or twelve dollars, but that it is, and always was, a shabby affair, and if the luxury of warm bathing be continued, it must be at the expense of forty or fifty dollars for a new boiler.

Winter comes, and a new difficulty is experienced with the water pipes. Relying upon the fact that these are carried up between two buildings and inclosed in the walls, it is supposed they cannot freeze; but they *do* freeze, and burst; and walls, carpets, and furniture are injured, if not ruined, by the flood. Again the plumber is called. You can find plumber's shops as plenty as drug stores. No wonder; there is plenty of business going. The plumber is all smiles. He proceeds to demolish the plastering to reach the pipes, so that in addition to the damage by water, there is the damage by lime-dust. His labors completed, and his not small bill settled, the plasterer follows, careful not to let his work be speedily forgotten, by bespattering with mortar every available spot of floor and paint upon which his mark can be left.

Why water pipes should be placed under the plastering is a mystery to us, especially as they seem artfully contrived to give as much trouble as possible to the inhabitants of the average city dwelling house.

Further developments will show that the roof is made to last scarcely more than four or five years. The leaders are made of some flimsy material, the nature of which is concealed by painting, but which in two or three years is found to be consumed by rust, and to crumble into pieces like a Boston cracker.

The moral of all this is, that if a man want a good house he must own, not rent it; and if he would own a house that shall be worth the money he pays for it, he must have it built under his own supervision; or, if he be not competent to supervise, he must employ the services of a competent and reliable architect.

The profits to builders of the average dwelling house are very great, as any one will find by a proper investigation of the cost of materials and labor. Invest these profits in superior material and workmanship, and, while your house will cost you no more, it will be at least one third better.

ANNUAL REPORT OF COMMISSIONER OF PATENTS.

UNITED STATES PATENT OFFICE, January 31, 1871.

To the Senate and House of Representatives of the United States of America, in Congress assembled:

By the 9th section of the Act of Congress, approved July 8, 1870, entitled "An act to revise, consolidate and amend the statutes relating to patents and copyrights," the Commissioner of Patents is required to lay before Congress, annually, in the month of January, a report, giving a detailed statement of all moneys received for patents, for copies of records or drawings, or from any other source whatever; a detailed statement of all expenditures for contingent and miscellaneous expenses; a list of all patents which were granted during the preceding year, designating under proper heads the subjects of such patents; an alphabetical list of the patentees, with their places of residence; a list of all patents which have been extended during the year; and such other information of the condition of the Patent Office as may be useful to Congress or the public.

In compliance with this requirement of the statute, I have the honor to submit the following report:

The receipts and expenditures of the Office for the year ending December 31, 1870, and the condition of the balance in the Treasury on account of the patent fund, as well as the character and extent of the business done by the Office during the year, are shown in the following statements:

Amount received on applications for patents, re-issues, extensions, caveats, disclaimers, appeals, and trade-marks, etc.	$669,456·76
Amount paid for salaries, photography, stationery, and miscellaneous expenses, etc.	557,147·19

STATEMENT OF BALANCE.

Amount to the credit of the Patent Fund, January 1, 1870	531,045·64
Fund of receipts during the year 1870	669,456·76
Total	$1,200,502·40
From which deduct expenditures for the year 1870	557,147·19
Balance on the 1st of January, 1871	$643,355·21

BUSINESS OF THE OFFICE FOR THE YEAR 1870.

No. of applications for patents during the year 1870		19,171
No. of patents issued, including reissues and designs		13,321
No. of applications for extensions of patents		200
No. of patents extended		111
No. of caveats filed during the year		3,273
No. of patents expired during the year		2,543
No. of patents allowed, but not issued for want of final fee		1,016
No. of applications for registering trade-marks		188
No. of trade-marks registered		131
Of the patents granted, there were to citizens of the United States	12,677	
Subjects of Great Britain	349	
Subjects of France	89	
Subjects of other foreign governments	206	
		13,321

The patents issued to citizens of the United States were distributed among the citizens of the several States, Territories, etc., as follows:

Alabama	86	Montana	1
Arkansas	11	Nebraska	16
California	216	Nevada	9
Colorado Territory	18	New Hampshire	111
Connecticut	739	New Jersey	474
Delaware	39	New Mexico Territory	21
District of Columbia	174	New York	2,962
Florida	5	North Carolina	54
Georgia	81	Ohio	982
Illinois	835	Oregon	22
Indiana	452	Pennsylvania	1,481
Iowa	208	Rhode Island	197
Kansas	46	South Carolina	35
Kentucky	148	Tennessee	109
Louisiana	111	Texas	48
Maine	139	Utah Territory	1
Maryland	206	Vermont	123
Massachusetts	1,448	Virginia	110
Michigan	401	Washington Territory	1
Minnesota	70	West Virginia	47
Mississippi	50	Wisconsin	22
Missouri	210	Wyoming Territory	1
Citizens of the United States residing in foreign countries			17
Persons in the U. S. Army			7
Persons in the U. S. Navy			1
Total			12,677

COMPARATIVE STATEMENT OF THE BUSINESS OF THE OFFICE, FROM 1837 TO 1870, INCLUSIVE.

YEARS.	Applications filed.	Caveats filed.	Patents issued.	Cash received.	Cash expended.
1837	—	—	435	$29,289·08	$33,506·98
1838	—	—	520	42,123·54	37,402·10
1839	—	—	425	37,260·00	34,543·51
1840	765	228	478	38,056·51	39,020·67
1841	847	312	495	40,413·01	52,666·87
1842	761	391	517	36,505·68	31,241·48
1843	819	315	531	35,315·81	30,776·96
1844	1,045	380	502	42,509·26	36,244·73
1845	1,246	452	502	51,076·14	39,395·65
1846	1,272	448	619	50,264·16	46,158·71
1847	1,531	553	572	63,111·19	41,878·35
1848	1,628	607	660	67,576·69	58,905·84
1849	1,955	595	1,070	80,752·78	77,716·44
1850	2,193	602	995	86,927·05	80,100·95
1851	2,258	760	869	95,738·61	86,916·93
1852	2,639	996	1,020	112,656·34	95,916·91
1853	2,673	901	958	121,527·45	132,869·83
1854	3,324	868	1,902	163,789·84	167,146·32
1855	4,435	906	2,024	216,459·35	179,540·33
1856	4,960	1,024	2,502	192,588·02	199,931·02
1857	4,771	1,010	2,910	196,132·01	211,582·09
1858	5,364	943	3,710	203,716·16	193,193·74
1859	6,225	1,097	4,538	245,942·15	210,278·41
1860	7,653	1,084	4,819	256,352·59	252,820·80
1861	4,643	700	3,340	137,354·44	221,491·91
1862	5,038	824	3,521	215,754·99	182,810·39
1863	6,014	787	4,170	195,593·29	189,414·14
1864	6,932	1,063	5,020	240,919·98	229,868·00
1865	10,664	1,937	6,616	348,791·84	274,199·34
1866	15,269	2,723	9,450	495,665·38	361,724·28
1867	21,276	3,597	13,015	646,581·92	639,263·32
1868	21,420	3,705	13,378	681,565·86	628,679·77
1869	19,271	3,624	13,986	693,145·81	486,430·78
1870	19,171	3,273	13,321	669,456·76	557,147·19

A subject-matter index of the patents issued during the year 1870, an alphabetical list of the patentees, with their places of residence, and a list of the patents extended during the year, have been prepared, and are submitted herewith as a part of this report.

Called upon to perform the duties of Commissioner of Patents, temporarily only, until the gentleman already appointed to fill the vacancy occasioned by the resignation of the late Commissioner shall assume the office, it would manifestly be improper that I should embrace the present opportunity to recommend measures, the advisability of which can in any respect be called in question. I shall refrain, therefore, from any general discussion of the affairs of the Patent Office, and confine myself to two or three matters which demand early attention, and about which it would seem that there can be but little difference of opinion.

