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Improvement in Looms.

We are seldom called upon to illustrate and describe a more important invention than the one shown in the accompanying engravings. The precise date at which the shuttle in the form which it has held so long was first employed in weaving would be hard to fix. It is mentioned in Job vii., 6. "My days are swifter than the weaver's shuttle." In this passage evident allusion is made to the darting motion of the shuttle when thrown by hand, and it is a most beautiful poetic figure by which the brevity of life is illustrated.

It is certain that the throwing of the shuttle by hand was practiced many centuries ago, and the fact that this method is still retained in the manufacture of many kinds of fine fabrics shows how difficult has been the substitution of any application of power to this motion, which could adequately take the place of the hand, in all kinds of weaving.

The introduction of the picker staff and its adjuncts to actuate the shuttle was an immense stride in the art of weaving. It and the Jacquard attachment constitute perhaps the most remarkable improvements made in the art of weaving up to the date of the present invention.

Notwithstanding the persistence with which the ancient form and method of actuating the shuttle have held their ground, there have always existed serious difficulties, which it was desirable to obviate. Without entering too minutely into details which are perfectly familiar to those acquainted with the art of weaving in all its branches, we will specify a few important defects that the general reader may understand the important advantages the device under consideration is destined to accomplish.

First, the distance to which the shuttle can be thrown with certainty, either by the hand, or by the use of the picker staff, is limited, and the difficulty of weaving wide goods is consequently so much greater than that of medium or narrow textures of similar materials, that the cost of wide goods per square yard is considerably more than the narrow. This alone would render a shuttle motion, capable of weaving wide goods as cheaply as narrow, a great desideratum.

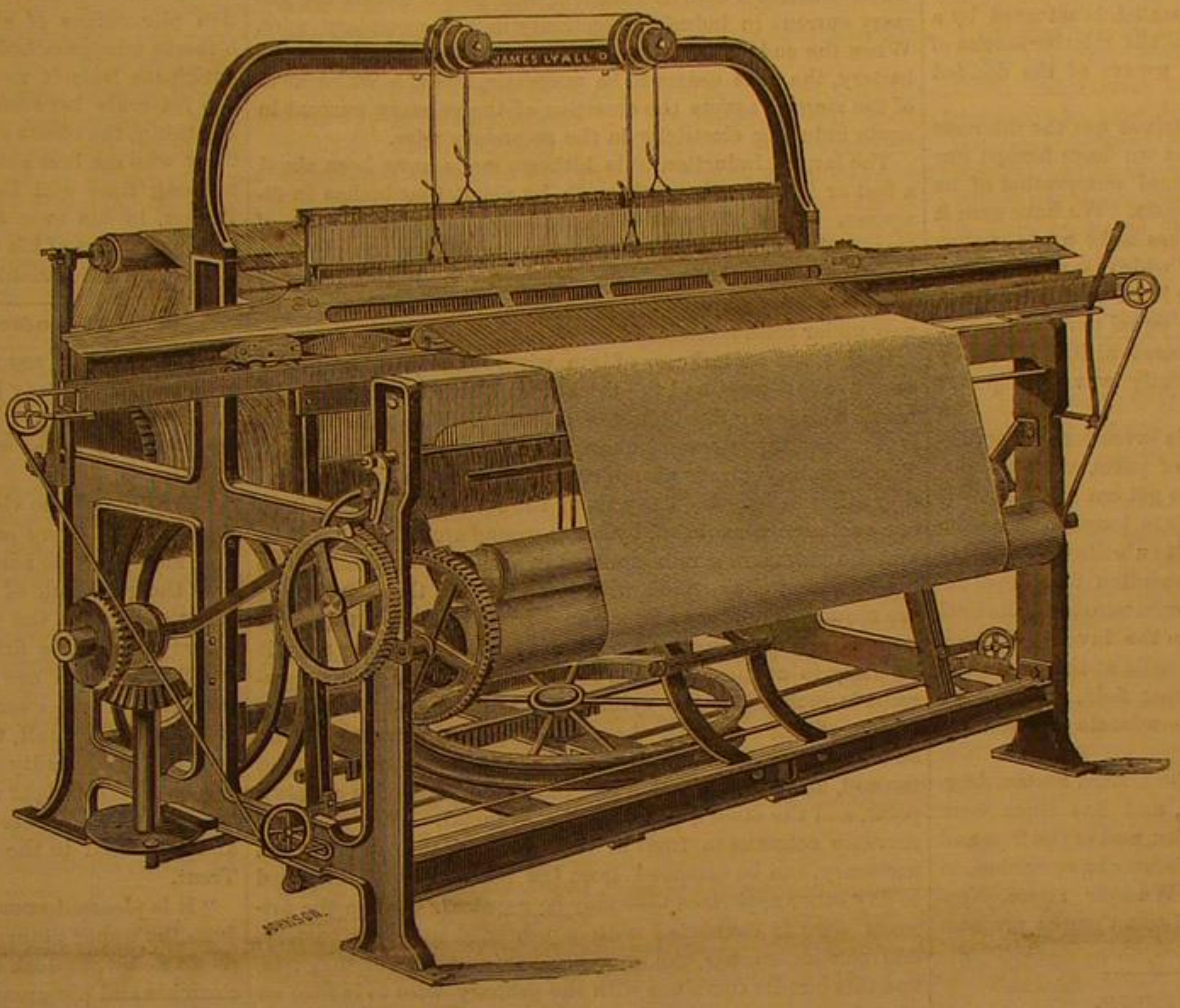
Second, the motion of the shuttle, having no positive relation to the other parts of the loom, the operator has no control over it during the time it is traversing the distance between the shuttle boxes; and the motions of the other parts, if by accident they should take place a little too soon, through the breaking of any of the working parts, or from any other cause, are liable to clash with that of the shuttle. To illustrate this, suppose the shuttle, impelled by too feeble a stroke, to pause in its passage between the sheds of the warp. In a power loom of the ordinary construction the lay would then make its beat, and either drive the shuttle through the warps, making an extensive breakage, or it would spring the dents of the reed. Or both these accidents may occur at the same moment.

In a piece of fine goods the bending of the dents is a disaster which cannot be wholly repaired. They cannot be again perfectly straightened without taking the piece out of the loom, and if the piece is woven to the end with such a defect in the reed, a slack woven streak will appear through the entire remainder of the tissue. In order that the shuttle may traverse with certainty, a regular speed must also be maintained, below which it is impossible to work a power loom with success.

Third, the shuttle reaches the shuttle box after its flight in either direction, and comes to rest before the lay makes its beat. An adjustment so perfect that, at this point, the thread of the weft shall be firmly drawn up against the exterior threads of the warp opposite the shuttle, is necessary to make a perfect selvedge. This perfect adjustment is difficult of attainment, so much so that the character of the selvedge on a piece of linen or silk goods is one of the criterions by which the quality of the article is determined.

To remedy these defects *in toto*, was a reform so radical in its nature, that a motion radically different was necessitated. It is evident from the nature of the case that no absolute connection between the shuttle and any appliance working exterior to the sheds of the warp, can be made capable of lateral motion without breaking the threads. The problem may therefore be enunciated as follows:

Required to produce absolute, positive, and uniform motion in a shuttle, by means of an external appliance moving exteriorly to the sheds of the warp *without absolute and positive connection between the shuttle and the motor through which it receives its motion.* A problem which the majority of mechanics would have pronounced impossible had not its possibility been demonstrated by this invention. But the problem is further complicated by another condition which is omitted in the general enunciation, namely, no lateral motion must be imparted to the threads of the warp.



LYALL'S PATENT POSITIVE MOTION LOOM.

Fig. 2.—Elevation of the Shuttle and Shuttle Carriage.

The ingenious method by which these conditions are fulfilled is shown by Fig. 2, which represents the shuttle resting in its carriage, *o*. Motion is imparted to the carriage and through it to the shuttle by means of a stout cylindrical band, *n*, in a manner to be hereafter described.

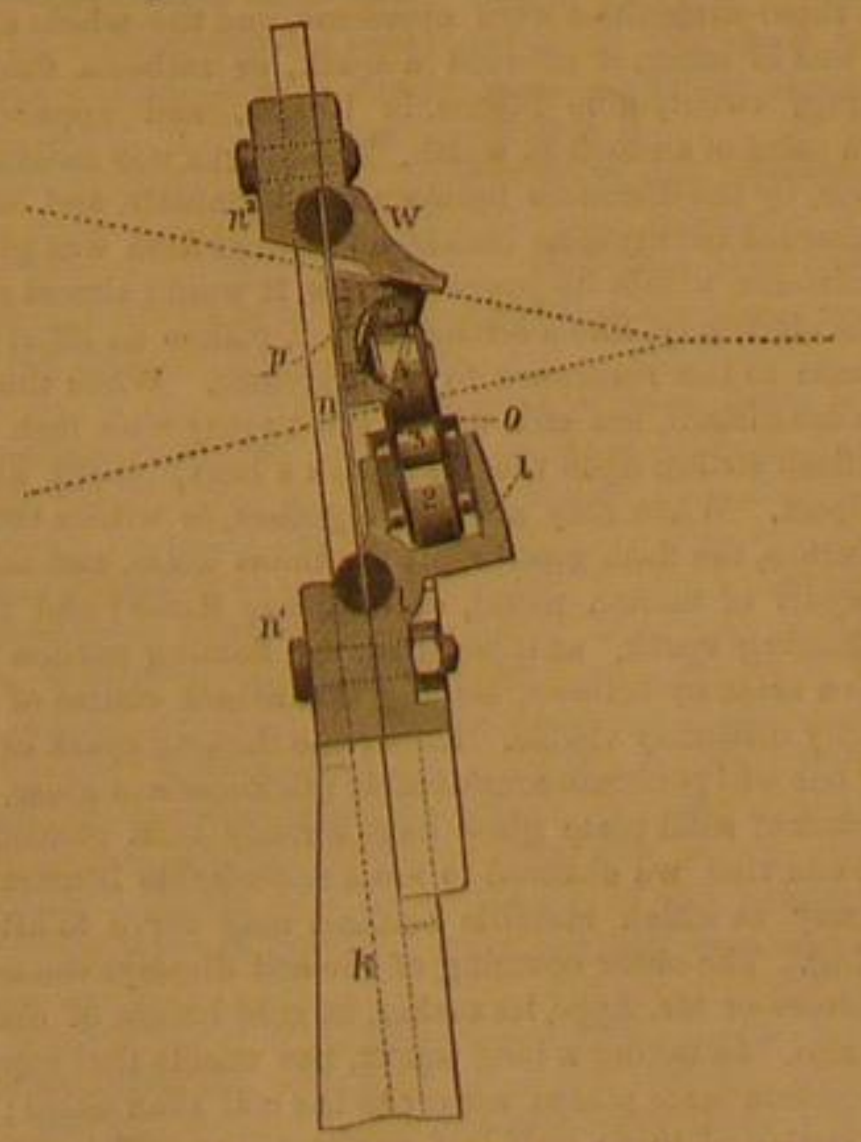


Fig. 3.—Section of Lay and Reed containing Shuttle and Shuttle Carriage

Let the reader now imagine a sheet of parallel threads stretched between the shuttle, *p*, and its carriage, *o*, and bear in mind that *l* is the upper surface of a race-way running across the lay beneath the warp, upon which the wheels numbered 2 roll. Also notice that the pivots of the wheels, 2, play in slotted bearings, so that their upper surfaces roll on the lower surfaces of the wheels numbered 3. Now suppose the shuttle to be taken off the carriage or driver, *o*, and let this be drawn to the left in the direction of the arrow. It is now evident that the wheels, 2, will revolve in the direction of the arrows drawn upon them, and that their circumferential motion will always be exactly equal to the motion of the carriage, *o*, upon the race-way, *l*, of the lay. But as the slotted bearings of the wheels, 2, allow the weight of the carriage to rest on the pivots of the wheels, 3, and these wheels rest on the tops of the wheels, 2, the wheels, 3, must evidently receive a counter motion in the direction of the arrows marked on them, exactly equal to the motion of the wheels 2, which is likewise equal to the motion of the carriage along the race-way, *l*. If now the sheet of threads be brought into contact with the wheels, 3, it will be seen that while the wheels, 2, are rolling along the race-way, *l*, the wheels, 3, are rolling along the *under* side of the shed of *warp threads*, causing no more lateral motion in those threads than the wheels, 2, cause in the lay, *l*, which is nothing.

We have now seen that the carriage itself produces no tendency to lateral motion in the threads of the warp. Now let us lay on the shuttle, holding it to its place by a beveled rail, a section of which is shown at *w*, Fig. 3; and move the carriage in the same direction as before. The wheels, 2, revolve to the left, and cause wheels, 3, to revolve to the right, and roll along the bottom of the sheet of warp threads. Some of these threads will be successively engaging at each moment between wheels, 3 in the carriage, and wheels, 4, in the shuttle; and, as these threads may be moved in a vertical direction without conflicting with the object we wish to attain, wheels, 4, also commence rotating to the left and thus roll along the top of the sheet of warp threads, at exactly the same speed as wheels, 3, so that each thread of the warp in succession is passed between the lower surfaces of the wheels, 4, and the upper surfaces of the wheels, 3, without being pulled laterally, their only motion being a slight vertical one, owing to the relative positions of the wheels. The wheels, 5, do not engage with the wheels, 4, but roll along the under surface of the beveled rail, *w*, Fig. 3, holding the shuttle down to its work.

The formation of the race-way in which the shuttle carriage rolls, is shown in Fig. 3. The back is the reed, *n*. The beveled rail which holds the shuttle from falling off the carriage in front, is shown at *w*, and another rail, *l*, does the same for the carriage. When the shuttle and carriage are in place they can only be removed by drawing them out at the end of the lay, unless the bevel rail be taken off by unscrewing the bolts which hold it in place. The extreme lightness with which the parts move, is shown by the fact that, in our recent examination, we found we could easily actuate the loom weaving the six yards wide drugget, by a crank screwed on to the main shaft; the labor being scarcely more than that required to turn a grindstone.

Fig. 1 is a perspective view of a power loom with this shuttle movement attached. In this engraving the band, *n*, which draws the carriage, *o*, may be traced passing over grooved pulleys fixed to the ends of the lay, down over other grooved pulleys attached to the lower parts of the swords, and from thence around a horizontal pulley under and a little back of the cloth beam. Motion is imparted to the horizontal pulley, from the main shaft, by means of a pair of beveled gears, driving a short vertical shaft, with crank and pitman at its lower end, actuating a rack and a pinion attached to the shaft of the horizontal pulley.

A reversing motion being thus given to the horizontal pulley, the band, *n*, which draws the shuttle carriage, is alternately wound up on one side, and unwound on the other side, and a reciprocating movement imparted to the shuttle carriage and shuttle. It is obvious now that by putting different sized pinions upon the shaft of the horizontal pulley, or by speeding up from the rack, any amount of throw may be obtained for the shuttle, so that the width of the piece to be woven, is only limited by other considerations; so far as the shuttle is concerned there would be no difficulty in weaving a piece sixty yards wide, if such a width were required, at precisely the same rate that it travels in narrow goods, and producing a given number of square yards of cloth just as rapidly in one case as the other. It will be also obvious that any precise rate of speed is not essential, when it is understood that the lay is actuated by a cam motion, and that the cam groove is so cut that the lay must remain stationary until the shuttle has passed entirely through between the sheds, and drawn the shoot of the weft perfectly tight. If a loom were stopped with the shuttle midway between the sheds, and then started, the first thing it would do would be to draw the shuttle out of the way. In short, a breakage resulting from failure of any part of the loom to operate, is a contingency so remote, that it may be considered practically to be nothing.

The loom frame, yarn beam, cloth roller, let-off and take-up motions, together with the heddles, and the means for operating them, are of any usual or desired kind and do not require description here. The lay swings upon swords like those of other looms, but as we have stated, is actuated by a cam, instead of a crank motion. As to the relative merits of the two motions for actuating a lay, we are of the decided opinion the cam motion is the better.

We should neither do justice to ourselves nor the interests of our readers, if we failed to state that we have formed our opinions of this improvement, from actual observation of its operation, both on narrow and wide goods. We have seen it weave various textures, from fine dress silks up to woolen drugget six yards in width, in each of which its work was of the most satisfactory kind. No power loom ever before used can be relied upon to make a selvedge equal to it, and, if we mistake not, many lines of goods produced hitherto only by hand weaving will ere long be successfully woven by power on the positive motion loom.