By the joint resolution providing for publishing the specifications and drawings of the Patent Office, approved January 11, 1871, it is provided that the publication of the abstracts of specifications and of the engravings heretofore accompanying the annual report of the Commissioner of Patents, shall be discontinued after the middle of the year 1869, the mechanical illustrations for the first six months of that year having been already prepared; and that in lieu thereof the Commissioner is authorized to have printed, for gratuitous distribution, 150 copies of the complete specifications and drawings of each patent thereafter issued, which copies, duly certified under the hand of the Commissioner and the seal of the Patent Office, are to be placed for free public inspection in the various State and territorial capitals, and in the Clerks' offices of the district courts of the various judicial districts throughout the United States; and this officer is further authorized and directed to have printed such additional numbers of copies of specifications and drawings, certified as before provided, as may be warranted by the actual demand for the same, to be sold at a price not exceeding the contract price for such drawings. It is also provided that the copies of drawings shall be made upon contract, after due advertisement by the Superintendent of Public Printing, under the direction of the Joint Committee on Printing.

This discontinuance of the publication of the mechanical report is in conformity with the recommendation of the late Commissioner of Patents. I have always doubted somewhat the wisdom of such a step, knowing, as I do, the avidity with which inventors, in all parts of the country, seek for copies of the report, and believing also that the matter contained therein, though necessarily imperfect, is nevertheless full of suggestion, and peculiarly calculated to furnish food for the inventive mind.

The delay heretofore connected with the publication of that report could have been entirely obviated by promptness in making the necessary appropriations for the work, as by proper management the office could easily have had all the matter ready for press within one month after the end of the year. If it were found that the report under the system of distribution heretofore adopted failed to reach the quarters where it would confer the most benefit, this evil could easily have been remedied by providing, among other things, that each patentee of a given year should receive as a gratuity one copy of the report for that year, and that the rest of the edition be sold at a price not exceeding the prime cost thereof. And as to the printed copies, to be hereafter placed at central points, as provided by the joint resolution, it is feared that they will be of comparatively little service to the great mass of inventors, who are scattered widely through the sparsely settled portions of the country, and who, practically, will have but little opportunity of consulting them. As evidence in the courts, as aids to patent solicitors, and to professional experts, upon whom inventors largely rely, and as sources of information to all persons living near the places of deposit, they will of course prove valuable, as furnishing more exact and reliable knowledge than can be gained from any other source. For this reason, they would form a most valuable adjunct to the present report; and, in view of the great benefits which the patent system has already conferred upon the nation—single inventions, like the sewing machine, the harvester, the telegraph, or vulcanized rubber, having more enriched the country than the whole system has cost, from its inauguration to the present time—I believe that the expense of retaining the mechanical report in addition to the new publication would be fully justified. The annual income of the Patent Office, in excess of its expenditures, would more than pay the cost of the proposed additional work; and the balance of six hundred and forty thousand dollars in the Treasury to the credit of the patent fund, warrants the most liberal policy in support of the workings of this bureau. The Government ought not to seek to raise revenue by levying taxes upon the inventive genius of the people; but all the money received from inventors should be expended in such a way as to secure the largest and most beneficent development of the patent system.

[The Commissioner then proceeds to remark upon the subject of reproducing the drawings*, that this should be done in the Patent Office, and not by contract. In dealing with contractors the office is compelled to part temporarily with the custody of its original records. When done in the office, the copies prepared for gratuitous distribution can be made uniform in size with those now made for office use, and a saving of many thousands of dollars could be effected annually. If, under the contract system, a smaller size be adopted, a recomposition of the letter press would be necessitated, involving an annual expense of not less than sixty thousand dollars, while the saving in paper and binding would not be more than thirty thousand dollars. For these reasons the Commissioner favors the performance of the work in the Patent Office. He also recommends an advance in the price of single copies and the accompanying drawings, making the minimum price ten cents, and the maximum fifty cents, the price of uncertified printed copies between these limits, to be fixed by the determination of the Commissioner].

By Section 20 of the Patent Act, approved July 8, 1870, the Commissioner of Patents is authorized to print or cause to be printed copies of the claims of current issues of patents, and copies of such laws, decisions, rules, regulations, and circulars as may be necessary for the information of the public.

Under this provision of law, the Office has for some time past been issuing a weekly "List of Patents," which contains the number, title, and claim of each patent issued, together with the name and residence of the patentee.

This publication costs the Government about five thousand dollars per annum. It is sold to subscribers at five dollars a year; and the amount realized from this source during the last year, is thirty-three hundred and sixty-eight dollars. The amount paid for advertising applications for the extension of patents during the same time is twenty-nine hundred and twenty-three dollars.

I would respectfully recommend that the Commissioner of Patents be authorized to enlarge the scope of the periodical publication named, so as to make it an official gazette, in which all the advertisements pertaining to the business of the office shall be inserted, in lieu of all other advertising as now required by law. At present the law requires that the Commissioner shall publish a notice of every extension application in one newspaper in the City of Washington, and in such other papers, published in the section most interested adversely to the extension of the patent, as he may deem proper. Under this law the patronage of the Office is distributed among three of the Washington papers, and a second copy of the advertisement is usually sent to some paper in the vicinity of the residence of the patentee.

This is at best an imperfect system of accomplishing the work intended, as there is no one paper in the entire country which contains all the advertisements of the Office, and which, therefore, a person concerned, professionally or otherwise, in extension applications can take, and feel assurance that the very case for which he is watching may not escape his eye. By the proposed change in this regard, all uncertainty of this kind would disappear; the public, both inventors and attorneys, would be much better served, since in connection with the list of claims they would receive the official advertisements without further expense; and a considerable saving to the government would be effected, both by the cessation of further payments for advertising, and by the largely increased circulation which by this means would be secured for the publication already authorized by law.

By Section 63 of the Patent Act, it is provided that an application for the extension of a patent shall be filed "not more than six months nor less than ninety days before the expiration of the original term of the patent." Under this section, applications are generally delayed until the last moment; and then it frequently happens, if the case be an important one, in which opposition is entered, and the taking of a large amount of testimony, to be obtained in remote and widely separated sections of the country, becomes necessary, that the application cannot be prepared for hearing until so late a day as to cause the careful consideration of it prior to the expiration of the patent, seriously to interfere with the Commissioner's duties in relation to other matters. It frequently happens, too, that on the day of hearing, a fatal defect in the presentation of the case is developed, which, if there were farther time at the disposal of the party, might be remedied. For these reasons, every such case, in my judgment, should be brought to a hearing at least four weeks before the date of the expiration of the patent. To this end, the application must be filed in the office at an earlier day than is now required by law. I would suggest that nine months be fixed as the maximum limit, and six as the minimum.

The business of the Patent Office for the past year is perhaps sufficiently exhibited by the tables already given, and does not call for any extended remark. I cannot, however, close this brief report without referring to the eminent service rendered by the late Commissioner, the Hon. Samuel S. Fisher, whose energy and ability in the discharge of his official duties have done so much to correct and systematize the practice of the office.

The periodical publication of the Commissioner's decisions, whereby the examiners, as well as attorneys, have received early information of the principles which controled the head of the office in deciding the cases brought to his personal attention, has proved a marked and most valuable feature of the late administration. Great care was also exercised in the filling of vacancies, the appointments being made with special reference to the merits of the persons receiving them, and in many instances after they had passed the ordeal of a severe competitive examination.

The manifest improvement thus effected, in the personnel of the Office, reflects credit upon the officer under whose administration it was brought about. The impress which he has left behind him will be lasting, and his official connection with the patent system will long be remembered with satisfaction and pleasure.

Respectfully submitted.

SAMUEL A. DUNCAN, Acting Commissioner.

* For economy of space, we have condensed that portion of the report relating to reproduction of drawings.—EDS

Business and Personal.

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

Answers to Correspondents.

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

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

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

Painting Whitewashed Walls.—In answer to question No. 4, January 28th, I will say: If the cracks be in the plastering, and the wash be sound around the cracks, plaster of Paris is the best thing to fill them with, as it hardens quickly, does not shrink, and leaves the surface on a plane with the wall. If the plaster of Paris set before it can be worked, wet it with vinegar. The stronger the acid, the slower it will set. If cracks be filled with putty, and the wall be painted in gloss color, the streaks of putty are very apt to be flat (no gloss), and if painted in flat color, the streaks are quite sure to have a gloss. These streaks, of course, will spoil the beauty of the work, but do not affect its durability. When filled with plaster of Paris the reversion of gloss never appears, if done as I shall direct. If the cracks be only in the wash, the latter is loosening from the wall; and if it has not begun to scale, it soon will, and all attempts to fasten it on and paint it, will be total loss. If it be loose enough to scrape off, scrape the wall, taking care not to gouge into the original wall. If not loose enough, let it alone until it is. If the wash be thin, solid, and even, it can be painted to look and wear well. When the surface is lumpy, rub the lumps off with a sandstone, or a brick. After a wall has been prepared, as in either of above cases, or if a wall that has never been washed is to be painted, size it with two coats of glue size (3 ounces glue to one gallon water). Be sure the glue is all dissolved before using any of it. Let the first coat dry before the second coat is put on. When the second coat is dry, paint as follows: Mix the first coat of paint in the proportion of 1 gallon raw linseed oil to 15 pounds white lead, ground in oil, and 1 gill of dryer. Second coat: 1 gallon raw linseed oil, 25 pounds white lead ground in oil, and ½ gill dryer. (The lead should be the best.) Then finish either in gloss or flat color, the same as if it were wood work, with one good coat of priming on. Shade all the coats of paint, as near as you can, to the color you wish to finish in. Mix the third and fourth coats the same as the first, that is, about the same thickness for a gloss finish, and a little thinner for a flat finish.—E. H. G., of Ohio.

Decomposing Water by Electricity, and using the Gases as a Motive Power.—Pumping water into a reservoir, and letting it run out to drive a wheel, would be nothing to the above application of electricity. The cost of a magneto-electric engine, or of a battery sufficiently powerful to decompose water in large quantities, would be one difficulty, and the certainty of blowing the engine out of the windows when the hydrogen and oxygen were fired, would be another. We advise our correspondent to read up in elementary chemistry and physics.

A Constant Battery.—A correspondent uses a zinc and carbon battery and complains that it runs down in a few hours. His sulphuric acid may have been too strong, and thus dissolved the zinc, or the nitric acid may have been too weak. By coating the zinc well with mercury, and using weak sulphuric acid, and substituting a solution of bichromate of potash for the nitric acid, he ought to be able to keep up action long enough to satisfy anybody. Such a thing as a constant battery that never requires looking after, and will run forever, does not exist, and will probably be invented in the same year as the perpetual motion.

Wire of Solder.—Take a ladle and bore a few holes in the bottom in a line with one another, say six holes, about the size you want your wire. When you get ready to pour, have a strip of smooth iron or steel (a saw blade being very good), have your pierced ladle in your left hand, having previously heated it in the melted metal; then dip up some metal with an ordinary ladle with your right hand, and pour it through the pierced ladle, at the same time moving the two along the strip of iron, and a few inches above it. After you get the hang of it you can make very pretty wire, smaller or larger as you move fast or slow.—H. W. S., of Ohio.

Potatoes as a Remedy for Incrustation in Boilers.—Let H. A. H. put into his boiler a peck of washed potatoes, boil with pressure ten hours, and then blow off. Repeat the process as often as necessary. Better use 25 pounds of potatoes than blow up the boiler, or stop to chisel off the scale. I answer for only lime deposits. I removed such an incrustation three sixteenths of an inch thick from a leg of a portable boiler by the use of potatoes in the manner directed.—C. E. G., of Conn.

Gearing Circular Saw.—E. O. T. wants to know if he can run a circular saw 400 revolutions per minute with gears direct from engine shaft to the arbors. I answer from experience—no. There are many practical difficulties that need not be specified in this answer.—C. E. G., of Conn.

T. J. W., of N. J.—Your method of boring curved cylinders is not practicable. It is not possible by any means known to us to bend a mandrel in a true circle, and if it were, a long mandrel so bent would spring out of truth from a very slight cause.

J. G., of Nebraska.—An answer to your question would involve a metaphysical discussion foreign to the scope of our paper.

D. E., of N. C.—Oils are deodorized, on a large scale, by oil of vitriol and super-heated steam. If they be sufficiently liquid, they can be passed through bone black. Permanganate of potash could also be tried.

A. P. L., of Ill.—It requires great skill to fill a mercurial barometer; the way to do it is described in most works on Natural Philosophy.

J. H., of Ill.—The best paint for a smoke stack, is asphaltum from the gas works.

Blueing Small Steel Articles.—Let J. W. K. give the pieces a bright fine polish, and lay them in a sheet-iron pan, with some slacked lime. Set the pan over a forge, or in any place where he can regulate the heat, and watch them carefully until they have the right color. If the steel be good, they will take on a bright vivid blue.—B. N. B.

J. L. I., of N. Y.—In computing the effective horse power of a steam engine, no allowance is made for loss by transmission through the crank other than that consumed by friction. Theoretically, the friction expressed in horse power is found by multiplying the weight in pounds of the rotating parts, into the distance in feet the bearing surfaces move over each other per minute, multiplying the product so found by the coefficient of friction for the peculiar materials of which the parts are made, and dividing the last product by 33,000. As, however, the above rule supposes perfection in construction, it will generally only approximate to the true friction. This is ascertained by the use of the steam engine indicator when the engine is running alone, or by the dynamometer when driving machinery. It is a mistake to suppose any loss arising from the *principle* of the crank. Both theory and practice show that there is no such loss.

J. E., of Texas.—The cause of the collapse of the steam pipe supplying steam to your shingle bolt steamer, was undoubtedly rapid condensation in the steam-box. As the steam is taken from the exhaust of a steam engine, it is evident that when no steam issues from the exhaust, such condensation would produce at least a partial vacuum in the pipe used, and it being of weak material (tin plate), the external pressure of the atmosphere crushed it.

J. H. C., of N. J.—The current of electricity produced by friction passed through a helix wound about a soft piece of iron, renders the soft iron electro-magnetic whenever the current is passed in either direction. The reversing of the direction of the flow reverses the polarity of the magnet, so that what is the north pole when the current flows in one direction will be the south pole when the current flows in the opposite direction.

W. D. S., of N. Y.—If the pressure of the atmosphere be excluded from the surface of water into which a pipe leading to a pump is inserted, no water can be drawn. We judge that this is the difficulty with your pump, but cannot say positively, as you do not state how you attach the pump to the pipe you have placed at the bottom of your well. The pipe being driven into the soft clay bottom, no air can reach the water through such material; so, if the pump be attached to the top of the pipe in such a manner as to prevent the ingress of air, no water can be drawn.

W. T. B., of Mo.—In our opinion electricity in any form has nothing whatever to do with boiler explosions. Our views on this subject ought to be well known to our readers, considering the amount we have published upon it. We call your attention to articles now in type in this office, and which will shortly appear. The views therein stated have our full concurrence.

J. B. E., of Pa.—The reason why 100° Centigrade do not equal 212° Fah., is that the zero on the Fahrenheit scale, is 32° below the freezing point of water, while the zero of the Centigrade scale is at the freezing point of water. 100° Cen. therefore equal 180° Fah., instead of 212° as you suppose.

J. H. D., of Mass.—Formerly indigo was used as "blueing" for laundry purposes. That now used is, however, for the most part, a soluble Prussian blue. Any good treatise on chemistry will give you the necessary formula for making this substance. You can buy it probably much cheaper than you can make it, unless you wish to use large quantities of it.

T. M., of Iowa.—The fatty acids (oil) cannot be profitably reclaimed from soap water.

Queries.

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

1.—Papier Mache.—I wish to know the way in which articles of papier mache are made, method of mixing the plastic material etc. Will some one give me full details of the process?—E. B.