Instead of complicating the loom, this invention has actually simplified it, reducing the number of parts, and introducing no motions or attachments liable to get out of repair. It is to the loom what the link motion is to locomotive engineering, or the compass to navigation. It substitutes certainty for uncertainty and thus lays the foundation for future development in the textile arts hitherto unattainable. Radical in its character, it may be compared to the invention which placed the eye of the sewing-machine needle at the point, and like that invention, it will, in its proper field, be likely to produce results impossible at present to estimate at their true value.

This improvement was patented in the United States, Aug. 11, 1868, by James Lyall, of this city, and has since been patented in the chief European countries, and is the first and only positive shuttle-motion loom. It is now in operation, in various kinds of work, at 35 and 37 Wooster street, New York, the office of the Positive Motion Loom Company, whom address for further information.

PLAYING WITH LIGHTNING.

From All the Year Round.

Although we had inspected electrical machines, and had looked as scientific as possible at the sparks we had seen elicited from them, the grand and heroic idea of lightning-making had never left us. Consequently, when we were told that lightning was made and exhibited at certain stated hours in the unromantic district of Regent street, we received the statement with some incredulity; and it was to test its truth that, after many years, we came to revisit the Polytechnic. Let us endeavor to give some account of what we learn from the lucid and interesting lecture, which explained to us the extraordinary performances of the great Induction Coil.

It was discovered by Faraday, many years ago, that a coil of wire, wound loosely round a magnet, became actively electric at the moment when the magnet was either placed within its folds or withdrawn from them, and also that a galvanic current, in passing round a conducting circuit, produces an "induced" current in another conductor that surrounds the first. A galvanic current is usually generated by what is called a galvanic battery, consisting of two dissimilar metals or other substances, technically named elements, not touching each other, but immersed in some acid fluid. Chemical action is excited, and electricity, in the form known as galvanism, is set free. If the elements are connected together outside the acid, by a piece of wire, or any other conductor, the electricity will proceed from one element, called the positive pole of the battery, and will pass along the wire to the other or negative pole, thus making what is called a circuit. If the wire be interrupted, the electricity, if present in sufficent quantity will leap across the gap in the form of a visible spark. If the gap be filled by any substance capable of being chemically decomposed by electricity, the decomposition will take place. In all this we have only the galvanic battery, and the primary current directly proceeding from it.

Now, Faraday's discovery was, that this galvanic or primary current, at the moment when it begins to flow, and again at the moment when it ceases to flow, produces a secondary, or induced, and perfectly independent current, in another conductor wound around the first, but not in contact with it. At the moment when the primary current begins to flow, the induced current passes in the same direction with it; but at the moment when the primary current ceases to flow, the induced current passes in the opposite direction. Instead of being, as in the primary current, continuous, the induced current is only momentary; and, in order to produce it at pleasure, it is necessary to have some contrivance by which to cut off and to restore the primary current as often as may be desired. As often as it is cut off, the reverse induced current passes; as often as it is restored, the direct induced current passes. The instrument used for this purpose is called a break, or contact breaker. It is placed in a gap in the primary or galvanic circuit, communicating with one extremity of the gap, and capable of being made to touch the other extremity also. When it touches, it is said to "make" contact, and when it ceases to touch, it "breaks" contact.

Not only does the magnet, like the primary current, induce electricity, but a piece of soft iron is rendered magnetic during the passage of a primary current through a coil of wire surrounding it. If the iron be massive, it retains its magnetic quality for a few moments after the galvanic current ceases; but, if it be of small bulk, it gives up its magnetism immediately.

In the manufacture of a "coil" for the display of induced electricity, all the foregoing facts are taken into account. The center, or core, of the coil is formed of a bundle of soft iron wire. Around this is wound the wire for the primary current, and around this again the wire for the secondary current. When the ends of the primary wire are connected with the two poles of a galvanic battery, the core of iron wires becomes a core of magnets, and hence assists the primary current in inducing electricity in the secondary wire. When the ends of the primary wire are disconnected from the battery, the core ceases to be magnetic, and the withdrawal of the magnet assists the cessation of the primary current in again inducing electricity in the secondary wire.

The largest induction coils hitherto made have been about a foot or fifteen inches in length, by about four inches in diameter. Seven miles have been about the extreme limit of length of the secondary wire; and nine inches the greatest length of spark that could be obtained. With these figures as standards of comparison, we approach the "monster coil" now under consideration.

In this, the central core of iron wires is composed of pieces each five feet long, and the thickness of knitting-needles, the whole core being five inches in diameter. The primary wire is of copper, thirty-seven hundred and seventy yards in length. The secondary wire is also of copper, and is one hundred and fifty miles in length. The rods of the core are separated from one another, or insulated, by being wound around with cotton, and the primary wire is covered in a similar manner. The secondary wire is covered with silk; and all these coverings are required in order to force the current to keep within each wire, or to pass along its length, instead of escaping from it laterally to contiguous turns of the spiral. The whole apparatus is inclosed within cylinders of vulcanite, and is mounted on strong supports, themselves similarly covered. The ends of the secondary wire issue one from each extremity of the coil, and are connected to "terminals," one of which is a point, and the other a polished disk of metal. They stand on movable columns in front of the coil; and the wires, when necessary, can be detached from the terminals, and attached to any other apparatus that may be required. When the primary wire is connected with a powerful galvanic battery, and contact is made, the core becomes a bundle of magnets, and this bundle combines with the primary wire to induce an electric current in the secondary wire. When contact is broken, the primary current ceases to flow, the core loses its magnetism, and an electric current is again induced in the secondary wire. If the terminals be not too far apart, this induced current leaps across the space between them in the form of a visible spark or flash.

There is yet another piece of subsidiary apparatus, called the condenser. This consists of a number of small sheets of insulated tinfoil, connected together, and with the primary wire, to which they form a sort of loop circuit. The condenser is supposed to afford a safety-valve, or reservoir of space for the primary current, and a security against any injury being done to the primary wire by the sudden rushing into it of a stream of electricity.

The first endeavors to work the new coil were frustrated by its own powers of destruction. It melted the platinum, and burnt up the brass of the original contact breaker. When used with a small amount of condenser surface, it burst the primary wire into fragments, and escaped from it laterally. When these difficulties were overcome, and the whole apparatus was in order, it afforded a spark, or rather a flash of lightning, twenty-nine inches in length, and apparently about a third of an inch in width. The length was measured, of course, by the distances between the terminals, and when this exceeded twenty-nine inches, no distinct flash was given. For a distance within its power to cross, it would almost seem that the electricity, like a strong leaper, makes an effort proportionate to the resistance to be overcome. When the terminals are distant, but still within the twenty-nine inch limit, the flash strikes upon the disk with a heavy shock and a loud report. When they are near together, or within two or three inches, the flash gushes forth without noise, and lazily, like a spurt of molten metal, or of dense flame; and from this "flaming spark," as it is called, the flaming portion can be blown aside by bellows, leaving the actual course of the electricity distinctly visible. Either the flaming spark or the longer one will perforate considerable thicknesses of glass, and five inches of solid plate glass have already been pierced by it. At one visit we chanced to see a remarkable illustration of the way in which metallic surfaces may serve to attract lightning. The outer covering of the coil displays the name and address of Mr. Apps, its maker, in gold letters of considerable size. In taking a long spark, the stands that support the terminals were placed nearer to the coil than usual; and the attraction of these gold-leaf surfaces was sufficient to divert the spark from its course, and visibly to break it up into portions.

In the darkened theater at the Polytechnic, the long flash lights up the room and the audience with the peculiar lurid glare so well known as an effect of brilliant lightning at night, and displays the features and action of every one present. But it is curious to note that, the flash being of instantaneous duration only, it allows no *motion* to be seen. We should think, if guided by our consciousness alone, that the flash lasted an appreciable time; but this would be an error, due to the persistence of the impression on the eye, after the flash itself had ceased. If the room be made perfectly dark, and if the spectators all raise their arms and wave their hands to and fro as quickly as they can, the flash will display the position of the arms, but not the movements of the hands. *While the flash lasts, the hand has no time to move*, and is consequently seen, as if motionless, in the position in which the flash finds it. It is in contemplation to exhibit the same effect in a more complete way by affixing a picture to a revolving disk. When the disk revolves so rapidly that no outlines of the picture can be distinguished by means of any ordinary light, they will be perfectly seen in a darkened room by the light of the flash. It lasts so short a time, that the revolving disk does not change its position in the brief period.

It is the smallest part of the advantage expected from the new coil, that it allows all the luminous and all the destructive phenomena of chamber electricity to be exhibited, in hitherto unapproached beauty and intensity. Men of science anticipate from it new discoveries of high importance. In the intervals between the public exhibitions of artificial lightning, the effects of the coil are being closely studied by those who are best able to appreciate them; and we believe no long time will be required in order to prove that Mr. Pepper, in his ever zealous catering for the entertainment and instruction of his especial public, has laid the foundation of real and solid scientific progress.

Manufacture of Malt Vinegar.

The following agreeable extract from the *Grocer*, gives a good idea of the way in which the manufacture of malt vinegar is conducted in England. It is extracted from a description of a visit to the works of Messrs. Hills and Underwood, at Norwich.

"The first of the visitor's pleasant surprises is the extreme cleanliness of every part of the building, the perfect ventilation, and the free admission of light; the second—if he follows the good rule of 'beginning at the beginning'—is the delicate odor of the malt lying on the two granary floors, where he sees the first process of the manufacture. These two floors, which are each some 50 feet square, will contain several thousand quarters of malt, and as vinegar, like beer, is the wine of malt, the difference being in the process of brewing, the quality of the grain is the first consideration. We could not forbear remarking on the resemblance between the fine, pale, delicate malt at the Norwich Vinegar Works, and that used in the great pale ale breweries of Burton-on-Trent.

"It is pleasant enough to walk into the hoist-house,leading from the upper granary, and there, amid the aroma from the rooms below, to look out over the ancient city with its forty churches and picturesque old buildings,and to trace the course of the Yare, the great highway for the produce of its modern factories; but if we are to learn how vinegar is made,we must follow the grain to a lower floor, where it is slowly ground into meal by great millstones cased in iron and moved by steam power; from these it is conveyed, in hot and odorous flakes, to a huge hopper, whence it finds its way by means of simple machinery along a trough to the mash tun immediately beneath. This great tun, in which the scientific process is added to the mechanical, is large enough to prepare about twenty-five quarters of grain at each mighty brew—a mass of meal which is rapidly converted into preliminary gruel by means of a series of rakes which are made to revolve inside the tun and mix the meal with water from an immense iron tank heated by steam pipes. As the revolving rakes mix and mix, more water is added, for the gruel, which grows thinner and thinner,must still be kept to boiling point,until the whole strength of the malt has been extracted; and during the operation,the odor arises from the seething, yeasty liquid in a pleasant steam. This operation having been completed, the liquor is run off into a cooler below the tun. This cooler is one of the most remarkable objects in the building, not only on account of its great size, which makes it look like a great plunge bath, and from the fact that its contents represent about 200 barrels of vinegar, but because, in looking down into it from the gallery above, where you have been witnessing the process of mashing, the whole area of that part of the building is reflected in its clear surface. The tall windows, fitted with louvre boards, cast the light on it in such a way as to convert it into a liquid mirror, wherein you see an inverted image of everything around, and begin to wonder how the fumes of the malt can take such an effect on a head, the strength of which had always been a subject of legitimate pride. The liquor into which we look is really intoxicating enough, however, for it is aromatic glutinous 'sweet-wort.' The sugar and the 'diastase,' which have been formed in malting,from the starch and the gluten of the grain,are dissolved; and the diastase, acting on that portion of the starch which has not been malted,changes it first into a sort of soluble gum and then into saccharine matter. From the cooler, this glutinous liquor passes through a Towlson's refrigerator, constantly cooled with water, the supply of which, though almost perpetually pumped from a well only twenty feet deep, has never yet failed in the driest season. On passing through the refrigerator, the wort loses some forty-five degrees of its temperature before it reaches the fermenting vats. There are eight of these enormous vats, each capable of holding about 10,000 gallons, and as large, therefore, as the space frequently made to 'accommodate' a small family. When the wort has been run into these, the process of fermentation commences, with the addition of the 'barm' the specific gravity rapidly decreasing if the operation is successfully conducted, and the final process of acetous fermentation, or 'acidification,' being alone required to convert the liquor into vinegar. The acidifying vats occupy a vast chamber beneath the granary floor, to which the fermented liquor is conveyed by means of pumps worked by steam power, and the top of each vat is occupied down to nearly one third of its depth, by large besoms or collections of birch twigs, upon which the wort is constantly pumped, that it may the more readily be exposed to the action of the atmosphere, the acidification being effected by means of the combination of the alcohol with the oxygen of the air. Before the use of this method of acidification, it was customary to expose the liquor in vats in large open fields or yards, which were, from that circumstance, called vinegar yards; but this was a slow process, and it also permitted the escape of the acetic ether, thus making the acidification less complete. This subtle and pungent essence escapes in such quantities, even here, that it is only possible to hold one's head over the vat for a few moments; but on the old system the piquancy of the vinegar must have been greatly deteriorated by the long process, which is rendered altogether unnecessary by the completeness of the system adopted by Messrs Hills and Underwood, and the careful selection of the grain from which their vinegar is manufactured. The acidification is by no means a rapid process, however, even under the most favorable circumstances; and a very delicate appreciation is required to determine the proper time for running off the liquor, which is now, indeed, vinegar, but 'unfined,' into a fresh series of vats, whence it is drawn out, bright and sparkling, and true vinegar. If the other vats were large, these refining vats are enormous; if the acidifying chambers were like drawing-rooms for size, these are capable of being converted into villa residences by the addition of a roof and a first floor. Some of them, we hear, will contain about 30,000 gallons, and, indeed, cost as much as a modern suburban residence. It is from these that the true vinegar is drawn into casks, and sent away to various parts of the world.

"It is necessary, however, to mention one other process, which, while it does not in the least affect the character of the vinegar, very essentially alters its appearance. In its natural state it is of a beautiful pale primrose color, resembling fine hock; but, for some reason or other, the British public insists on a dark hue, perhaps from some vague association with the 'old times,' when the dark color hid a great many deficiencies, and this prejudice is so strong that it is necessary for manufacturers to impart the color by means of burnt sugar. Curiously enough, our Scotch brethren have a prejudice the other way, and dislike any color at all, so that it becomes necessary to distil the vinegar to get rid of the natural tint. Neither process improves it; it is a question of fashion and popular prejudice, to which even science must sometimes bow if it involves commercial success."

THE LIGHT OF THE STARS.

Professor Robert Grant, F.R.S., Superintendent of Glasgow Observatory, recently lectured at the Royal Institution upon the light from the fixed stars. He said that the questions of the distances of the fixed stars, and of the amount of light reaching us from each star, are more intimately connected than is apparent at first sight. In early astronomical times it was not possible to discover the distances of the stars by parallax, so an attempt was ingeniously made to discover how far they are off by reasonings founded upon photometric measurements of the comparative amounts of light which they emit.

In a total eclipse the moon takes a long time to cover the sun, but if the sun were removed from us to the distance of the planet Neptune, the apparent diameter of the sun would be so reduced that the moon would eclipse it in ten minutes. Therefore, as the suns, which we call fixed stars, are eclipsed instantaneously by the moon, it follows that they are at enormous distances from the earth. As astronomers could not at one time measure this distance by parallax, they tried to find it out by comparing the intensity of the light of the stars with the light of the sun. This, however, was a difficult task, because when the stars were visible the sun was below the horizon, and when the sun was near the zenith the stars could not be seen.

This difficulty was surmounted by using the planets as intermediate bodies, and Saturn offering special facilities, was chosen for the purpose. The distance of Saturn being known, as well as the extent to which the sun's light was enfeebled by reflection from the planet, it was possible to compare the intensity of the light from the planet with the intensity of the light from the sun and with the light from the stars. Mitchell, and other astronomers, tried this method, and found that the sun must be removed to 220,000 times its actual distance to give us the same amount of light we receive from a bright star.