2.—Cheap Battery.—Will A. G. kindly give more particular directions how to make a cheap magnetic battery? I should very much like to make one, but cannot from his former directions. How are the conductors to be arranged, and what are they to be made of? Must an unusual amount of care be taken to prevent accidents to children?—L. D.

3.—Power to Run Circular Saw.—What power will be necessary to run a 52-inch circular saw 700 revolutions per minute, with two inch feed?

4.—Wood Filling.—What is the best filling for black walnut and other woods—something that will dry quickly, work easily, and leave a nice level surface without raising the grain, transparent, so that the color of the wood will not be altered, and cheap?—M. W. B.

5.—Renovating Engravings.—How can old copperplate and steel plate engravings be renovated, when soiled by grease and dirt, and yellow from age? Is there a work in any language that describes a method for cleaning and bleaching such prints?

6.—Varnish for Axes.—What is the blue varnish used to cover the polished parts of axes and other edge tools? It resembles as nearly as possible the blue color caused by tempering.—E. T.

7.—Care of Engine.—What is the best substance to use for keeping the polished work of a steam engine bright?—C. H. C.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

APPLICATIONS FOR LETTERS PATENT.

69.—Casting Apparatus for Iron and Steel.—A. L. Holley, Brooklyn N. Y. January 11, 1871.

70.—Brick-molding Machine.—B. M. Gard, Urbana, Ohio, and E. R. Gard, Chicago, Ill. January 11, 1871.

85.—Steam Generator.—John F. Allen, New York city. January 12, 1871.

86.—Combined Tiller and Digger.—J. P. Ross, Newark, N. J. January 12, 1871.

100.—Apparatus for Protecting Troops under Fire.—W. S. Wetmore of United States, residing at 123 Chancery Lane, London, Eng.

103.—Transmitting Apparatus.—E Morris, Burlington, N. J. January 14, 1871.

124.—Ticket Punching, etc., Apparatus.—J. H. Small, Buffalo, N. Y January 18, 1871.

125.—Shot Pouch.—A. F. Allen, Providence, R. I. January 18, 1871.

126.—Table Spoons.—Elise de Busson, Yonkers, N. Y. January 18, 1871.

141.—Apparatus for Refining Liquors.—S. H. Gilman, Galveston Texas. January 19, 1871.

142.—Electric Telegraph Cables.—P. S. Devlan, Jersey City, N. J., and Isaac Pennington Wendell and Stephen Paschall M. Tasker, both of Philadelphia, Pa. January 19, 1871.

164.—Air and Gas Engines.—A. K. Rider, New York city. January 21, 1871.

167.—Means for Securing Artificial Teeth.—B. J. Bing, of St. Mary's county, Md., now residing at 15 Finsbury Place South, London, England. January 23, 1871.

177.—Cheesemaking Apparatus.—Artemus Holdredge, of West Burlington, and Benj. F. Harrington and H. H. Harrington of New Berlin, both in N. Y. January 23, 1871.

Recent American and Foreign Patents.

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

EXTENSION LADDER.—William Kean, Chicago, Ill.—This invention has for its object to furnish an improved ladder, which shall be so constructed that a man upon the top of the ladder, when raised against the wall of a house, can raise and lower himself as he may wish, making it very convenient and useful for firemen, painters, etc., and which shall, at the same time, be simple in construction and conveniently operated.

THILL COUPLING.—W. B. Meloney, M.D., Smyrna, Del.—This invention has for its object to furnish an improved thill coupling, simple in construction, cheap in manufacture, safe in use, durable, and not liable to get out of order, or to be injured by water or mud, and which will admit of the application of a rubber anti-rattling attachment, without interfering with the convenient attachment and detachment of the thills.

WHEELS AND AXLES FOR RAILROAD CARS.—W. Hudgin, M.D., Athens, Ga.—This invention has for its object to furnish an improvement in the construction of wheels and axles for railroad cars, which will enable cars to be readily and quickly adjusted to run upon a wider or narrower track, as may be required.

FLOORING CLAMP.—David Nevin, Georgetown, Colorado Territory.—This invention relates to a new implement for pressing boards together before nailing the same to the floor beams. The invention consists in a new construction of stock, which is made self-fastening to the beams, and in the connection therewith of a sliding spring clamp and operating lever.

ANIMAL TRAP.—James Caswell Parrish, Petersburgh, Va.—This invention consists mainly in a peculiar arrangement of a vertical rotary cylinder, provided with a coiled spring, the same being set each time an animal is entrapped, and the animal itself operating the cylinder by depressing or withdrawing a stop.

TRUSS BRIDGE.—John A. McKay, Auburn, Ind.—The object of this invention is to render truss bridges more firm under heavy pressure or concussion; and it is accomplished by the use of a metallic socket or cap of peculiar construction, which rests on the upper chords, and holds the ends of the cross counterbraces; and also in part by the construction of the side braces, and the attachment of their ends to the chords.

IRON ABUTMENT FOR BRIDGES.—Jacob S. Goshorn, Fort Wayne, Ind.—The object of this is to provide an improved method of constructing iron abutments or piers for bridges, by which they can be made substantial and durable, with less expenditure of time, labor, and money, than heretofore; and so that, when the plates are broken by ice or other cause, new plates can readily be inserted in place of the old ones, without the necessity of taking any part of the pier to pieces.

MACHINE FOR CUTTING CORN STALKS.—John Wood, Pilla, Iowa.—This invention consists in the combination, with a suitable frame, of two wheels, armed with radial blades, which, when the machine is drawn over a row of standing stalks, cuts off the same; and also in a drag to be placed beneath the wheels when the machine is moving over the highway.

BRAKE FOR RAILROAD CARS.—Charles W. Tierney, Altoona, Pa.—This invention relates to a new automatic mechanism for applying brakes to the wheels of railroad cars, and has for its object to make the apparatus self-acting in such reliable manner that the collisions of the cars produced by a slacking of the speed of a locomotive on a train in motion, will at once cause the application of all the brakes.

ÆOLIAN CHIME.—Heinrich Hermann, New York city.—This invention relates to a new chime, which is made of glass bells that are suspended from the branches of trees, or otherwise exposed to the air, provided with very light clappers, that will be swung to and fro by the action of the wind. The bells are properly tuned, and will, when the clappers are moved by the air, produce a series of harmonious, but more or less indefinable sounds, very pleasant to the ear.

HYDRAULIC APPARATUS FOR SHIPS.—Edward A. Inglefield, 10 Grove End Road, St. John's Wood, England.—This invention has for its object to obtain occasional power from the inflow of external water, employing constantly a moderate power for removing, by bilge pumps or other convenient means, the water which has done its work in entering the vessel.

FAUCET FOR DRAWING BEER.—Theo. W. Bartholomew, New York city.—This invention consists in the application to faucets of conical rubber sleeves, which serve as linings for the faucets in the barrel heads. The rubber prevents the splitting of the barrel heads, and the bending of the faucet, by injudicious application of the latter.

FOUNTAIN BLACKING BRUSH.—Albert D. Pentz, New York city.—This invention relates to a new and useful improvement in brushes for blacking boots and shoes, and consists in a fountain or chamber in the back of the polishing brush from which the liquid blacking is expressed by means of a valve and pressure on the supply brush.

DENTAL PREPARATION.—Edward G. Kearsing and Leonzo Kearsing, Spring Valley, N. Y.—This invention relates to a new and useful improvement in metallic preparations for dentists' use in filling decayed teeth, and it consists in the use of platina covered with gold.

MACHINE FOR DEGERMINATING MALT.—Karl Sauter, New York city.—This invention has for its object to construct a machine whereby the germs sprouting from grain, during the conversion of the same into malt, can be conveniently broken off and separated from the grain, so that they will not enter the still during the process of brewing.

SELF-CLOSING COCK.—William Dalziel, New York city.—This invention has for its object to prevent the waste of water or other liquid, drawn from reservoirs or other limited supply. The invention consists in providing the cock, through which such liquid is drawn, with a self-acting apparatus, whereby, after a certain quantity of the liquid has been drawn, the cock will invariably be closed.