In these experiments it was necessary to assume that the stars were of the same magnitude and splendor as our sun. Now that the distance of some of the fixed stars is known by the unobjectionable method of parallax, it has been proved that the photometric measurements placed some of the stars nearer to us than their real distance. It follows, therefore, that those stars are either larger in size or more brilliant than our sun, and this is the way in which photometric measurements give some clue to the relative sizes of the stars, and show that some of them are larger and some smaller than our sun. In the present state of experimental astronomical science, it is impossible to learn the diameters of any of the stars by actual measurement, their distance is so enormous.

The following is the result of the measurements of the intensity of the light of some of the principal stars: Sirius, 416; Canopus, 204; Alpha Centauri, 100; Arcturus, 72; Rigel, 66; Capella, 51; Alpha Lyræ, 51; Procyon, 51; Alpha Orionis, 49; Aldebaran, 44; Antares, 39; Alpha Aquilæ, 35; Spica Virginis, 31; Fomalhaut, 26.

The excessive distances of the nearest of the fixed stars are very difficult to measure, and with more distant stars the difficulties of measurement are vastly increased. The only clue to the distance of faint stars depends upon the space-penetrating power of telescopes. It is assumed that the faintest stars are those which are most distant, and this is a very reasonable supposition, because, if stars were pretty evenly distributed in space, the fainter stars should greatly out-number the bright ones, and this is the case in reality.

Rosse's small reflector will bring into view stars 100 times less bright than the smallest visible to the naked eye. His forty-feet reflector penetrates into space 192 times further than the distance of the smallest star visible to the eye, so that the furthest stars revealed by his telescope, are so far away that the light from them takes about 8,064 years to reach the earth, traveling at the rate of nearly 190,000 miles per second. Yet through this telescope, beyond these distant stars, many a faint haze is revealed, which might be resolved into other galaxies of stars, could more powerful instruments be brought to bear.

In a previous lecture Professor Grant called attention to the peculiar light which benefits the inhabitants of the worlds which revolve round colored double stars. For instance: the inhabitants of a world which travels round a green and a red sun, must have red or green day, according to which sun chances to be above the horizon. Two or three months ago, Mr. James Buckingham, F.R.A.S., was kind enough to let me have two evenings with his great refracting telescope, which powerfully separated many of the double stars and resolved some of the colored star clusters into magnificent individual gems, the whole of them flashing more brilliantly than the finest jewels. Mr. Buckingham, by curiously-constructed steam machinery, and long years of labor, in which he was assisted by Mr. Wray, the optician, has overcome the enormous difficulties in grinding great telescopic object-glasses. The object glass of the telescope just mentioned is 21¼ inches in diameter, and perfect up to the edge, with a fine "black polish" over its whole surface. I believe it to be the largest object-glass in the world in practical daily use. Although many opticians have tried to make larger glasses, I think that none approaching this in size has proved successful.—*British Journal of Photography.*

The Rising of the Nile.

To the annual phenomena of the rising of the Nile, Egypt is entirely indebted for its fertility, and even for its existence as an inhabited and populous country. Without it the land would always have been a desert, incapable of affording the means of subcistence to man. Except occasionally near the shores of the Mediterranean, no rain falls throughout the land, and therefore its parched and sandy soil would be entirely unfruitful, were it not that regularly, at a certain season of the year, the river overflows the whole adjacent country.

Why it should do so was a mystery in ancient times, and many absurd theories and conjectures were raised to account for it. The Egyptians themselves believed the river was a god, who, in his beneficence, spread himself annually over the land, to supply the wants of his people. If the rising did not begin to make its appearance at the expected time—and it has hardly varied a single day throughout the course of ages—they hastily prepared a sacrifice to this deity, usually a beautiful girl, who was richly adorned and then thrown into the stream.

Some of the ancient philosophers lighted on the true reason of the rising of the waters, when they imagined it to be due to heavy rains falling in the interior of Africa, and swelling the sources of the river. What those sources were, it had baffled the investigation of thousands of years to ascertain, until recently our travelers, Speke, Grant, and Baker, discovered them in immense lakes situated near the equator, more than 3,000 miles, as the stream winds, from the mouth of the Nile on the Mediterranean coast. To these lakes the names of the Victoria Nyanza and the Albert Nyanza have been given by the successful explorers.

In the regions adjacent to these lakes, rain falls throughout the greater part of the year, and most heavily in March, at the time of the spring equinox. The lakes form huge reservoirs for the water which descends from the elevations known as the Mountains of the Moon; and as they become swollen, the size of the streams which emerge from them is proportionately increased. Several of these streams, uniting in their course, form the Upper or White Nile, and this river, flowing gradually on, until it meets the Blue or Lower Nile, bears irrigation to the thirsty lands below. Not only this, but as these rivers come down they bring with them a quantity of alluvial soil of the richest kind; and when the Nile at last spreads itself over the flat and sandy plains of Egypt, it enriches them year by year with this muddy but fertile deposit. The consequence is a gradually rising of the land, to the extent, it is calculated, of from five to six inches in a century. Owing to this fact, many of the remains of the proudest cities of ancient Egypt are now half buried in the soil.

Although in these days we know more about natural phenomena than the philosophers of old, and can satisfactorily explain the reason of the rising waters, there remains one wonder connected with it which is as great to us as to them, and that is its uniformity. As we have said, throughout the course of ages its commencement has scarcely varied by one day, and its extent is also comprised, as a rule, within a narrow limit. So equal, in the main, must be the quantity of water which falls annually at the equator, and so regular the commencement and decline of the rainy season.

The rising commences in Lower Egypt about the 25th of June, and steadily increases during the three months following. In this time the valley of the Nile becomes covered by its waters, and its villages stand out from them like little islands, as for the time they are. When the water has attained its maximum hight, it remains stationary for about ten days, and then declines as steadily as it arose. On its subsiding, the land has been thoroughly fertilized, and vegetation becomes luxuriant.

The hight to which the river rises is a matter of vital importance. A few feet more or less make the difference between starvation and abundance. The average hight varies according to the distance traversed by the river, from about forty feet where it enters Egypt, to four feet only near the Mediterranean. Taking as an intermediate hight that observed at Cario, if the rise is less than twenty feet, there is scarcity, or even famine; if it is three or four feet more, the crops will be short; three or four feet more again, and they will be abundant; but if the water goes still higher, it becomes an unhealthy flood.

Contrivances for measuring the exact rise of the Nile were in use in ancient times, and in two instances the remains of these "Nilometers" still exist. One, and the most ancient, supposed to have been erected in the time of the Roman dominion, is found in the island of Elephantine, in Upper Egypt; and on the walls of the building in which it is contained are inscriptions recording the hights of the inundation in various years. The other is situated in the island of Rhoda, near Cairo, and is believed to have been built in the time of the Arabian caliphs. It consists of a square well, into which the water is admitted as it rises, while in the center is a column of marble marked at frequent intervals with the distance from the lowest level. The Nilometers are supposed to have been of chief utility in adjusting the taxation of the country, as they would give indications as to whether the season would be plentiful or otherwise.—*World of Wonders.*

Revision of the Rules of the Patent Office in Regard to Drawings.

Commissioner Fisher has made the following important modifications of the Patent Office rules, which are now in full force:

UNITED STATES PATENT OFFICE, June 15, 1869.

It is proposed, as soon as possible after the 1st of July, to photograph the drawings of the current issues, for the purpose of attaching one copy to the patent, of placing in the room of each Examiner a copy of those belonging to his class, of binding a copy of each drawing for the inspection of the public, and for furnishing certified copies at cheaper rates than heretofore. The adoption of this plan has made it necessary to make essential modifications in the rules relating to drawings, to which the careful attention of inventors and agents is invited. It is absolutely necessary to the success of the undertaking that the rules should be rigidly enforced, and drawings which do not comply with them will not be received.

The rules, which are as follows, go into effect immediately.

DRAWINGS.—The applicant for a patent is required by law to furnish duplicate drawings when the nature of the case admits of them. One must be on thick drawing paper, sufficiently stiff to support itself in the portfolio of the Office for which it is intended. It must be neatly and artistically executed, with such detached sectional views as to clearly show what the invention is, its construction and operation. Each part must be distinguished by the same number or letter whenever it appears in the several drawings. The name of the inventor should be written at the top, the shortest side being considered as such.

This drawing must be signed by the applicant or his attorney and attested by two witnesses, and must be sent with the specification.

Tracings upon cloth pasted upon thick paper will not be admitted.

Thick drawings should never be folded for transmission, but should be rolled.

The duplicate drawing to be attached to the patent will be furnished by the Office at the expense of the applicant, and will be a photographic copy of the thick drawing. A fee of fifty cents per sheet of 10 by 15 inches will be charged, which must be transmitted with the final fee.

If the applicant does not choose to pay this fee he must furnish the duplicate drawing, as heretofore. This must be on tracing muslin, which will bear folding and transportation, and not on paper. It need not be forwarded until the patent to which it is to be attached is ordered to issue. It must have, for the purpose of attaching it, a margin of one inch on the right hand.

Copies of drawings of patents issued after July 1, 1869, will be furnished to any one at the uniform rate of fifty cents per sheet of standard size.

The following rules must be observed in the preparation of the drawings in order that they may be photographed. They must be executed in deep black lines, to give distinctness to the print. In shading, small lines of black ink should be used. Pale, ashy tints should be dispensed with. All colors except black should be avoided, even in lettering; but light blue, pink, and brown, are entirely inadmissible, and deep blue, yellow, and carmine take black.

The sheet must not be larger than 10 by 15 inches, that being the size of the patent. If more illustrations are needed, several sheets must be used.

Applicants are advised to employ competent artists to make the drawings, which will be returned if not executed in strict conformity with these rules, or if injured by folding.

S. S. FISHER, Commissioner of Patents.

TO TAKE OIL OUT OF LEATHER.—A correspondent, Mr. A. D. Fisk, of Newark, N. J., answers a recent inquiry on the subject as follows: "In the factory where I am employed we use 4 *F. aqua ammoniæ*, which will take oil out without injury to the leather. It must be used two or three times in order to get it all out. First use it and let the leather stand until more comes out, and apply again. This is the only thing that will take it out and not hurt the leather.

Improved Automatic Apparatus for working Ships' Pumps.

Various make-shifts have been employed by the crews of leaking vessels, to relieve them from the excessive labor of the pumps often required to keep a vessel afloat. Not unfrequently this labor is so prolonged in the struggle between life and death, that exhaustion has incapacitated a crew from making even such provision as lay in their power for their scant comfort, when they have been finally driven to their boats. One can scarcely imagine a more terrible condition than that of a crew when all hands are ordered to the pumps. Then begins an unremitting and exhausting toil, monotonous and nearly hopeless, a toil the end of which, is known only to Him who holds the destinies of the shipwrecked mariners in His hands.

In steam vessels this labor is performed in most cases by steam power, and is so effectually performed, that instances are on record where such ships have sailed for days, and finally made their destined port safely, with a leak that would without such aid, have sunk them in a few hours.

In view of these facts, all will agree that an apparatus which shall successfully take the place of steam power on board sailing vessels, is a boon which should secure fame and fortune to its inventor, as well as the gratitude of the civilized world.

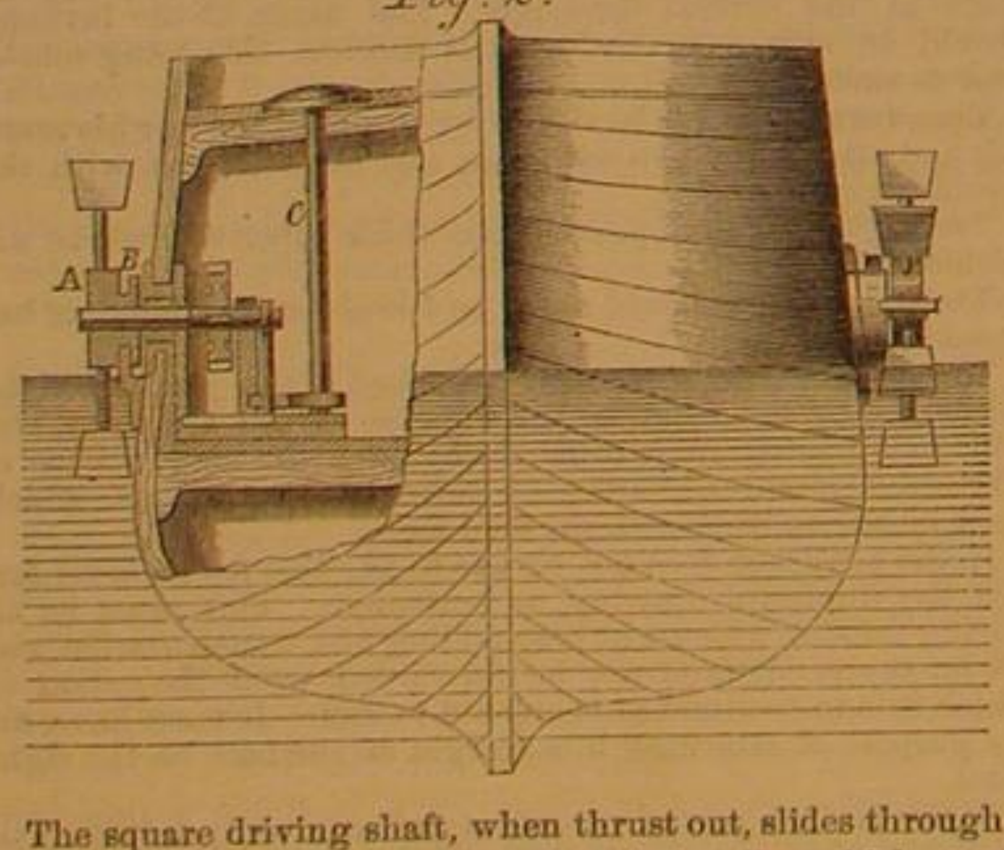
The inventor—an old mechanic—of the apparatus shown in the accompanying engravings, claims to have done this, and his device certainly seems to be tolerably free from any impracticability.

In the sides of a vessel are pierced holes through which shafts may be thrust out when wanted, or drawn in when not in use, and the ports closed. Paddle wheels are lowered over the sides of the vessel and attached to these shafts when required, which, when the vessel is under motion by the force of the wind, revolve, and thus generate power to work the pumps. The appearance of these wheels when in operation is shown in Fig. 1.

The method of attaching the paddle wheels is shown in Fig. 2. The arms of the paddles are inserted into a central disk, A, having a flanged bearing which, when the paddle wheel is lowered prevents its slipping off the shaft. The shaft upon which the wheel revolves, and through which it imparts motion to the other working parts of the apparatus, is square, and fits into a square hole in the central disk, A. This together with the flanged bearing which fits into a suitable step, permanently attached to the side of a vessel, obviates all necessity of keys or set screws.

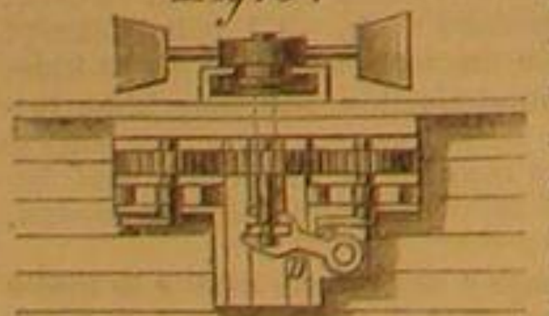
A vertical shaft, C, Fig. 2, operates a slotted arm, D, Fig. 3, by means of which the square driving shaft is thrust out or drawn in, while it at the same time slides the central spur wheel, Fig. 3, attached to the driving shaft, into gear with two other gears, which, through their crank shafts operate the pumps. When the shaft, C, is not employed, it is covered by a circular cap, fitting tightly into the deck.

Fig. 2.



The square driving shaft, when thrust out, slides through a square hole in the center of a cylindrical collar which serves as a bearing for it and revolves with it, at the same time closing the port against the ingress of the water.

Fig. 3.



Thus the hungry waves are made to defeat themselves in their struggles for the lives of a ship's crew, while the men are at liberty to work the vessel and to provide for any emergency that may arise. The inventor will have the heartiest wishes of all humanitarians for the success of his attempts to introduce his apparatus into general use; and we consider his device as being well worthy the attention of ship owners and underwriters.