SCAFFOLD.—Samuel Hollabaugh and T. W. Letts, Mount Union, Pa.—This invention relates to improvements in builders' and painters' scaffolds, of that class whereon the workman raises himself and the platform while on it, and it consists in a long frame or platform, mounted at each end on a pole, to slide up and down on it, and having a crank and pinion at each end, gearing into a toothed rack on the pole, for raising it or letting it slide down. The poles are to be arranged at the upper ends for splicing on additional pieces, to extend them for high buildings, and the platform is made two stories high, with a ladder connecting one with the other, for enabling the workmen to work over a greater area of space without moving it than they could otherwise do.

CLOVER STRIPPER.—John M. Hull and Albert C. Stifler, Alquina, Ind.—This invention relates to improvements in machines for stripping and gathering the seeds from the clover standing in the field, and it consists in a combination with a large box suspended from a truck and provided with fingers at the front of the bottom, resembling, in some respects, the guard fingers of a mower, to project into the clover and gather the tops into the angles between them; of a cutter and rake arranged to cut the heads and rake them back into the box, said cutter and rake working close to the fingers when moving backward, but rising upward when moving forward, to pass over the clover heads. The invention also comprises an adjusting apparatus for raising or lowering the front of the case.

WELL MOUSE, OR DEVICE FOR ENLARGING WELLS.—Thomas Donnelly, Pittsburgh, Pa.—This invention consists in a series of notched or serrated vertical bars, hinged at their upper ends to the head of a stem or stock. When put into a well, the bars may be forced outward by a collar which slides on the stem, thus enlarging the bore.

HAY AND COTTON PRESS.—Jacob L. White, Hernando, Miss.—This invention relates to a press in which the follower moves upward in the box, in order to compress the bale, and consists chiefly in the arrangement of toggles at the ends of the press box, in combination with a horizontal frame loosely inclosing said box.

PRINTING PRESS ATTACHMENT.—Alexander L. Bevans, Flushing, N.Y.—This invention relates to improvements in printing presses, and consists in an improved card guide and holding and discharging attachment, applicable to the Gordon card printing press.

CANCELING STAMP.—Gotlieb Rost, Union Hill, N. J.—This invention relates to improvements in the construction and arrangement of self-inking and revolving hand canceling stamps, for stamping letters, bills, notes, and the like.

TANNING.—W. C. Stone, Derby Line, Vt.—This invention relates to an improved process for tanning hides and skins.

APPLICATIONS FOR EXTENSION OF PATENTS.

MACHINE FOR SPLITTING WOOD.—William L. Williams, New York city, has petitioned for an extension of the above patent. Day of hearing, March 29, 1871.

BIT STOCKS.—Lydia Moore, Wilmington, Vt., has petitioned for an extension of the above patent. Day of hearing, March 27, 1871.

Official List of Patents.

ISSUED BY THE U. S. PATENT OFFICE.

FOR THE WEEK ENDING FEB. 7, 1871.