This invention was patented June 8, 1869, through the Scientific American Patent Agency, by Almon Roff, of Southport, Conn., who has also secured patents in various foreign countries through this office.

One of the "shoe kings" of Portland, Me., who is very wealthy, began business five years ago with but $150.

ROFF'S AUTOMATIC PUMPING APPARATUS.

The Locomotive of the Future.

It would be difficult for the most enthusiastic engineering futurist, if at all practical, to point out the direction in which any radical improvement in the locomotive engine is to be sought. As long as the resistances opposed to the motion of trains are what they are, and as long as the present rates of speed are maintained, the amount of locomotive power to be provided cannot be lessened. There is not the slightest chance that any other agent than steam will be employed, in our generation at least, to produce this power. Compressed air locomotives, hot air locomotives, vapor of alcohol locomotives, and electro-magnetic locomotives have all been tried, and they have failed for perfectly obvious reasons—reasons which should have been foreseen by any one possessing the least knowledge of the motive agencies thus called into play.

Steam, then, being our only resource, it can be generated only by the combustion of fuel, and this fuel must obviously be the cheapest available. With us, the cheapest fuel is coal. We can none of us see the way to anything cheaper. Petroleum may be burnt easily enough—its use is entirely practicable, but it is too dear. Even were it cheaper than coal, its use would involve no important constructive modifications of the locomotive boiler, and none whatever in the working machinery.

And what can be simpler than the locomotive boiler as it is? A large amount of heating surface *must* be provided, and how could it be better provided? There are few who would not desire to welcome improvements were they possible, but it will prove no easy task to improve upon the principles, or the general construction, of Neville's multitubular boiler of 1826, as successively improved in detail by so many locomotive engineers since George Stephenson first brought it into practical work. The locomotive boiler has been made in almost every possible form. There have been twin barrels, double fireboxes, round fireboxes, combustion chambers, midfeathers, return tubes, water tubes, water grates—indeed, every imaginable modification of the original structure to which all successful practice has again returned.

We have no doubt that steel will yet take an important place in locomotive boiler construction, as it has already done in that of fixed boilers. The Bolton Steel and Iron Company appear at last to have produced Bessemer steel boiler plates which can be thoroughly depended upon in large quantities, and there are fireboxes of a somewhat kindred material—Howell's homogeneous metal—which have perfectly withstood nine years' use on the Scottish Central Railway. In all this, however, there is no new principle, and the most that can be hoped from steel is somewhat greater economy in repairs, and the possibility of working higher pressures of steam, should it prove desirable to do so.

In the motive machinery of the locomotive, beginning with the regulator and ending with the driving wheels, no improvements beyond those of mechanical detail appear to be possible. No possible application of the principle of the rotary engine holds out the least hope.

As for the rest, the locomotive engine is a carriage merely. So much total weight, divided by so much permissible weight per wheel, and we have the necessary number of wheels, to be coupled or not, according to the requisite adhesion.

It is only as a carriage that we see much room for improving the locomotive. It does appear anomalous that with from one hundred to two hundred wheels beneath a train none of them loaded beyond 3 or 3½ tuns, a permanent way of twice the strength otherwise necessary should be required to carry 7 tuns each on a pair of driving wheels. It is equally inconsistent that with wheel bases of from 8 to 10 feet under the wagons and carriages from 15 to 18 feet should be necessary for the engine. Were the maximum weight per wheel not more than 4 tuns, and the maximum wheel base in any one unalterable rectangle no more than 10 feet, it is almost beyond dispute that a very considerable economy would be effected in the maintenance of the permanent way.—*Engineering.*

NEW AND IMPROVED FORM OF SIMPLE MICROSCOPE.

The chief peculiarities of this microscope are, its being made almost entirely of wood, the general arrangement, and, particularly, the mode in which the focal adjustment is effected.

The instrument (Fig. 1), consists of a circular base, A, from which rises a standard, B, having a mirror, C, attached to its lower part. The mirror is turned by the head, D, so as to reflect the light coming in front of the observer. Through the center of the standard runs a square groove into which a bar, E, of similar shape fits. An iron screw firmly secured to the lower end of this bar, fits into the head or nut, F, and by turning this the bar is raised or depressed. The head, F, fits accurately into the cut made for its reception in the standard, which has two opposite sides flattened at this part in order to allow a slight projection of the head, thus giving the thumb and middle finger a good hold on it. A lens holder, G, is attached to the upper part of the bar, E. Several disks of wood having spherules or globules of glass mounted in them, are made to fit into this holder. When a change of powers is desired, nothing is necessary but to take out one disk, drop another in its place, and then make the proper focal adjustment. A full size section of part of the lens holder, showing the manner of mounting the globule and fitting the disk, is given at Fig. 2. At I, is the stage with an aperture at J for admitting the light from the mirror. To the stage are attached two spring clips, K K, for holding the glass slide containing the object firmly in its place. Beneath these clips two transverse bars are fixed to the stage, and the slide resting on these is slightly elevated, thus giving the fingers a better hold in moving it about. A portion of the under side of the lens holder, G, is cut away, as shown in the engraving, in order that the spring clip passing underneath, may not prevent the lens from being brought very near the object, as is necessary when high powers are used. That part of the stage through which the bar, E, passes, is lined with leather moistened with a little oil. By this means the lens holder is kept free from any lateral movement while the focal adjustment is being made. The stage is 4½ × 1½ inches, and is designed to allow the use of a full sized slide 3 × 1 inch

The groove in the standard is planed in a piece of wood, another piece is glued over this, and the block afterwards turned to the proper form in a lathe.

Metal and rubber, or suitable combinations of these and wood, may be used in the construction of the microscope, but it answers equally well if made of wood. Hard and dark colored woods, such as black walnut, rosewood, mahogany, etc., are the best. The microscope from which the engraving was made, was made of black walnut oiled. None of the parts were of metal except the screw and spring clips.

Fig. 1

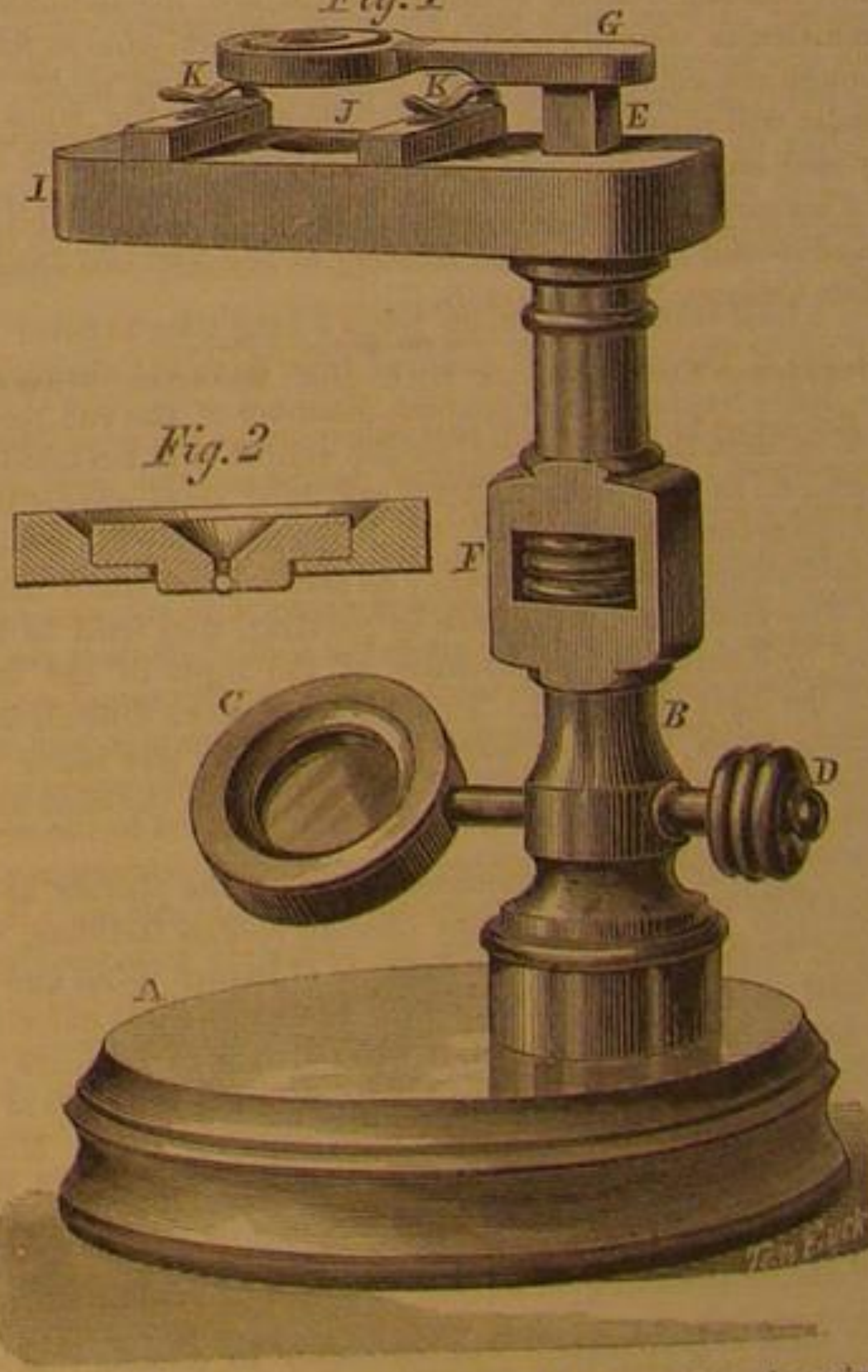


Fig. 2

In using the microscope the head for turning the mirror must be at the right or left hand, as may be most convenient, and the light must come in front of the observer. No advantage is derived from having the mirror fixed so as to reflect light from the left or right, because the arms, while moving the slide, will always cut off the light so reflected. The nearer the lens is to the object the greater is the care necessary in making the focal adjustment. In examining infusoria, or other objects found in water, a drop or two of the fluid may be placed on the middle of an ordinary slide and covered with a square of very thin mica or glass. Most objects, whether dry or in fluid, will need this precaution, which is often necessary to prevent the globule lenses from getting soiled by coming in contact with the object under examination. Care must also be taken that the mica or glass cover does not approach too near the spring clips, otherwise the fluid may be drawn under the clips and wet the stage. Should the globules get soiled, and rubbing them with tissue paper does not clean them, they must be punched out and replaced by new ones.

The microscope was designed with special reference to the most convenient and efficient use of these globules as magnifiers. Globules of high power were first made and used by Robert Hooke, an English microscopist of the seventeenth century. These when well made show objects remarkably well. They may be made to give enormous powers, and that, too, at a cost of only a few cents. It is not a very difficult matter to obtain with these a power of 1,000 diameters, or even more. The field of view is rather small and its extent is the same for all powers. This is because it is limited by the pupil of the eye, as may be readily proved by a simple experiment. Looking through a globule lens, arrange the mirror so that just sufficient light is given to make the field visible. Then suddenly turn the mirror so as to illuminate the field with a strong light when it will be seen to contract. With the larger globules the light given by the flat mirror is sufficient, but when globules having a focus less than $\frac{1}{40}$ or $\frac{1}{50}$ of an inch are used a concave mirror will be necessary. Any person may, after a little practice, be able to make and mount his own globules.

The globules should be made of French plate or other very pure and clear glass. The glass must be cut into a narrow strip, carefully cleaned, and then drawn out into threads in the flame of a spirit lamp. The threads should be made of different thicknesses and carefully kept on a clean plate. The wick of the lamp should then be pushed down until the flame is not more than half an inch long. One end of a thread is now to be held in the flame when it will melt and run up into a globule. When the globule is seen to be perfectly spherical it must be withdrawn, held a little while to cool, broken from the thread, and put aside until wanted for mounting. The larger globules are the most difficult to make, the fine threads melt and run up into perfect globules almost as soon as thrust in the flame. The hole in the disk for the globules must be burnt in and then cleaned by rubbing it with a piece of wood. Care must be taken that the inside of the hole is made dark in order to prevent all reflection of light. A needle will be convenient for burning in the smaller holes. The globule is then to be carefully placed in a hole with the broken end of the thread to one side, and may then be fastened securely by pressing it in a little. If desired, other forms of magnifiers, such as ordinary double convex lenses, Wollaston doublets, triplets, and Coddington lenses may be used.

For the examination of infusoria, animal and vegetable tissues, and such other objects as are, or can be made transparent, these globules have been found to answer very well indeed. It is for the use of globules in such examinations that the microscope here described was devised. It was not intended for, and cannot conveniently be used as a dissecting microscope. By means of a globule magnifying over 500 diameters the writer has been able to perceive clearly the hexagonal markings on the most common diatoms found in the "Richmond earth." He has examined live diatoms and animalcules whose movements he has been able to follow, though not without difficulty when they were rapid. The reader will thus get some idea of what may be accomplished by such simple things as globules of glass.

This invention was designed by James H. Logan, who may be addressed for further information, at the National Deaf and Mute College, Washingon, D. C.

Picrates—Their use as Gun and Blasting Powders.

Referring to a notice on this subject in our issue of May 15, we propose to give some further details on this new and interesting compound. In 1867, Designolle, of Paris, made powder for firearms and for blasting purposes by means of picrates. Both kinds consist of a mixture of picrate and nitrate of potassa; the only difference being that the former contains in addition an admixture of charcoal. Their manufacture, as may be inferred from the accident which recently took place in Paris, appears to be carried on to a considerable extent, and the well-known chemist, Payen, in a report to the *Société d' Encouragement*, ascribes to them several advantages over the ordinary powder. He points out that various kinds of powder may be manufactured by means of them, the relative effects of which may be varied between the limits 1 : 10; viz., that, on one hand, a powder may be made, which will possess ten times the effect of common gunpowder of equal weight; while on the other hand, it is just as easy to prepare an explosive of the same projectile force, but of a less bursting tendency compared with odrinary powder It is said that between these limits all desirable kinds can be made. If so, the long sought for problem is solved; that is, an explosive can be prepared in a charge of a certain weight, which will impart a definite velocity to a projectile from a firearm of stated dimensions.

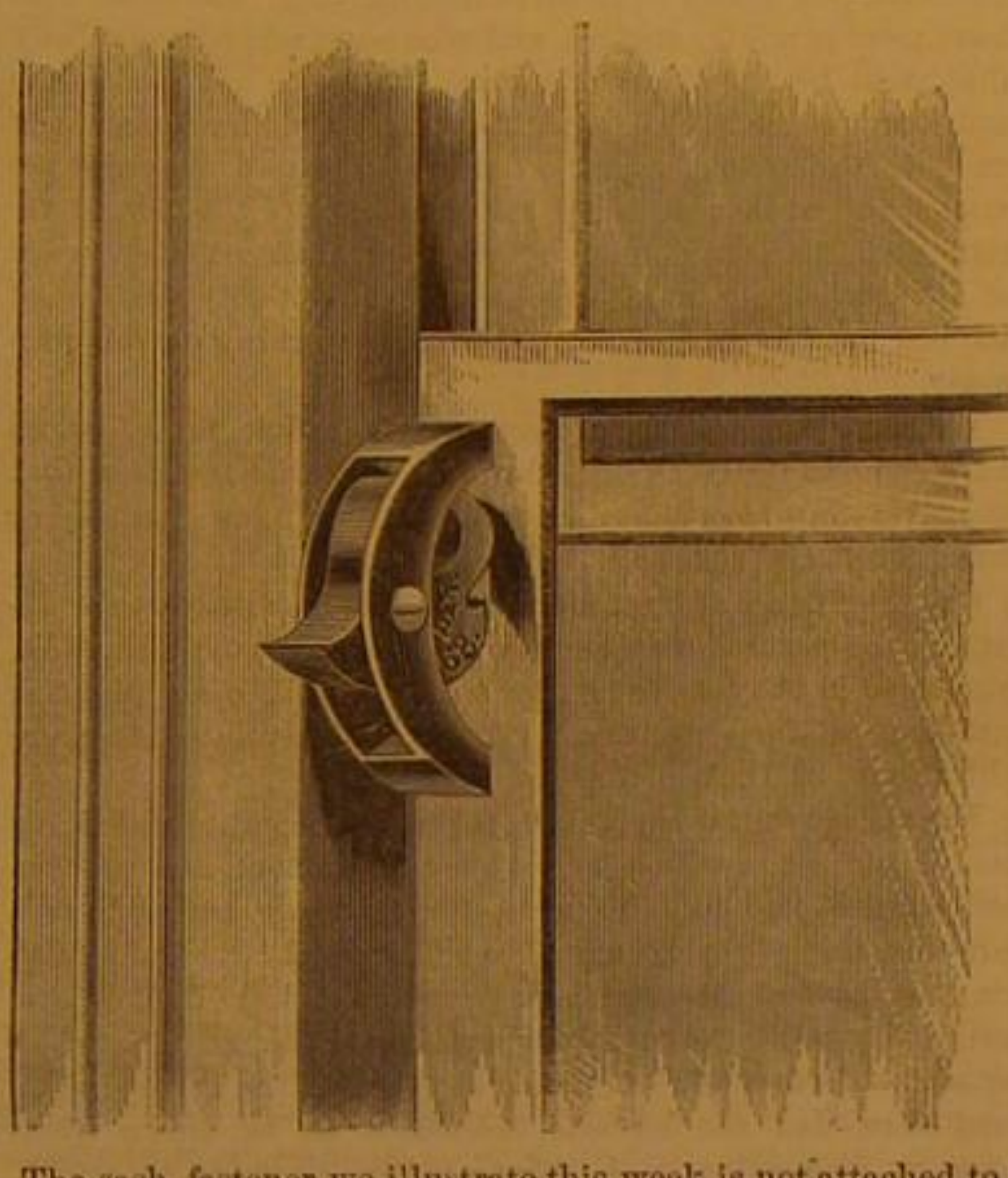
Other advantages of the picric acid compound are that its projectile force can be increased without enhancing its blasting force, or changing its manner of manufacture; the velocity of combustion may be regulated at will; and its ignition is not attended with the generation of disagreeable gases, as they consist simply of steam.