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111,505.—COFFEE-POT.—Niven Agnew, Delaware, Canada.
111,506.—ADJUSTABLE SHUTTLE BINDER.—N. J. Allen and James C. Moody, Brunswick, Me.
111,507.—SPARK ARRESTER.—T. A. Andrews, Jr., Philadelphia, Pa.
111,508.—FENCE.—Hugh M. Barber, Franklin Station, Ohio.
111,509.—FAUCET.—Thomas W. Bartholomew, New York city.
111,510.—CORN PLANTER.—Leander Becker, Jackson Township, Pa.
111,511.—APPARATUS FOR OILING FELLIES, SPOKES, ETC.—P. E. Bomby, Espy, Pa.
111,512.—LAMP FOR COAL-OIL STOVES.—John Bowles (assignor to himself and Samuel Bard), Augusta, Ga.
111,513.—OSCILLATING BALANCE STEAM VALVE.—John C. Bromley, Rock Island, Ill.
111,514.—PAPER-COLLAR BOX.—Lee Churchill, Troy, N. Y.
111,515.—HINGE FOR GATES.—Charles B. Clark, Buffalo, N. Y.
111,516.—BROILER.—Levi H. Colborne and David H. Lowe, New York city.
111,517.—COOKING STOVE.—John B. Crowley and Addis E. Chamberlain (assignors to Chamberlain & Co.), Cincinnati, Ohio.
111,518.—SELF-CLOSING COCK.—William Dalziel, New York city.
111,519.—CLOTHES DRIER.—Alfred Day, Skowhegan, assignor of one half his right to Francis Lyford, Augusta, Me.
111,520.—ASPHALT CEMENT FOR PAVEMENTS, DRAIN PIPES, ETC.—E. J. De Smedt, New York city.
111,521.—MAIL BAG FASTENING.—D. F. Dodge, Lowville, N.Y. Antedated January 28, 1871.
111,522.—CARRIAGE CURTAIN KNOB.—W. B. Douglass, Newark, N. J., assignor to Frederick Baumgartner, Brooklyn, N. Y.
111,523.—MACHINE FOR WARPING YARN.—George Draper, Hopedale, Mass.
111,524.—SASH HOLDER.—Henry W. Drott, Cumberland, Md.
111,525.—FUNNEL.—L. P. Edwards, Hamilton, Pa.
111,526.—WATER HEATER FOR STEAM BOILERS.—David. C. G. Field, Lowell, Mass.
111,527.—STEAM GENERATOR.—Loyal C. Field, Galesburg, Ill.
111,528.—BEDSTEAD FASTENING.—Sebastian Goetz, Reed's Mills, Ohio. Antedated January 25, 1871.
111,529.—INVERTIBLE TROUGH.—Francis J. Goldsmith, Concord, assignor of one half his right to Peter F. Young, Painesville, Ohio.
111,530.—FEED GRINDER.—Myron Gore, Ottawa, Ill.
111,531.—LAMP.—F. T. Grimes, Liberty, Mo.
111,532.—MACHINE FOR BORING POSTS.—Jesse R. Group, Idaville, Pa.
111,533.—LEATHER-PUNCHING AND CUTTING MACHINE.—E. E. Hardy and Napoleon Dubrul, Joliet, Ill.
111,534.—CARTRIDGE SHELL EJECTOR FOR REVOLVING FIRE-ARMS.—G. H. Harrington, Worcester, Mass.
111,535.—WATER-PROOF PIANO COVER.—H. F. Herkner, New York, and Jared W. Post, Brooklyn, N. Y.
111,536.—HYDRAULIC APPARATUS.—George H. Herring, Durand, Ill.
111,537.—ÆOLIAN CHIMING BELL.—Heinrich Herrmann, New York city.
111,538.—DOUBLE-ACTING ROTARY ENGINE.—J. P. Herron Atlanta, Ga. Antedated January 30, 1871.
111,539.—APPARATUS FOR TRANSMITTING POWER AND CHANGING THE SPEED.—Spencer Hiatt, Clayton, Ind. Antedated February 1, 1871.
111,540.—SCAFFOLD.—Samuel Hollabaugh and T. W. Letts, Mount Union, Pa.
111,541.—SHOES FOR THRASHERS.—D. W. Hollihan, San Francisco, Cal. Antedated January 26, 1871.
111,542.—AUTOMATIC STEAM WATER ELEVATOR.—Charles Houghton, Roxbury, Boston, Mass.
111,543.—WHEEL AND AXLE FOR RAILWAY CARS.—Wescom Hudgin, Athens, Ga.
111,544.—CLOVER HARVESTER.—John W. Hull and Albert G. Stifler, Alquina, Ind.
111,545.—FLOUR SIFTER.—Curtis Huntley, Lowell, Mass.
111,546.—STEERING APPARATUS.—E. A. Inglefield, 10 Groves End Road, St. John's Wood, England.
111,547.—MODE OF FASTENING HUB BAND, ETC.—James Ives, Mount Carmel, Conn.
111,548.—BATTER POT.—E. A. Jeffery, New York city.
111,549.—MANUFACTURE OF RUBBER FLOOR CLOTH, ETC.—H. W. Joslin, Jersey City, N. J.
111,550.—COUPLING FOR SHAFTS FOR MILLS.—William Kean, Chicago, Ill.
111,551.—PREPARATION OF PLATINUM FOR FILLING TEETH.—E. G. Kearsing and Leonzo Kearsing, Spring Valley, N. Y.
111,552.—BOILER TUBE PLUG.—Thos. La Blanc, Philadelphia, Pa.
111,553.—CARPENTER'S WORK BENCH.—Robert C. Love, Augusta, Me.
111,554.—SPRING BED.—Nicholas Mason, Lincoln, Mass.
111,555.—CHURN.—James McBride, Ithaca, N. Y.
111,556.—THILL COUPLING.—W. B. Meloney, Smyrna, Del.
111,557.—HARVESTER.—James Moran, Auburn, N. Y., and C. D. Wallace, Corry, Pa., assignors to themselves and H. K. Needham, St. Louis, Mo.
111,558.—TONGUE FOR CHILD'S CARRIAGE.—E. A. Morse, Rutland, Vt.
111,559.—MAT.—P. W. Neefus, New York city.
111,560.—FLOOR CLAMP.—David Nevin, Georgetown, Colorado Territory.
111,561.—INVALID BEDSTEAD.—J. H. Oerter, New York city
111,562.—CHURN.—William Parks, Meadville, Pa.
111,563.—CLOTHES DRYER.—A. H. Patch, Hamilton, Mass.
111,564.—RATCHET COUPLING FOR BARGES, ETC.—W. W Patterson and Edmund Bishop, Pittsburg, Pa.
111,565.—ARTIFICIAL FUEL.—B. F. Penny, Rochester, N. Y assignor to T. B. Curtis, New York city.
111,566.—FOUNTAIN BLACKING BRUSH.—A. D. Pentz, New York city.
111,567.—LATCH LOCK.—Nicholas Petré, New York city.
111,568.—WINE SIRUP AND BEVERAGE.—A. D. Puffer, Boston, Mass.
111,569.—KILN FOR DRYING MALT.—J. A. Remer (assignor to himself and Henry Assenheimer), New York city.
111,570.—PORTABLE SWING.—D. M. Reynolds, Chicago, Ill.
111,571.—POTATO DIGGER.—R. B. Robbins, Adrian, Mich Antedated Jan. 23, 1871.
111,572.—MACHINE FOR THREADING SCREWS.—D. M. Robertson, East Boston, and J. A. Bidwell, Boston, Mass.
111,573.—FERRULE.—W. H. Rodden, Toronto, Canada.
111,574.—THILL COUPLING.—L. S. Rowe, Derby Line, Vt., assignor to himself and U. T. Sheafe.
111,575.—RIVETING MACHINE.—William Sellers, Philadelphia, Pa.
111,576.—FEATHER RENOVATOR.—J. T. Seldon, Chicopee Mass.
111,577.—PORTABLE BOOK HOLDER.—C. W. Sherwood, Chicago, Ill.
111,578.—PORTABLE FENCE.—Hector Sinclair, New York city.
111,579.—PAPER FOR USE IN THE BOTTOMS OF BIRD CAGES. J. H. Singer, New York city.
111,580.—BOILER FURNACE.—Le Grand Skinner, Chittenango, N. Y.
111,581.—PRINTING PRESS.—E. H. Smith, Bergen, N. J.
111,582.—PULLEY.—S. A. Smith (assignor to Cresson & Smith), Philadelphia, Pa.
111,583.—TANNING.—W. C. Stone, Derby Line, Vt., assignor to himself and W. S. Foster.
111,584.—BRAKE FOR RAILWAY CARS.—C. W. Tierney, Altoona, Pa.
111,585.—WASH BOARD.—Westley Todd. Allegheny, Pa.
111,586.—PRISON LOCK.—H. R. Towne, Stamford, Conn.
111,587.—PERMUTATION LOCK.—H. R. Towne, Stamford, Conn.
111,588.—FLUTING MACHINE.—T. M. Tucker, Newark, N. J.
111,589.—STOVE DRUM.—Willard Twitchell, Syracuse, N. Y.
111,590.—LUBRICATOR FOR LOOSE PULLEYS.—Stephen Ustick, Philadelphia, Pa. Antedated Jan. 26, 1871.
111,591.—RAILWAY CAR BRAKE.—J. E. Weaver, Lancaster, Pa. Antedated Feb 4, 1871.
111,592.—CANDY-CUTTING MACHINE.—Christopher Wentz, Albert Green, and O. P. Connor, Trenton, N. J.
111,593.—APPARATUS FOR DELIVERING GRAIN, ORES, ETC., INTO GRINDING MILLS.—J. D. Whelpley and J. J. Storer, Boston, Mass.
111,594.—FEED CUTTER.—J. R. Whittemore, Chicopee Falls, Mass.
111,595.—LOOM-PICKING MOTION.—H. A. Whitten and E. D. Gove, Holyoke, Mass.
111,596.—DROP TUBE STEAM GENERATOR.—S. L. Wiegand Philadelphia, Pa. Antedated Jan. 23, 1871.
111,597.—VELOCIPEDE.—W. L. Williams, New York city Antedated Jan. 25, 1871.
111,598.—STEAM HEATER.—J. L. Winslow, Portland, Me.
111,599.—VESSEL FOR HOLDING OIL.—A. T. Woodward, New York city.
111,600.—HYDRAULIC TURNPIPE.—Samuel Adams, Michigan Bluff, Cal.
111,601.—WATER WHEEL.—J. P. Allen, Springfield, Ohio.
111,602.—COATING BRICK, WOOD, AND OTHER SURFACES ON WALLS, ETC.—E. E. Alvord, Salt River, Mich.
111,603.—DRIVING POWER FOR LOCOMOTIVES.—W. D. Arnett, Denver, Colorado Territory.
111,604.—SAND SIFTER.—William Bailey, Friendship, N. Y
111,605.—SCOOP AND SIFTER.—Joseph Baker, Trenton, Canada.
111,606.—FEATHER RENOVATOR.—James A. Bell (assignor to himself and Henry Z. Stetler), Tyrone, Pa.
111,607.—FRUIT JAR.—Mellville R. Bissell, Kalamazoo, Mich., assignor to Salmon B. Rowley, Philadelphia, Pa.
111,608.—FLOWER STAND.—Elijah D. Castelow, Meriden, Conn.
111,609.—ALCOHOL STILL.—George Clarkson (assignor to himself, Samuel D. Wilder, and Albert Sherwin, Elgin, Ill.
111,610.—STAIRWAY.—Charles Saunders Close, Philadelphia, Pa.
111,611.—MANUFACTURE OF STRAW-BOARD FOR THE CONSTRUCTION OF BUILDINGS.—Judd M. Cobb, Beloit, Wis.
111,612.—APPARATUS FOR CLEANING SULPHURETS AND OTHER ORES.—Charles C. Coleman, San Francisco, Cal.
111,613.—BOOT JACK.—Ezra Coleman, San Francisco, Cal.
111,614.—APPARATUS FOR FEEDING PULVERIZED FUEL TO FURNACES.—Thomas Russell Crampton, Westminster, London, Great Britain.
111,615.—APPARATUS FOR DISTRIBUTING AND FEEDING POWDERED FUEL TO FURNACES.—T. R. Crampton, Westminster, London, Great Britain.
111,616.—FURNACE FOR BURNING PULVERIZED FUEL.—T. R. Crampton, Westminster, London, Great Britain.
111,617.—SUSPENDER.—John W. Dayton, Waterbury, Conn.
111,618.—HAND VISE.—James W. Devlin, Yonkers, N. Y.
111,619.—SAW.—Henry Disston and Thomas Oates Hill (assignor to Henry Disston & Son), Philadelphia, Pa.
111,620.—DEVICE FOR ENLARGING WELLS.—Thomas Donnelly, Pittsburgh, Pa.
111,621.—VALVE AND COCK.—Isidore Dreyfus, New York city.
111,622.—HEATING STOVE.—S. H. Emery, Jr., and C. H. Castle, Quincy, Ill.
111,623.—SIFTER AND STRAINER.—Lyman Fay, Fall River Mass.
111,624.—WATER METER.—Thomas B. Fogarty, Brooklyn N. Y.
111,625.—BOOT AND SHOE FASTENING.—F. D. Ford, New Bedford, Mass.
111,626.—GATE LATCH.—Wm. Fosket (assignor to Charles Parker), Meriden, Conn.
111,627.—WALKING CULTIVATOR.—Andrew Friberg, Moline, Ill.
111,628.—SAFETY DEVICE FOR HATCHWAYS.—Alexander Fries, Cincinnati, Ohio.
111,629.—BRICK MACHINE.—Benjamin M. Gard, Urbana, Ohio, and Emery R. Gard, Chicago, assignors to United States Brick Machine Company, Chicago, Ill.
111,630.—WATER WHEEL.—James Gardner, South Lee Mass.
111,631.—CLOD FENDER.—Robert T. Gillespie, Millport, Ohio.
111,632.—PLANING MACHINE.—James Goodrich and Henry J. Colburn, Fitchburg, Mass.
111,633.—HARVESTER.—William F. Goodwin, Metuchen N. J.
111,634.—HORSE POWER.—William F. Goodwin, Metuchen N. J.
111,635.—HAIRPIN.—Charles M. Gormly, Pittsburgh, Pa.
111,636.—IRON ABUTMENT FOR BRIDGES.—Jacob S. Goshorn, Fort Wayne, Ind.
111,637.—DEVICE FOR SECURING CORKS IN BOTTLES.—S. L. Gouverneur, Frederick City, Md.
111,638.—APPARATUS FOR THE MANUFACTURE OF CONFECTIONERY.—William F. Goward, Boston, Mass.
111,639.—SECTIONAL STEAM BOILER.—James S. Griffith and Charles E. Emery, New York city.
111,640.—WINE AND CIDER PRESS.—Thomas W. Grinter Russelsville, Ky., assignor to James L. Haven, Cincinnati, Ohio.
111,641.—BRIDGE FOR SUPPORTING SHAFT-DRILLING MACHINES.—Joseph P. Griscom, Port Carbon, and John Fritz, Mahanoy Plane, Pa.
111,642.—EXPLOSIVE COMPOUND.—Joseph Hafenegger, San Francisco, Cal.
111,643.—CAM FOR QUARTZ MILLS.—Oliver P. Hart, Logtown Cal.