The manufacture of the powder from picrates proceeds as follows: The various ingredients are powdered in a stamping mill for at least three or at most six hours, under addition of six to fourteen per cent of water, according to their composition. The mass is now subjected to a pressure of from 600 to 1,000 hundred weight per square inch, according to the velocity of combustion to be imparted to the powder. The cake obtained is then granulated, polished and dried in the ordinary manner. The process remains the same for all kinds.

Gunpowder cannot well bear over twenty per cent of picrate of potassa, while for cannon powder, it should not exceed fifteen per cent. For the latter from eight to fifteen per cent are taken according to the desired velocity of combustion. Designolle prepares also colored fire-work compositions by means of picrates, of which the following are recipes: Gold rain—50 parts of picrate of ammonia, and 50 parts of picrate of iron; Green fire—48 parts of picrate of ammonia, and 52 parts of nitrate of baryta; Red fire—54 parts of picrate of ammonia, and 46 parts of nitrate of strontia. Until recently, the picrate of potassa has been very expensive, but improvements made in its mode of preparation enable the manufacturer to sell it at a price sufficiently low to ensure its application for all practical purposes.

WALKER'S PATENT SASH FASTENER.

Deliverance from the inconvenience and expense of cords, pulleys, and weights, attached to window sashes, seems to be an attainment much desired, and inventors are racking their brains to meet the demands of the public in this respect. Among the best devices produced are those which employ an eccentric, which by engaging with the sash at the moment it tends to fall, forces it against the side of the frame thus generating friction and holding more and more firmly, the greater the force which tends to move it.



The sash fastener we illustrate this week is not attached to the sash, but the semi-circular frame which holds the eccentric, is screwed on the window frame, close to but not touching the sash. The eccentric or cam is cut so as to give two supporting surfaces—upper and lower—one of which holds the window from being raised, and the other prevents it from falling. To raise the sash the eccentric is thrown up; to lower, it is thrown down.

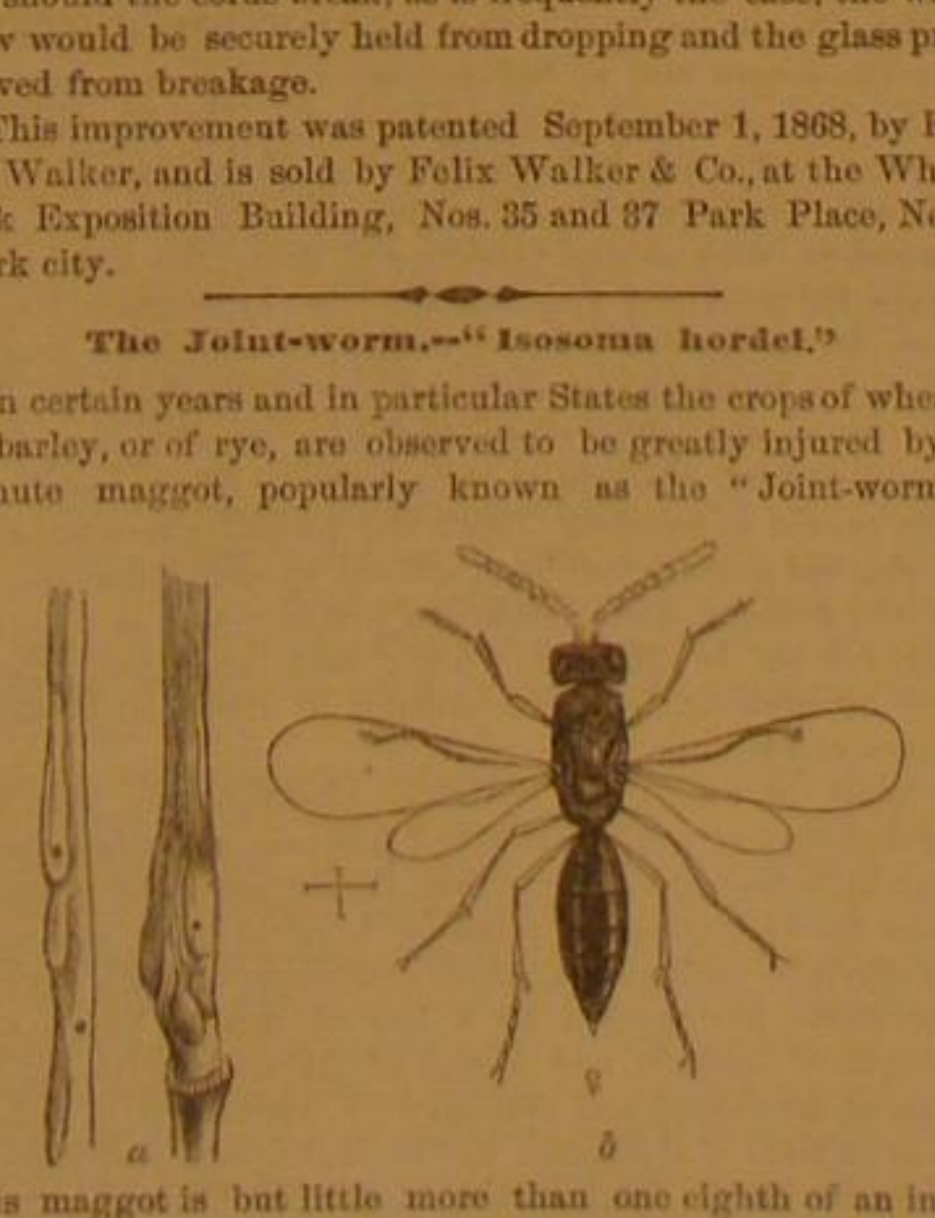
It thus acts as a lock, and precludes the necessity of a bolt or other fastening.

The inventor is aware that where sashes are of great weight, a cord, pulley, and weights, may be necessary to balance the sash, and moderate the exertion of raising it; but even in such cases, the fastener would be a valuable adjunct, as, should the cords break, as is frequently the case, the window would be securely held from dropping and the glass preserved from breakage.

This improvement was patented September 1, 1868, by Felix Walker, and is sold by Felix Walker & Co., at the Whitlock Exposition Building, Nos. 35 and 37 Park Place, New York city.

The Joint-worm.—"Isosoma hordei."

In certain years and in particular States the crops of wheat, of barley, or of rye, are observed to be greatly injured by a minute maggot, popularly known as the "Joint-worm."



a b

This maggot is but little more than one eighth of an inch long, and of a pale yellow color with the exception of the jaws which are dark brown. It inhabits a little cell, which is situated in the internal substance of the stem of the affected plant, usually a short distance above the first or second knot from the root, the outer surface of the stem being elevated in a corresponding elongate blister-like swelling; and when, as is generally the case, from three to ten of these cells lie close together in the same spot, the whole forms a woody enlargement honey-combed by cells, and is in reality a many-celled gall. In the figure, *a*, will be seen a sketch of one of these galls, the little holes being the orifices through which the flies produced from the joint-worms have escaped. At first sight, these knotty swellings of the stem are apt to elude observation, because, being almost always situated just above the joint or knot on that stem—whence comes the popular name "Joint-worms"—they are enwrapped and hidden by the sheath of the blade; but on stripping off the sheath, as is supposed to have been done in the engraving, they become at once very conspicuous objects. We have observed that the "internodes," as botanists call them, or the spaces between the knots, in infected straws, are always much contracted in length; none out of a lot of over fifty specimens examined by us, exceeding six inches in length, and many being reduced to only one and a half inches. A similar phenomenon occurs in two "polythalamous" galls formed by certain gall-gnats (*Cecidomyia*) upon the tips of the twigs of certain species of willow.

DAMAGE DONE BY THE JOINT-WORM.—The damage occasioned by the joint-worm is, in certain seasons and in certain localities, ruinously great. In the year 1851, throughout a large part of Virginia, many crops of wheat were hardly worth cutting on account of its attacks, and all that we have seen or heard of, except one, were badly hurt by it. According to Prof. Cabell, of the University of Virginia, the loss occasioned by this insect often amounts to one third of the average crop, and is sometimes much greater; and in 1851 "some farmers did not reap as much as they sowed." In 1860 the rye crop was considerably injured by this little pest in Lycoming Co., Pennsylvania; and according to Mr. Norton, the species is very common upon rye "in Connecticut and probably the other New England States." As long ago as 1829, it had been noticed in various parts of the New England States to attack the barley, causing it in some places "to yield only a very small crop, and on some farms not much than the seed sown;" although since that date it does not appear to have been materially troublesome in that region. But in central New York, formerly the great barley-growing district of America, it has been ruinously destructive to the barley since about 1850. In the words of Mr. George Geddes, "Formerly we expected forty bushels of barley to the acre; now we cannot rely on more than twenty." And he goes on to state that this falling off is principally due to the depredations of the joint-worm; and that, unless some relief from it is found, the farmers of Central New York will have to discontinue raising this crop. Lastly, in Canada West, in the neighborhood of Grimsby, it was very abundant upon barley in the years 1866 and '67.

NATURAL HISTORY OF THE JOINT-WORM.—The mode in which the joint-worm produces its destructive effects upon small grain, may be readily explained. Not only is the sap of the plant abstracted on its road to the ear, in order to form the abnormal woody enlargement or gall, in which the larvæ are embedded, each in his own private and peculiar cell, but a very large supply of sap must be wasted in feeding the larvæ themselves.

The joint-worm fly, b, makes its appearance in the North in the fore part and middle of June, and in southern latitudes in the middle of May. After coupling in the usual manner, the female joint-worm fly proceeds to lay her eggs in the stems of the growing grain.

Before commencing operations they walk leisurely up one side of the plant as far as the last leaf, and then down the other, apparently to make sure that it has not already been oviposited in. Head downward, they then begin by bending the abdomen downward, and placing the tip of the ovipositor on the straw at right angles with the body, when the abdomen resumes its natural position, and the ovipositor is gradually worked into the plant to its full extent. Very shortly after this the egg must hatch out.

By the beginning of September, the infested grain having ripened long before this period, the galls are already dry and hard, and the larvæ contained in them full grown, measuring now about 0·13 inch in length. The great majority of these larvæ are destined to remain in that state, inclosed in their little cells, until the succeeding spring; but—as happens with many different insects—a small percentage of them seem to pass into the pupa, and thence into the perfect state, the same summer that the eggs are deposited.

REMEDY.—Whenever you discover the stems of your small grain to be badly affected near the root, in the manner shown in the figure a, then you ought to burn off your stubble ground any time before the following summer, and burn up all the tailings and refuse straw after thrashing. If you do this and can persuade your neighbors to do the same, you will soon kill out out the joint-worm; if you neglect it, the parasites sent by a kind Providence may perhaps do the work for you; and again it may be possible that, in spite of the parasites, the joint-worm may increase upon you year after year.—*The American Entomologist.*

THE library of Congress has recently acquired a valuable addition of books in the Spanish language, largely relating to America, many of which formed a portion of what is known as the Maximilian library, recently sold at Leipsic The library now contains 180,000 volumes, about 2,000 of which have been added within the past sixty days.

MENDING PLASTER MODELS.—Wax and resin, or shellac varnish, is recommended in the last number of the *Dental Cosmos* for the above purpose. Dr. Chaim suggests the use of liquid silex. Wet the two surfaces with it, and allow a few moments for it to dry. It will be found very useful in cases of accident to a cast.

Correspondence.

The Editors are no responsible for the Opinions expressed by their Correspondents.

Spectacles or No Spectacles.

Messrs. Editors.—In No. 23, last volume (June 5), Dr. J. V. C. Smith advises the public to begin with the firm resolution never to wear glasses of any kind for reading or writing, but to attempt persistently to read without them, by which the eye will regain its former power. To strengthen his suggestion he brings names of celebrated persons who have done without them, still having the perfect use of their eyes to a good old age. Such an admonition is hardly necessary in this age of vanity, for it is usual now, that persons arriving at a period where the failing organs proclaim advancing age, strenuously resist the use of glasses, because they advertise the unwelcome fact.

The truth of the doctor's assertion consists in the fact that the eyes of some are probably susceptible to such a change; but it is only the empiric whose confidence is absolute and final, while the thinking professional makes experiments and watches the results of a trial.

It is easy to collect a small volume of telling examples to prove preposterous opinions, but that is no evidence. Experience must be our guide. Much depends on the individual case, much on the condition of the organism. What will help one won't help others; the great difficulty, beside, consists in deciding whether the beneficial effects attributed to any particular cause really has reference to its action or to some concurrent cause.

As it comes under our daily notice, the method recommended by the doctor has a directly opposite effect on the eyesight, we cannot withhold the suspicion that the recommendation put forth is a fallacy. Let the doctor make experiments, collect precise data; let him give us the maximum time during which we must grope in the dark in order to see light again.

Studious habits, overwork, the taxing of the eye to perform most severe duty for a considerable period of time, are the universal causes of the early failing of its functions, but the idea of relying upon time for its restoration, is utterly inadmissible, for if time is invoked at all, it must be invoked as the cause of the very evil which we thus propose to leave to its cure.

The progress of civilization, the art of printing, does a great deal toward the increase of weak sight, and as Gutenberg put forth his invention only in 1438, the ancients could not suffer from that source; but even before that date, in 1292, Roger Bacon mentions the benefit derived from the use of a plano-convex glass, by old men and those with weak eyes. This shows conclusively that although Cicero never complained of imperfect vision, even at the age of sixty-three (perhaps he had his, so-called, "second sight," an occurence not very uncommon among aged people), there must have been many others who have suffered from that defect.

The Bible mentions that Isaac, the patriarch, had dim eyes from old age.

Experience proves daily that the judicious use of glasses is mostly accompanied by beneficial results; therefore we should think, with due deference to Dr. Smith's opinion, that it is best to submit with good grace to an affliction which cannot be averted.

Louis Black.

Detroit, Mich.

A Lunar Rainbow.

Messrs. Editors:—I think the following may be of interest to some of your readers:

In latitude 25° 35' south, and longitude 47° 12' west, at a place called the Situo Americano (belonging to the Parana Manufacturing Co.) one and a half miles from the village of Morretes, in the Province of Parana and Empire of Brazil, on the evening of Feb. 9th, 1868, at the hour of 8·15 P. M., we saw a most beautiful and distinct lunar rainbow, with all the colors clearly and plainly defined. It formed a complete arch with the apex at an elevation of about 45°, and lasted nearly half an hour. The moon was about twenty minutes above the horizon when we first observed the rainbow and was nearly full though on the wane. Thermometer 77° Fah.; weather damp or humid but not rainy; light fleecy clouds passing between us and the moon. The bank of clouds that almost continually hang around the Mirumbi Mountains, formed, as it were, a back ground for the beautiful sight. The base of the mountains was about six miles off and the summit about thirteen miles. The mountains here are about 6,000 feet above the Situo Americano. I have but lately returned from there, after an absence of nearly two years, in erecting the works of the Parana Manufacturing Company, and expect to return again at an early day.

James K. Miller, Supt. of Parana Man'f'g Co.

Litchfield, Ill.

The senior class of the Michigan University have placed underneath the class tree a boulder which has long been known as "calico rock," on account of the curious arrangement of the smaller fragments on the surface. It is a rare and curious specimen of conglomerate, from the fact that so many different kinds of rock are found cemented together. It is thought that as many as twenty can be named, some of which are granite, gneiss, quartz, mica, schist, chlorite scihst, dolerite, hyperite, etc. The boulder belongs to the azoic period of the world's history, and was probably brought from the Lake Superior region by the great glacier which Agassiz says once passed over this part of the continent. Its size is about a square yard, and its estimated weight two and a half tuns.

AN IMPORTANT QUESTION IN SOCIOLOGY---THE INTERMARRIAGE OF RELATIONS.

The researches of Darwin and others of his school, together with the results of in-and-in breeding in the perfection of stock, have attracted the attention of social philosophers and have, so to speak, reopened the question as to what extent the intermarriage of blood relations is allowable, and whether it could not be made, setting aside the moral and religious bearings of the subject, a means of improving the physical constitution of the human race.

In the discussion which has arisen upon the subject science has taken a stand as something distinct from theology, and asserted its right to ask and to answer the question whether there exists in nature a law inimicable to the intermarriage of blood relations, and if so, to what limit of consanguinity does that law extend. The conclusions arrived at, so far as we have been able to follow the discussion, demonstrate clearly to our mind, a fundamental truth applicable to all scientific investigations, which is, that the more theological views and considerations are kept apart from any investigation pursued by modern scientific methods, the more probable is the attainment of truth by these methods, and the less likely are the results obtained to conflict with those great and sublime truths, which underlie all religious belief. It was once thought by many that geology was atheistical in its tendencies and subversive of all religious faith. Who believes this now? It is at present thought by some that Darwin's views of natural selection and the origin of species must lead its followers to a denial of creative intelligence. But those who have most carefully studied, and who comprehend most fully that most beautiful law of nature, for we do not hesitate to consider it as such, only recognize in it the development of one of the many ways in which creative intelligence works, and while perceiving the simplicity of the law of variation and its perpetuation by selection, also see the necessity of acknowledging an all-wise Deity, who not only established the law but has made direct use of it in working out his purposes.

So in regard to the subject of this article, investigators have come to the conclusion, by pure scientific methods, that the divine law is in accordance with nature's laws, and by so doing admit their oneness.

Our attention has been more immediately called to this subject by the perusal of an essay written by Nathan Allen, M.D., published in the *Quarterly Journal of Psychological Medicine and Medical Jurisprudence*, for April, and reprinted in pamphlet form, by D. Appleton and Company.

We cannot follow the author through the entire line of his able argument in which he reviews the ancient and modern ecclesiastical and civil law upon intermarriage, and adduces a large number of psychological and biological facts and statistics, to show that intermarriage beyond a certain limit of consanguinity tends to disastrous results upon the race; but shall content ourselves with a glance at some of the more important facts, and the obvious inferences to be drawn therefrom, in connection with what appears to us to be a well-stated and overwhelming argument against close intermarriage.

"In an elaborate article upon 'Ancient Marriages of Consanguinity,' found in the *Medical Journal* of Nashville, Tenn., for 1859, Dr. J. Casselberry, in an examination of the early history of Syria and Egypt, brings out some remarkable facts. He shows that, among the rulers, generals, and leading characters in the history of these two great nations, there was an unusual amount of such intermarrying, and that almost invariably it turned out badly. In the history of the royal founders of different nations there has been at times a great number of such intermarriages, and it is well known that very many of these have proved decidedly unfavorable as far as offspring is concerned. So marked was the effect that a peculiar disease, called the 'king's evil,' was said to originate from this source, and to become very common and trouble some. The power and influence which these families had endeavored in this way to perpetuate had come to naught, and their names in history almost extinct. In the history of certain orders, such as the patricians of Rome, the nobility of France, the peerage of England, and other aristocratic classes, where, for the sake of position, wealth, or some other consideration, intermarriages among members of the same families have frequently taken place, and this practice continued through several generations, the hereditary effects have generally proved unfavorable. Both the mental character and the physical organization have suffered by such alliances. It has been found that such classes or orders would, in time, actually run out in offspring, if their ranks were not replenished occasionally by those moving in lower or humbler spheres of life.

"Again: in some small islands or places remote from the thoroughfares of public travel and business, and where there is but little change in society from immigration, the practice of the intermarrying of relatives becomes quite common. The effects of such unions, when continued through several generations, are marked by a loss of mental power and strength, of boldness and energy of character, with an increase of scrofulous and consumptive complaints, of defects in one or more of the senses, and not unfrequently of deformities of the body. With such a people there is not only little real improvement or progress in securing the most important objects of life, but, after remaining awhile in a kind of stationary state, they gradually decline both in numbers and character. This change may not be very perceptible in one generation, but, when continued through several generations, it becomes most marked both in reference to the body and the mind. Probably nowhere in the world can there be found more striking illustrations of this truth than in some of the valleys of Switzerland, where, from the barriers formed by almost impassable mountains, the same seclusion of communities and frequency of family alliances have been found to exist for hundreds of years. Here we find goitre, cretinism, scrofula, albinism, mutism, and idiocy, in all their most aggravated forms. A writer in the *American Journal of Insanity* gives the following sketch of this people: 'Marriage between blood-relations is nowhere of such frequent occurrence as in the localities where are born the greatest number of deaf and dumb. I have before described certain valleys in the Canton of Berne, the inhabitants of which, collected in masses, and living almost without any means of communication with neighboring countries, offer all the conditions favorable to these unions between relatives. There the men marry very young, in order to avoid the troubles and cares of celibacy without compensation. They marry their cousins, and all the families have been allied for a long time. The children of two brothers, of a brother and of a sister, marry as a matter of expediency, and thus preserve the inheritance intact; consequently the new family is founded in physical conditions than which nothing could be more injurious. It is in the midst of these isolated populations that we find in all its hideousness the degradation of the species, the coruuption of the race. There reign cretinism, idiocy, and congenital deafness to such a degree, that the demonstration of the fact I have advanced blazes forth in all its brilliancy.'

"According to a great mass of facts collected on this subject, the functions of the brain seem to be affected far more than those of any other organ. Hence, a great number of weak or feeble-minded persons, together with every grade of idiocy, has been reported as originating in such unions. It is through the brain also that certain peculiarities or idiosyncrasies of character, as well as a great predominance of the animal propensities, are thus transmitted. The organs of the senses are so immediately connected with the brain, that their functions would generally become more readily impaired. Riliet considered that epilepsy was the most frequent disease thus transmitted, which has its seat in the nervous system.

"Dr. Barlow states that the tuberculous diathesis shows itself in the greatest intensity in the offspring of marriage between relations in whose family the taint has already existed. Hence we have a large number of cases of phthisis—consumption—from this source, as well as scrofula in all its diversified phases. There is also the disease known as rickets, with curvatures of the spine, and deformities of the body in an endless variety of forms. It should be borne in mind that all these abnormal states increase most rapidly with every generation thus intermarrying, becoming thereby intensified more and more. These morbid forces resemble somewhat the falling of heavy bodies where the power of gravitation is constantly accumulating. A small force will hold these bodies in check at the start, but, when far advanced, no power can well resist them.

"Dr. S. M. Bemiss, of Louisville, Ky., published a large collection of facts bearing on this subject, in the *North American Medico-Chirurgical Review* for 1857. Says he: 'By much labor I have obtained statistical accounts of 34 marriages of consanguinity; of this number, 28 were between first cousins, and 6 between second cousins. Of the total number of marriages, 27 were fruitful and 7 sterile. The 27 fruitful unions produced 191 children. Of the 28 marriages of cousins, 23 were fruitful and 5 sterile; of the 6 marriages of second cousins, 4 were fruitful and 2 sterile. In both these latter instances of sterility the female was the product of a marriage of consanguinity.

"'Of the 192 children resulting from these marriages, 58 perished in early life. In 24 of the 58 deaths the causes were stated as follows: Of consumption, 15: of spasmodic affections, 8; of hydrocephalus, 1. Of the 134 who arrived at maturity, 46 are reported as healthy; 32 are set down as deteriorated, but without absolute indications of disease; and 9 are returned without any statement as to health or condition. The remaining 47 all possess such abnormities as to render them the subjects of particular observation. These are classed as follows: 23 are scrofulous; 4 are epileptics; 2 are insane; 2 are mutes; 4 are idiots; 2 are blind; 2 are deformed; 5 are albinos; 1 has chorea, and 6 have defective vision.' While these statistics present a goodly number of children, there was an unusual number tuberculous (15 dying of consumption) or scrofulous (23), making 38 in this class. Nearly one half inherited, probably an imperfect organization.'

"In the Transactions of the American Medical Association for 1858 is an extended paper by Dr. Bemiss on this subject, made up mostly of tables, reporting 833 such marriages, giving the time of marriage, the occupation, the temperament, the health, habits, etc., of the parents, with the number of children, their defects, peculiarities, etc., etc. The whole number of children was 3,942, of which 1,134 were defective; 145 deaf and dumb, 85 blind, 308 idiotic, 38 insane, 60 epileptic, 300 scrofulus, 98 deformed, and 883 died early. The proportion reported deaf and dumb, blind, idiotic, scrofulous, and deformed, is altogether larger than what would be found among the children of families in the community, taking them indiscriminately. The degree of relationship in these cases is thus given: 10 marriages between brother and sister, or parent and child; 12 between uncle and niece, or aunt and nephew; 61 between blood relations, who were themselves the descendants of blood relations; 27 between double first cousins; 600 between first cousins; 120 between second cousins, and 13 between third cousins. In a careful examination of the several degrees of consanguinity here given, the hereditary effects are found to be the worst in the first and second degrees, in the third not so bad; but when we come to the fourth, fifth, and sixth, the digerence is not so perceptible."

The significance of these facts cannot be denied, and we might gather from Dr. Allen's pamphlet, a much larger mass of facts bearing upon the subject, all going to prove that intermarriage has universally proved disastrous to the human race wherever it has prevailed to any considerable extent.

But it has been stated, and it must be admitted that there is force in the argument, that in all these cases, intermarriage has not been according to psychological laws; and that had these laws been observed as rigidly as stockbreeders observe them in producing the improved animals for which "In-and-in" breeding has become so celebrated, improvement, and not deterioration, would have been the result.

This is dealt with by Dr. Allen, in the most candid spirit, but at the same time his argument seems to us entirely incontrovertible. It is much too long for us to transcribe, but its gist may be summed up very briefly, as follows: Granted that the statement that intermarriage if conducted in rigid accordance with psychological laws, would improve progeny, it is simply impossible so to conduct it. Even the stockbreeder who is dealing with a coarser and far less complex organism than the human constitution, and who has power to control the coupling of the sexes at will, makes at times the most grievous blunders. The effect of such blunders may be corrected by killing a deformed or diseased animal, or preventing it from perpetuating its defects in future progeny, but these resources are not available in the case of the deformed, deaf, or diseased of the human race, and if they were, they would afford no remedy for the evils of intermarriage, which depend upon such complex and indeterminate physical characteristics that their effects upon the offspring of two nearly related individuals cannot be predicted with even approximate certainty.

From the doctor's essay we infer that the proper limit of consanguinity excludes first cousins from intermarriage, in which we agree with him. We believe that psychological laws have been altogether too much disregarded in the marriage of those not related by blood, and that much of the disease now prevalent in the world may be traced directly to this cause, and when we consider the largely increased tendency to impress upon offspring any peculiarity of consanguineous parents, we are convinced that such marriages are injurious in their effects upon society at large; and also that the Levitical law upon intermarriage was based upon sound psychological science as well as being an expression of the divine will, through the prophet Moses, to the Israelitish Nation.

NATURAL SELECTION.

The following, from the *London Quarterly Review*, is so terse and clear an exposition of Darwin's theory of natural selection, and presents such interesting facts bearing upon a subject now attracting universal attention in the scientfic world, that we give it a place in our columns.

"Mr. Darwin's theory is based on a very few groups of observed facts, and on one demonstrable principle. The first group of facts is the *variability* of all organisms descended from the same parents; a variability not confined to external form or color, but extending to every part of the structure, and even to constitutional and mental characteristics. This variability is found to be one of the most universal facts in nature. It is not common or general only, but absolutely universal. Every one knows from his own experience that no two individuals of a family, whether human or animal, are absolutely alike, but no one knows the large amount, or the infinite phases of this variability, but the naturalist or the breeder.

"The fact of universal and all-pervading variability being proved, it is next shown that every kind of variation can be accumulated, by the simple process of choosing from a great number of individuals those which possess any given variation in a marked degree, and breeding from these. It is found that in the next generation, the offspring do not, as might perhaps have been supposed, cease to vary further in the same direction, but generally vary from their parents as a center in every direction, and if a large number of individuals are produced, a considerable increase of the first variation may be obtained. For example the wild jungle cock (*Gallus bankiva*) has an average size about equal to that of our smaller kinds of domestic poultry, and out of thousands or millions of individuals none are ever so large as the 'Shanghai,' or so small as the 'Bantam' breeds. Yet these are descended from the same race, made permanently larger or smaller by the process above described. In pigeons, the bill, the feet, the wings, and the tail have been altered in size and form to an extent nowhere seen in the original wild stock, and Mr. Darwin has shown that the bones and internal organs are capable of modification to an equal extent. The power of accumulating every kind of variation is therefore proved, and this is the very corner-stone of the theory, and that which best distinguishes it from all hypotheses of transmutation of development that have preceded it.

Another fact of importance is, that all living things have the capacity of increasing in a geometrical ratio. If a pair produce ten young ones once during their lives, and these breed at a year old, there will be nearly 20,000,000 produced in ten years. Many animals, and most plants, have far greater powers of increase than this, and even the slowest breeding of all, the elephant, would, in five hundred years, increase from a single pair to 15,000,000. But we know that in any country once stocked with animals and plants, the number of individuals may fluctuate slightly, but never regularly increases.

Taking an average of all the species, it certainly remains nearly stationary. It follows, therefore, that the deaths every year are almost exactly equal to the births. If the number of sparrows in England is on the average half a million, and if a million young ones are hatched every year, then before the next year a million sparrows must die. So in a forest of oaks, the number of trees cannot increase on the same space of ground, yet millions of acorns are dropped annually, and would all become oak trees under favorable conditions, but all must die before maturity till an oak falls and leaves room for some of them. Now when, according to our supposition, a million sparrows die every year, what is it that determines which individuals die and which survive? We know that wild animals die of diseases, of hunger, of cold, by the attacks of enemies, and perhaps from other causes. Will it be the healthy or the sickly that will die of disease—the strong or the weak that will die of hunger—the well-feathered or the poorly-feathered that will die of cold—the active and wary or the slow and careless that will be killed by enemies? We can only answer these questions one way. We are as sure of the average result, as we are that an insurance company, which charged the ordinary rates to all people with consumption and heart disease would soon be bankrupt; and we may well express it by the term—'survival of the fittest' (this term was first used by Mr. Herbert Spencer in his remarkable work, 'The Principles of Biology,' and its more general adoption would alone answer some of the popular objections to Mr. Darwin's theory), a term which states the absolute fact, that those best adapted to survive do survive, and those least adapted die. This is Mr. Darwin's celebrated theory of 'Natural Selection,' but which is more properly a self-evident principle or axiom. Having been led to it by the analogy of the choosing or selecting by man of certain varieties to continue the breed, while others were neglected or destroyed, he personified the various natural causes which led to the preservation of the half million, and the death of the million, and termed them 'natural selection.' But people are continually forgetting that the term is an analogical one, and object over and over again that 'selection' implies a selecter; whereas if they would take pains to understand the thing, instead of puzzling over the mere term, they would see that the preservation of those best fitted to live, was as much the secondary result of the powers of nature as is the arrangement of sand and pebbles by water, or the selecting of leaves to be drifted into heaps by the wind, while the stones and sticks are left behind.