111,644.—Steam Road Wagon.—Charles W. Hermance, Schuylerville, N. Y.

111,645.—Pump.—Oliver Higgins, Napoleon, Ohio.

111,646.—Spring Bed Bottom.—E. B. Hill, Grand Rapids, Mich.

111,647.—Tap Wrench.—George W. Huntoon and Edwin Simonds, Lowell, Mass.

111,648.—Auger.—William A. Ives, New Haven, Conn.

111,649.—Bit Brace.—William A. Ives, New Haven, Conn.

111,650.—Feed-water Apparatus.—James Kindel, Wilmington, Ohio.

111,651.—Plow.—Sampson B. King, Starkville, Ga. Antedated February 8, 1871.

111,652.—Ice Crusher.—Oliver B. Kinsey, Newark, N. J. Antedated January 28, 1871.

111,653.—Portable Stall.—D. P. Leach and W. F. Leach, Franklin, Ind.

111,654.—Dyeing and Printing Textile Fabrics.—John Lightfoot, Lowerhouse, near Burnley, England.

111,655.—Medical Compound.—Henry Lister, Houston, Texas.

111,656.—Potato Digger.—George C. Love, English Center, Pa.

111,657.—Cooking Stove.—Peter Low, Cleveland, Ohio.

111,658.—Apparatus for Extracting Oil from Bone Dust.—William W. Lucas, Cleveland, Ohio.

111,659.—Faucet.—John R. Mackay, Meriden, Conn. Antedated January 28, 1871.

111,660.—Scaffold.—Nicholas Martz, Lykens, Pa.

111,661.—Manufacture of Paper, Cordage, Twine, etc.—James H. McConnell, Springfield, Ill.

111,662.—Truss Bridge.—John A. McKay, Auburn, Ind.

111,663.—Type Holder.—Wm. McNaughton (assignor of one half his right to John H. Trumbull), Chicago, Ill.

111,664.—Vent Plug.—Charles H. Miller and Wm. Ascough, Buffalo, N. Y.

111,665.—Wagon.—Alexander Moffitt, Washington, D. C.

111,666.—Vapor Burner.—Thomas Moore, Bloomington, and James O'Donald, Clinton, Ill.

111,667.—Dental Engine.—James B. Morrison, St. Louis, Mo.

111,668.—Die for Forging, Trimming, and Shaping Spring Clips for Carriages.—Francis B. Morse (assignor to H. D. Smith & Co.), Plantsville, Conn.

111,669.—Feeding Quicksilver to Stamps and Amalgamators.—George C. Munson, Empire City, Colorado Territory.

111,670.—Meat Cutter.—Hugh B. Murphy, Allegheny City, Pa.

111,671.—Animal Hoisting Apparatus.—Jason Newton, Marengo Township, Mich.

111,672.—Clock-Pendulum Rod.—Russell W. Norton, New Haven, Conn.

111,673.—Animal Trap.—James C. Parrish, Petersburgh, Va.

111,674.—Feeding Device for Carding and other Preparing Machines.—Edwin Pettitt, Manchester, England.

111,675.—Combined Grain Drill and Corn Cultivator.—David R. Platt, Jeffersonville, Ind.

111,676.—Gate.—John Pool, Elizabeth City, N. C.

111,677.—Governor for Steam Engines.—George F. Pottle, Boston, assignor to himself and Reuben K. Huntoon, Wakefield, Mass.

111,678.—Shuttle for Sewing Machines.—George M. Pratt, Middletown, Conn.

111,679.—Cast-iron Barrel.—Abel Putnam, Jr., Saratoga Springs, N. Y.

111,680.—Water Cooler.—Abel Putnam, Jr., Saratoga Springs New York.

111,681.—Propelling Apparatus for Boats.—Joseph Repetti, Philadelphia, Pa. Antedated February 4, 1871.

111,682.—Medicated Plaster.—Albert D. Richards (assignor to Tufts, Grosvenor & Co.), Somerville. Mass.

111,683.—Pen Holder.—Henry Roth, Virginia City, Nevada.

111,684.—Box for Packing and Transporting Sheet-metal Cans.—Charles E. Russ, Boston, Mass.

111,685.—Fertilizer Distributer.—Christopher Salvo (assignor to himself, Joseph C. Brewer, and Robert W. Milford), Columbus, Ga.

111,686.—Machine for Degerminating Malt.—Charles Santer, New York city, assignor to himself and G. Schütz, Jersey City, N. J.

111,687.—Corn Planter.—Levi Scofield, Watertown, Wis.

111,688.—Electrotype Die or Mold for Molding Plastic Materials.—David Scrymgeour, Foxborough, Mass.

111,689.—Rock Drill.—Jacob Shelley, Mahanoy Township, Pa.

111,690.—Shirt.—Solomon Sibley, Boston, Mass.

111,691.—Hot-blast Stove for Heating Air, Steam, etc.—Charles William Siemens and Edward Alfred Cowper, Westminster, and Charles Cochrane, Ellowes Upper Gornal, England; said Siemens and Cochrane assign their right to said Cowper.

111,692.—Railroad Ticket.—Joseph T. Smith, Louisville, Ky. Antedated February 4, 1871.

111,693.—Spring Bolt.—Wm. E. Sparks (assignor to Sargent & Co.), New Haven, Conn.

111,694.—Device for Reefing and Furling Sails.—Wm. Spear, Cape Elizabeth, Me. Antedated February 4, 1871.