"Fully bearing in mind these great and demonstrable facts—the universal variability of all organisms and of all their parts—the possibility of accumulating these variations in definite directions—the enormous reproductive powers of all living things; and the mortality equal to the births—and lastly the necessary survival of the fittest—we shall be able to see, that the changes in external nature, animate and inanimate, continually going on, must produce indirect effects vastly greater and more important than any which, as Lamarck supposed, they can produce by their direct action on individuals or species.

"Let us take first the differences of color in animals. These are absolutely inexplicable on Lamarck's theory, for we do not find that any change of conditions produces definite changes of color, still less does it produce the varied spots, lines, bands, and patches of color that occur in animals. Neither have the motions of animals, their desires, or their food been proved to produce any definite effects on their colors. But we know that color is the most variable of all an animal's characters, and yet in a state of nature, color, as a rule, is very constant in each species.

"Mr. Darwin has shown, however, that color is often intimately associated with other constitutional peculiarities. In Virginia the paint root (*Lachnanthes tinctoria*) is eaten by pigs, and makes their hoofs drop off. But black pigs are uninjured by it. Consequently, in places where this plant is abundant the farmers never keep any but black pigs, as no others can be raised except in confinement. Here we have a beautiful illustration of the mode of action of 'natural selection.' The pigs of Virginia are not all born black any more than in other countries, but those of all other colors soon die, and therefore in a state of nature a black race would be produced; and from the powerful action of the law of hereditary descent there can be little doubt that in time the litters would consist almost entirely of black pigs. If after this had happened it were first discovered that white or brown pigs could not live in the district, we should have a striking example of adaptation; but the adaptation would evidently be an adjustment brought about by the simple law of 'natural selection' or 'survival of the fittest,' and the rigid extermination of all individuals not adapted to the surrounding conditions. It can be easily seen that in this case 'natural selection' does not imply a personal selecter, since exactly the same result must happen whether the farmer kills off the white pigs himself and turns the black ones loose, or turns out all together.

"This case, although curious, is by no means isolated. White terriers suffer most from distemper, and white chickens from the gapes. In Sicily the *Hypericum crispum* is poisonous to white sheep alone. White horses suffer severely from eating honey-dewed vetches, while chestnuts and bays are uninjured. Purple plums in North America are subject to a disease from which green and yellow plumbs are free. Again, the white pigeons of a flock are the first to fall victims to the kite. White rabbits of a very hardy kind have been turned loose but failed to maintain themselves, and black fowls on the west coast of Ireland are picked off by sea eagles. Here we have the explanation of the otherwise puzzling fact, that white quadrupeds and birds are so rare in nature, although abundant in all domestic animals; and the explanation is all the more satisfactory because it accounts for the exception to the rule, in the case of many arctic birds and quadrupeds as well as of sea birds, for to these the white color is a protection instead of a danger. Now this same principle will apply to structural and constitutional peculiarities and to habits.

"Man can accumulate variations either in the root, the leaf, the flower, or the fruit of plants, their color, odor, or taste; in the size, swiftness, or scent of dogs; he can alter the bill, the feet, the tail, or the habits of pigeons; can increase the milk of the cow or the fat of the pig; can alter the length of ear in the rabbit and of horns in the bull, or can attend to two or even more of these points at once. In like manner the law of 'survival of the fittest,' by simply determining which out of the immense surplus annually born shall be the parents of the next generation, must lead to the modification of every part of an animal's organization that affects its welfare—that is to say, sooner or later of its whole organization. So long as the changes of land and sea of which geology assures us, and their concomitant changes of climate, of soil, and of vegetation, and of the distribution of animal forms, are going on, each species in turn must be exposed to new conditions and new dangers, must have to live upon new food, or to struggle with new enemies. Those whose organization is sufficiently flexible to furnish in each generation favorable variations, will become adapted to the new conditions, and will appear as the new or representative species of the naturalist; such as could not vary quickly enough would die out, and furnish the extinct species whose remains the palæontologist disentombs.

"Here we have at all events a real and a powerful cause in action, and one which is accurately defined, and has been copiously illustrated by observation and experiment. No occult powers are postulated, but instead of them demonstrable groups of facts; and Mr. Darwin has developed his theory so fully, and has shown it to be in accordance with such a vast mass and variety of phenomena which on any other hypothesis are unintelligible, that it has commanded very general acceptance, especially among geologists with whose general doctrine it so well harmonizes."

Cultivation of the Truffle.

The truffle is a species of tubercular mushroom which grows and lives below the surface of the ground. Since the days of Pythagoras and of the ancient Greeks, a reputation for delicacy of flavor and perfume has been attached to it, which has made it a favorite with all true epicures, and has given it a high market value.

In France, which has at present almost an exclusive monopoly of the trade in this vegetable, more than 18,000,000 francs worth of truffles are consumed annually.

The region from whence these truffles are procured is south of the river Loire, and more especially those portions of France popularly known as Lorraine, Perigord, Saintonge, Gascony, Rouergue, Languedoc, Provence, and Dauphine.

A careful study of localities and a chemical examination of soils by Mr. Chatin, has proved that truffles will only grow in a calcareous soil, and that they are never found in silicious, schistose, or granitic soil. The ground must be perfectly free from permanent moisture. The climate needed must be temperate as both extremes of heat or cold are prejudicial to the truffle. In the Pyrenees truffles are found at a hight of 2,500 feet above the sea, but on the Alps they do not thrive at half this hight.

Singularly enough truffles are only found growing at the foot of a certain limited number of trees or shrubs (27 in all), but the various species of oak seem to be preferred above all others.

Truffles are hunted by means of small dogs trained for the purpose, who smell from the surface the whereabouts of the subterranean tubers, and by scratching the ground indicate to their master the spot where he has to introduce his spade in order to dig up the precious tuber. In the absence of dogs, the hog, whose sense of smelling is much more delicate than most persons believe, is often employed for the same purpose, a boy driving the animal slowly along through the woods, while he holds on by means of a string attached to the porker's hind leg. Wherever the hog stops to "root," the probability is that a truffle is to be found.

Attempts to cultivate the truffle have at various periods been made by enthusiasts but always without success.

It seems, however, that a M. Rousseau, of Carpentras, in France, has at last succeeded in this new branch of gastronomic horticulture, but no report of his system has yet been published.

Gas vs. Gunpowder.

The *Advertiser and Times*, Oswego, N. Y., says: "We saw, yesterday, a novel experiment involving the explosive power of gas. In the new tank excavation, now in a forward state, at the gas works in this city, an old well had been pumped out and then filled up after leaving an aperture beneath. Into this space a limited quantity of gas was introduced from the gas pipe, sufficient to form an explosive compound with the air in the covered well. A match trigger touched off the mine, when a general upheaving of the surrounding earth took place, loosening up the soil and making easier digging."

CEMENT FOR FASTENING INSTRUMENTS IN HANDLES.—A material for fastening knives or forks into their handles, when they have become loosened by use, is a much-needed article. The best cement for this purpose consists of one pound of colophony (purchasable at the druggists'), and eight ounces of sulphur, which are to be melted together, and either kept in bars or reduced to powder. One part of the powder is to be mixed with half a part of iron filings, fine sand or brick-dust, and the cavity of the handle is then to be filled with this mixture. The stem of the knife or fork is then to be heated and inserted into the cavity; and when cold it will be found fixed in its place with great tenacity.

Improved Plow.

The improvement here noticed is one of those simple in character, but on account of practicability and obvious utility, worthy of the earnest attention of those interested in the manufacture and perfection of agricultural implements.

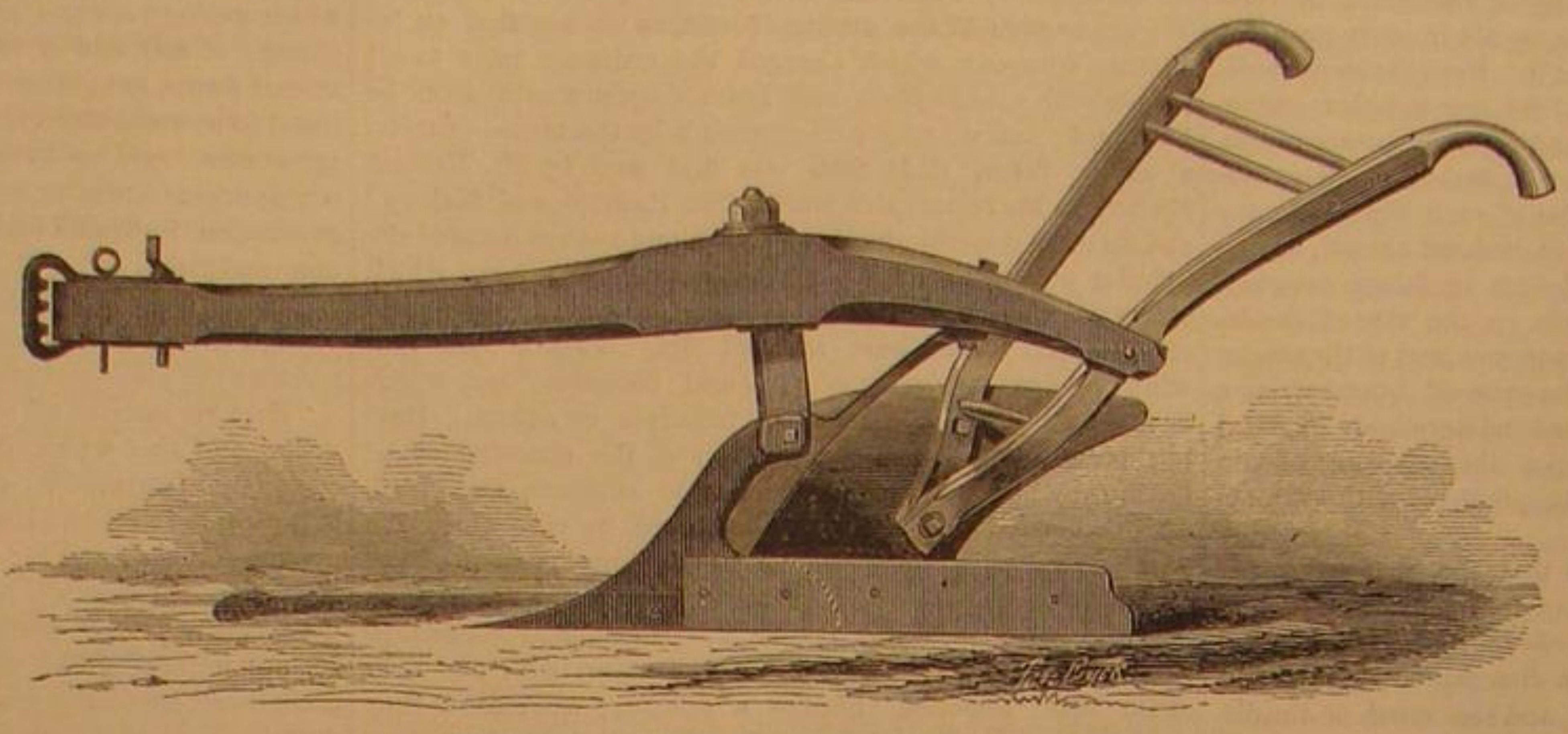
Its object is to firmly brace and stay the beam and other parts of a plow, and, at the same time, to obviate the clogging which takes place from attaching one of the handles to the landside bar or to an arm projecting from the rear of the standard.

The method of attachment adopted in this device leaves a clear space behind the standard, and between the beam and the landside bar; thus permitting stones, weeds, clods, or anything likely to fall into and clog an ordinary plow to escape readily.

The improvement consists in bringing the landside handle by a proper bend directly across to the mold board and attaching it at, or very nearly at, the same point that the opposite handle is attached. In the engraving they are shown as being attached by a single bolt passing through the lower ends of both handles; but separate bolts may be used if thought best.

The beam is thoroughly braced to the shank, and the landside bar is also strongly braced laterally.

It will be at once seen that the friction upon the landside bar must be very much less when made in the form shown in the engraving, than when it is increased in width to cover and shield the handle as in the old form; and that the draft must be correspondingly lessened. The plow never becomes loaded with stones, weeds, and earth, but constantly clears itself, which also greatly lessens the draft.



MANN'S PATENT IMPROVED PLOW.

The inventor has in his possession certificates from those who have tested the draft of this plow, stating that it is twenty-five per cent lighter than plows of the former construction. Let any farmer figure out for himself what a saving would here be made by the use of this plow. Work implies food for the animals which perform it. A given amount of work represents a given amount of oats, hay, or other forage consumed. Let a farmer estimate the value of one fourth the feed required for a team required to do a spring's plowing on an ordinary farm, and set the value of it against the cost of one of these plows, and he will at once see that if the tests above alluded to are to be relied upon, a large saving has been accomplished by this improvement.

This plow was patented, April 16th, 1861, by Henry F. Mann, at that time of La Porte, Ind., but now of Pittsburgh, Pa., who may be addressed for exclusive rights or licenses at the latter place.

Improvement in Tea-kettle Breasts

That simple, useful, and universal kitchen utensil, the tea-kettle, it would seem has in its ordinary construction some important defects. When it has got "to the boil" it makes steam faster than the meager avenues around the cover can permit it to escape; pressure is thus generated, and the water is forced up the spout and ejected, producing the catastrophe known to housewives and kitchen maids as "boiling over." If it be sought to prevent this by taking off the cover, the fingers are in danger of scalding, and are not unfrequently badly burned.

When the article in question is made of tin, it is liable to rust around the cover and thus enlarge the aperture rendering the cover loose and liable to drop into the tea-kettle, or off during the pouring, when a scald is almost certain. The rust also, not unfrequently extends back as far as the ears, weakening the attachment, which finally breaks out, necessitating a patch.

DIXON'S TEA-KETTLE BREAST.

The engraving shows an improved tea-kettle, which has not the defects we have described. It has a perforated dome for the escape of steam when generated, so that it cannot boil over; and the apertures in the dome are placed on the opposite side from the handle, which directs the steam away from the hand when the handle is grasped. The aperture into which the cover fits is bound with sheet metal, of any suitable kind not acted upon by water; as copper, block-tin, or other suitable material, which also as a col lateral advantage, strengthens the breast.

The old method of punching of a hole through the cover gives vent to the steam, but directs it against the hand precisely where it is not wanted; this improvement on the contrary obviates all necessity for any such clumsy make shift. A tube bent to the proper form may be substituted for the perforated dome, and can be applied to copper or iron kettles which may dispense with the binding.

The whole forms a simple, perfectly practicable, improvement, on a very useful article of kitchen furniture.

A patent was obtained on this improvement, April 6, 1869, by Z Dixon, Bristol, Ill., who now offers for sale the right for the New England States, and who may be addressed as above for further information.

LEGHORN STRAW HATS.

The Leghorn, or Italian straw bonnets and hats are celebrated the world over on account of their beautiful texture, pliability, artistic make, and high cost.

This modern branch of industry, which is limited to Tuscany, was begun in Florence in the year 1825, and has gradually acquired an importance of from three to five millions of dollars for crude straw for export.

The material used is a special variety of wheat cultivated for this express purpose, the seed of which sells at a much higher price than that of ordinary wheat.

The straw is harvested in the mountainous regions of Prato, Empoli, etc., where the vegetation is poor and stunted, the soil being light and sandy.

The fields are weeded by hand and worked with as much care as a garden plot. Fourteen bushels of seed are usually sown to the acre; two bushels being "broadcast" at each time, and each sowing made at a different angle to the first. The effect of this is to produce a very close, compact growth, and only one elongated stem rises from each seed sown.

The straw is harvested while green and before the ear is fully developed. It is gathered into small sheaves weighing about half a pound each, which are at first placed upright in the field to dry, one acre bearing about three thousand of them. Next day these bundles of straw are spread out over rocks and pebbles in the dry bed of water-courses, where they are submitted to the action of sun and dew. At night they are covered up, great care being taken to protect them from rain. The straw is now bleached by means of sulphuric acid gas.