111,695.—Car Coupling.—Laroy S. Starrett, Athol, Mass.

111,696.—Bee Hive.—Monroe J. Stearns, Galesville, Wis.

111,697.—Fountain.—Joseph Storer, Hammersmith, England.

111,698.—Cooking Stove.—David Stuart, Philadelphia, Pa.

111,699.—Combined Removable Cock and Fixed Socket.—Cornelius Sullivan, Boston, Mass.

111,700.—Sand or Emery Paper.—George C. Taft, Worcester, Mass., assignor to himself and Augustus B. Davis, Philadelphia, Pa.

111,701.—Filter for Cistern.—Robert W. Thompson, Mansfield, Ohio.

111,702.—Paper-cutting Machine.—Wm. H. Topham, New York city. Antedated February 1, 1871.

111,703.—Hub for Wheels.—James L. Van Wert, Tolland, Mass.

111,704.—Mill-stone Bail and Driver.—Albert G. Waldo, Milwaukee, Wis.

111,705.—Furnace for Burning Pulverized Fuel under Steam Boilers, Evaporators, etc.—James D. Whelpley and Jacob J. Storer, Boston, Mass.

111,706.—Hay and Cotton Press.—Jacob Lewis White, Hernando, Miss. Antedated Jan. 28, 1871.

111,707.—Electro Magnetic Alarm Bell.—Charles Williams, Jr., Somerville, and Jerome Redding, Charlestown, Mass.

111,708.—Wheel for Wheelbarrows.—George Withington, Ione City, Cal.

111,709.—Machine for Cutting Cornstalks.—John Wood, Pella, Iowa.

111,710.—Harness Snap.—Alonzo P. Woodard, Alfred Center, N.Y., and William Bruen, Newark, N.J.; said Bruen assigns his right to said Woodard. Antedated Jan. 28, 1871.

111,711.—Medicated Smoking Tobacco.—Wesley A. Wright, Lynchburg, Va.

111,712.—Treating Smoking Tobacco.—Wesley A. Wright, Lynchburg, Va.

111,713.—Device for Saving Gold Amalgam and Quicksilver.—Oliver H. Young and Daniel J. Vaughn, Wisconsin Hill, Cal.

111,462.—Propulsion of Canal Boats.—Thomas Main, Green Point, N.Y. Dated Jan. 31, 1871.

REISSUES.

4,252.—Cultivator.—Augustus Adams, Sandwich, Ill., assignee of William A. Dryden and Cyrus E. Dryden. Patent No. 67,173; dated July 30, 1867.

4,253.—Manufacture of Enameled Bracelets.—Abiel Codding, Jr., North Attleborough, Mass. Patent No. 91,604; dated June 22, 1869.

4,254.—Cooking Stove.—Charles P. Geissenhainer, Pittsburgh, Pa., assignor to Esek Bussey and Charles A. McLeod, Troy, N. Y. Patent No. 32,764; dated July 9, 1861.

4,255.—Ventilator.—Melville E. Mead, Darien Depot, Conn. Patent No. 90,180; dated May 18, 1869.

4,256.—Shaft Coupling.—Silas C. Schofield, Chicago, Ill. Patent No. 63,182; dated March 26, 1867.

4,257.—Overshoe.—Henry G. Tyer, Andover, Mass. Patent No. 68,398; dated September 3, 1867. Reissue No. 2,830; dated December 24, 1867.

DESIGNS.

4,623.—Heater for Milk, etc.—George Sumner Albee, Hopkinton, Mass.

4,624.—Carpet Pattern.—John H. Bromley (assignor to John Bromley & Sons), Philadelphia, Pa.

4,625.—Liquor Holder.—James A. Dunworth and Frank Dunworth, New York, assignors to "Vidvard and Sheehan," Utica, N.Y.

4,626.—Type.—Heinrich Flinsch, Frankfort, Prussia.

4,627.—Type.—Andrew Gilbert, Boston, Mass.

4,628.—Show Case.—Winfield S. Grove (assignor to himself and Abraham B. Grove), Philadelphia, Pa.

4,629.—Show Card.—Charles S. Hall, Rochester, N. Y.

4,630.—Match Safe.—Albert D. Judd, New Haven, Conn.

4,631.—Dovetail.—J. Dwight Kellogg, Jr., Northampton, Mass.

4,632 and 4,633.—Carpet Pattern.—Hugh S. Kerr (assignor to Israel Foster), Philadelphia, Pa. Two patents.

4,634 and 4,635.—Chair.—Anton Kimbel, New York city. Two Patents.

4,636.—Carpet Patterns.—Christian J. Koch (assignor to John Bromley & Sons), Philadelphia, Pa.

4,637.—Sieve.—Robert J. Mann, Dallas City, Ill.

4,638.—Drawer Pull.—Julius E. Merriman (assignor to Foster, Merriam & Co.), West Meriden, Conn.

4,639.—Oil Cloth Pattern.—James Patterson, (assignor to Thomas Potter, Son & Co.) Elizabeth, N.J.

4,640 and 4,641.—Mold for Lager Bier Glasses.—John P. Pears, Pittsburgh, Pa. Two patents.

4,642.—Lead Pencil.—Joseph Reckendorfer and Teile H. Müller, New York city, assignors to Joseph Reckendorfer.

4,643 and 4,644.—Bracelet.—Theron I. Smith, North Attleborough, Mass. Two patents.

4,645.—Stove Plate.—Nicholas S. Vedder and Francis Ritchie (assignor to Hicks & Wolfe), Troy, N.Y.

TRADE MARKS.

148.—Composition Oil.—Butler & Haynes, Bangor, Me.

149.—Shoes, Brogans, and Boots.—Edward Francis Jones, Farmington, N.H.

150.—Sugar, Sirup, and Molasses.—William Moller & Sons, New York city.

151.—Machinery Oil.—Charles L. Morehouse, Cleveland, Ohio.

152.—Illuminating Oil.—Charles L. Morehouse, Cleveland, Ohio.

153.—Lubricating Oil.—Charles L. Morehouse, Cleveland, Ohio.

154.—Factory Oil.—Charles L. Morehouse, Cleveland, Ohio.

EXTENSIONS.

Machine for Paring and Slicing Apples.—D. H. Whittemore, Worcester, Mass. Letters Patent No. 16,417; dated January 13, 1857.

Platform Scales.—Thaddeus Fairbanks, St. Johnsbury, Vt. Letters Patent No. 16,381; dated January 13, 1857. Reissue No. 445; dated March 31, 1857.

Platform Scales.—Francis M. Strong and Thomas Ross, Vergennes, Vt. Letters Patent No. 14,119; dated January 15, 1856.

Sewing Machine.—Albert F. Johnson, Parkville, N. Y. Letters Patent No. 16,387; dated January 13 1857.

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Pursuant to an order of the Stockholders of the Atlantic Iron Works and Dock Company, I will sell at public auction, to the highest bidder, on the premises, on WEDNESDAY, the 8th day of March, at 12 o'clock M., that valuable and well known property,

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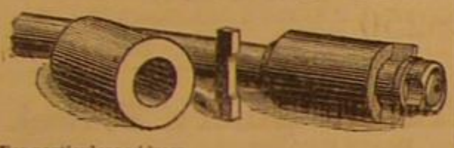

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Intercolonial Railway, Commissioners' Office, Ottawa, 19th January, 1871.

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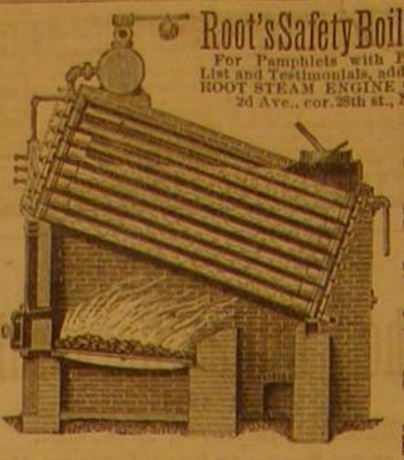

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