The next operation consists in taking off the ear below the first joint, in separating the lower useless portion, and in cutting the straw into lengths of four inches. Each blade of straw usually furnishes three such lengths. It is then bleached for the second time by fumes of sulphur.

At this point the straws are sorted according to their various sizes—an operation performed by women who acquire, through long habit, a most remarkable tact in distinguishing the smallest variation in diameters, as may be inferred from the fact, that in front of each operator are placed goblets numbered from 30 to 180, each of which is the receptacle for a special size of straw.

The braids are plaited with from eleven to thirteen straws each. Their length is from 300 to 320 feet, their width and the quantity of straw entering into them varying according to quality. With No. 30 straw the braid is coarse and wide, and weighs two pounds and a half. It takes, however, a whole month to plait a single bonnet from such straw. With Nos. 120 to 180 it takes about one pound and a half of straw to a braid. With extra straw—No. 180—the braids are not more than 0·039 of an inch in width, and it takes six months' labor to make a sufficiency for a single bonnet for a lady.

The braids are cleaned, exposed to the sun for a short time, and then sent to the manufacturer to be sewn into shape. This last operation is performed with the very greatest care, the stitches being nearly invisible and yet strong, and not liable to unravel during the pressure to which the hats are often subjected after being sized.

The hats are "ungreased," and any bumps or protuberances on their surface are effaced by rubbing one portion of the tissue against another, or by means of friction with a dog skin.

If an accidental tear be made, a piece is immediately inserted into the slit, and so adroitly is this done that the most practiced eye can hardly discern the imperfection. The hats or bonnets are then immersed into a warm-water bath containing a certain amount of acetate of lead, and are finally bleached for the last time by means of sulphureous fumes. The pliability of these hats is very remarkable when compared with the common straw fabrics made in other parts of the world.

Imitation Leghorns have of late years been largely made, and with considerable success, in the Canton of Aargau, in Switzerland. The trade from this latter region amounts already to a value of several millions of francs per annum. These hats are neither as fine nor as strong as the genuine, but they sell at much lower prices.

The manufacture of "fancy" straw goods is a remunerative branch of agricultural technology, which might profitably be introduced into the United States. Such work is well paid for, and is of a nature suited to our country women and girls, who could earn a living at home, without being obliged to leave their families.

The seed of Tuscany wheat would probably have to be imported annually from Italy, as it has been proved by careful experiments in various portions of Europe, that it rapidly degenerates in quality whenever grown, for several successive years, in regions far removed from its original place of production.

Cheap Method for Grapes.

Mr. William J. Flagg, a practical vine-grower in Ohio, has recently spent three summers among the vineyards of Europe, most of the time in France, but Italy, Austria, and Switzerland were also visited. The modes of vine culture were carefully examined, with a practical eye, and although the excellence of various foreign practices were readily acknowledged, we do not find any desire to recommend or adopt any particular mode of cultivation merely because it is foreign. Mr. Flagg believes the souche (or stock) mode of training vines more suitable for this country at present than those now in vogue "We can and will," says the author, "grow wine cheaper than the Europeans, and for the same reason that we can grow wheat cheaper than they, namely, that we have cheaper land and more of it. In raising grapes on our present system, however, we abandon the only vantage ground we possess and enter into competition with them in a field where they are stronger than we." The appearance of vines trained after the *souche* method is thus described in an earlier portion of the work. "'What is that?' I exclaimed, with no little astonishment, as, turning away from the trellises where vines were so tenderly upheld, we entered a field where there was never a bit of trellis nor stake at all, nor peg to tie to, nor tree to hang upon, but where each individual plant, alone and self-sustaining, scorning all support—its arms embracing nothing—its tendrils twining around nothing—stood on its own bottom, and held up its own top, like a strong-minded woman planted on her rights! It was a field of the variety known as *la folle blanche* (the crazy vine), growing *en souche basse*, which may be translated by stump, or stool, *souche* meaning, literally, stock. * * * As a workman drew apart the branches of one of the *souches*, a profusion of full-sized, white grapes was revealed, all hanging close about the head, and easily sustained by the rugged old stock, which was about ten inches high and five inches thick. 'It is a perfect fountain of wine,' said the man." It is this mode of training that Mr. Flagg would have introduced in America, and apparently with good reason.—*Albion.*

We notice in one of our exchanges the death of Professor Dussauce, a native of France, who at the time of his death filled the position of chemist to the establishment of Messrs. Tilden & Co., of New Lebanon, N. Y.—The deceased was evidently an indefatigable worker, having written and compiled several scientific works. Respecting Professor Dussauce's early history and education we have no mportant facts.

Scientific American.

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Contents:

(Illustrated articles are marked with an asterisk.)

WANTED A SUBSTITUTE FOR EARTH AND PLASTER WALLS.

In the matter of external construction, the architecture of the civilized and semi-civilized races shows a very marked contrast to the rude habitations of savages; but so far as inside walls are concerned we are but little removed from them. We daub the insides of our dwellings with what if not exactly mud is but little removed from it. In this respect our civilization is but little above that of the beaver, the mason bee, or the mud wasp. It seems strange that in this age of improvement, the public is content with the rude plastering, the earliest date of which would be about as hard to fix as the date at which building began.

Mortar is ill adapted to the purpose in several respects. First, it is uncomely, unless covered with hard finish or paper, or frescoed in a much more artistic manner than most modern fresco painters seem capable of. Second, it is friable and inelastic. A slight inequality in the settling of buildings fills it with unsightly cracks, the repair of which fills a dwelling with dirt, ruining furniture and irritating temper. Third, a certain temperature must be maintained after it is applied until it is dry, to obtain a successful result. Fourth, it is liable to fall from the ceiling upon the heads of people quietly and unsuspiciously sitting beneath it, from the effects of jar or an undetected leak in the roof. Fifth, it is a porous and absorbent material, and forms, unless covered with hard finish, painted, or otherwise covered, a reservoir for the accumulation of noisome odors and pestilential effluvia, etc.

Standing opposite these objections it has the advantages of cheapness and easy application, which do not in our opinion balance the account.

It would seem that with all the resources now at command something much better than mortar may be found out of which to construct inside walls; something not so expensive as wooden wainscoting and ceiling, while at the same time it might be susceptible of a high degree of adornment, and free from the objections we have enumerated.

We believe an excellent, warm, and durable wall might be made of straw board, sized with glue, or some other permanent stiffening, and painted on the inside. This material has considerable strength and elasticity. It is a bad conductor of heat, and would not condense moisture from the air in cold weather, as is frequently the case with plastered walls, in churches and assembly rooms, when an audience assembles in them.

Nothing can be more unsightly than the streaks formed by condensed moisture on a frescoed wall, unless perhaps it may be the streaks of color sometimes seen on the cheeks of ladies in overheated assembly rooms.

It is even possible that a preparation of straw pulp could be made that might be applied in a plastic form; a sort of straw *papier mache*, capable of being molded into forms of beauty in cornices, center pieces, etc. Such a wall would seem to be inexpensive and easily put on, it would not be attended, in repairs, by the disagreeable and destructive lime dust. If varnished over the paint, it could be easily kept clean by washing, and any colors desirable might be used in its decoration.

There are other materials which will suggest themselves to inventors as being likely to prove available for the purpose, and there can scarcely be a question that the public would eagerly embrace any improvement that would secure immunity from the objectionable features of plastered walls. But perhaps the material which will soonest be thought of in this connection is sheet metal. We are informed that ceilings of corrugated metal have been manufactured, but we do not know the parties who make them, nor have we learned the success which has attended their use. It must be remembered however, that metallic bodies conduct and radiate heat with greater facility than other substances, and are therefore perhaps open to some objections on the score of economy in cold climates where a saving in fuel is a desirable attainment.

To find a substitute for mortar, every way answering the requirements of the case, will undoubtedly necessitate some experiment, but we believe the value of such an improvement would warrant the devotion of considerable effort toward its attainment.

WANTED—LIGHT IN DARK PLACES.

While the means of creating artificial light have received much attention, and have been greatly extended within a few years, we find city corporations still clinging to common illuminating gas for lighting streets, railroad companies using kerosene for lighting stations and tunnels, and the United States Government holding on to the lard oil lamps for lighthouses. We have seen only one indication that anything better than gas is sought by city governments in this country for street lighting. This indication is found in the annual message of Mayor Hall to the Common Council of New York, which contains a suggestion that the magnesium, or, more properly, magnesia light—for this must not be confounded with the light produced by the combustion of the metal magnesium—might prove cheaper and better than the gas now used. The light in question is produced by the combustion of two small jets of gas, one of ordinary illuminating gas and the other of oxygen, in contact with a pencil of magnesia. It is precisely similar in principle to the well-known lime light; the substitution of magnesia for lime on account of its superior durability, and common illuminating gas for pure hydrogen on account of its cheapness, being all the modifications made, if we except the improved burners intended for general use. The process of Du Motay has so cheapened the cost of obtaining oxygen that the light thus obtained is rendered cheap enough for general use.

The want of diffusiveness complained of in the lights of this kind, placed at the corners of Trafalgar Square, in London, does not appear to us an essential defect of this light, and we are of the opinion that proper adjustment would entirely obviate any such objection.

We are assured by Dr. Doremus that the city streets could be illuminated far more cheaply and efficiently by the magnesia light than is possible by the old method.

It is also demonstrable that the safety of life and property is enhanced by thoroughly lighted streets, while the comfort of the populace is greatly increased.

But while it needs no argument to show the superiority of the magnesia light over the ordinary gas, we think a suggestion in regard to the placing of lights, of whatever character they may be, is worthy of consideration.

In approaching one of the ordinary gas lamps the eyes are so dazzled by the direct rays from the burner, slightly elevated above the heads of foot passengers, that a person, although his face may be perfectly recognized by another coming from the light toward him, cannot recognize distinctly any one a few feet in advance.

A remedy for this occurred to us one evening during the past winter, when upon the occasion of a *fete*, held in the Academy of Music, on Fourteenth street, in this city, the street for several blocks was illuminated with the magnesia light. The light being placed at quite an elevation, there was considerable diffusion of the light through the atmosphere approximating the effect of daylight. The faces of people coming from the light were as readily recognizable, as—when we had passed it—were those of people approaching it. The light, although very dazzling to look at from a short distance, was above the line of ordinary vision, except at a considerable distance, which so tempered it that its dazzling effects were not felt. Our observations at the time convinced us that the elevation of street lights would not only add to their general illuminating power but would render their effect much more agreeable.

The adaptation of the magnesium light to the illumination of dark tunnels on railways, seems not only obvious, but, it appears to us, demands the attention of railroad managers, from its economy, efficiency, and the increased safety which would be secured by its adoption.

For example, the Bergen Tunnel, on the Erie Railroad, a short distance from the ferry in Jersey City, has trains passing and repassing nearly every half hour of the day. It is three quarters of a mile in length. It is the custom to light the lamps in the cars when a train is about to enter this tunnel and extinguish them after the tunnel has been passed. The rushing into this darkness from broad daylight, produces a very uncomfortable sensation. This annoyance to passengers might be obviated, and the trouble of lighting lamps be done away with, by a suitable disposal of a few magnesia lights, which would light up the entire tunnel. We are certain that the adoption of this suggestion would be hailed with satisfaction by the crowds of people who daily pass through the Bergen Tunnel.

What reasonable excuse can be given by the Government for neglecting the advantages of this light for lighthouses along the coast, we cannot conjecture. In power it is as much superior to the lard oil lamps as they are superior to total darkness. When it is reflected that the loss of a single loaded vessel would supply the lighthouses along the entire coast with the new light for a long time, it is hard to conceive why our Government should not at once gladly avail itself of a means whereby immensely greater efficiency could be at once secured.

Many of our city readers will remember the humorous and sarcastic manner in which Prof. Doremus spoke of some of the officials who have this matter in charge, at his lecture on the Photometer, before the American Institute last winter, and the hearty laugh which burst from the audience on that occasion, when after the hall had been flooded with the magnesia light, he made the simple announcement that the government officials above alluded to, thought on the whole, lard oil was the best thing for the lighthouses. We heartily wish Professor Henry, of the Smithsonian Institute, whose intensely old-fogy letter upon the subject was read by Dr. Doremus, could have been present on that occasion. He would have found the lard-oil party decidedly in the minority at the moment.

But we have said enough for our purpose at this time. The whole matter may be summed up by the plain assertion that the public want, and will have, better light than is at present provided by tardy officials.

SPONTANEOUS GENERATION.

Discussion upon this topic seems to have been revived in some quarters. Most of our readers will understand what is meant by spontaneous generation, but lest there should be any misapprehension in the minds of any we will state what we understand by the term.

It certainly does not mean the springing into existence of living beings without any cause or causes for such an event; but, as we understand it, it signifies the production of a living thing from the elements which enter into the composition of its tissues, without the previous existence of parents and the formation of a germ through the action of vital energy, which, in general, is the commencement of reproduction.

It is not to be denied that the tendency of modern science is to the belief that spontaneous generation is possible, though if so, rare, and occurring only in the lower forms of life, under circumstances very difficult to separate from those which tend to obscure, and defeat demonstration. Notwithstanding all attempts at positive demonstration have hitherto failed, there remain some stubborn facts very difficult to reconcile with the belief that spontaneous generation can never occur.

Our readers will recollect reading of the appearance of certain insects of the *acarus* tribe in a highly caustic solution upon which the celebrated English electrician, Andrew Crosse, was experimenting in 1836. A considerable sensation was caused by the discovery, and a sharp discussion followed as to whether the appearance of the *acari* was an example of spontaneous generation or otherwise. The wife of Mr. Crosse has testified since his death that he never so regarded the occurrence, although surprised and nonplussed by it. Professor Faraday and Mr. Weeks confirmed the experiment of Mr. Crosse, but it has since been repeated by Professor Schulze, of Germany, without the appearance of the *acari* or anything resembling a living germ.

Others, among whom the most prominent is perhaps M. Pouchet, have endeavored to demonstrate the possibility of spontaneous generation by actual experiment, but though they have performed their experiments with much care and have succeeded in finding in their solutions many new infusoria, they have not generally convinced the scientific world of the satisfactory nature of their experiments.

The views of Professor Fick are that every organ of living beings is formed of congeries of cells, that each of these cells has a separate and distinct existence, and that, could proper conditions be attained, these cells would preserve their individuality of existence, and continue to live though the body of which they form a part were dead.

Professor Clarke, in his investigations upon the origin of *vibrios* from decaying muscle, says that he was impressed with the thought "that the *vibrios* were neither more nor less than the fibrillæ of the muscle set free from the fibers," a suspicion which he says was eventually verified by actually witnessing the fibrillæ disentangling themselves. He concludes, however, that the *vibrios* are nothing but dead muscle, notwithstanding their active motions.

A writer in *Scientific Opinion* now takes the ground that these are or may be living organisms; and accounts for the organisms found in the infusions of M. Pouchet and others, by the assumption, that they are simply the re-arrangements, and re-combinations, of the liberated cells of the substances infused; basing his views on those of Professor Fick above alluded to.

Now it is certain that every germ is a living entity, and that it is composed of matters found in the inorganic world. These matters have been combined by some means, and the compounds blended in the tissues are of a chemical character, yet possess a certain undefined something which merely chemical compounds, so far as present knowledge extends, do not possess, but which has received the name of vital force.

This force is synthetic in its nature; it builds up tissue, or it enables tissue to build up other tissue like itself. Hence we have growth, and when the vital energy decreases, or ceases, we have decay of parts, or general death and decay. While it is not proved that vital energy is not identical with chemical affinity, there are many reasons for believing it to be a distinct property belonging only to living things, and capable of being imparted only by living things to combinations of dead matter which thus becomes quickened. There are, at present, too few data for determining the question at issue, and while the subject is one of intense interest, and presents a most captivating field for study and speculation, it is one upon which it is absurd to hazard an opinion at present.

However deep we enter the penetralia of nature, there yet remains something between us and the ultimate; and all analogy teaches us that this must ever be the case. Every new discovery only leads us one step nearer the great controlling intelligence, who infinitely removed from mortal ken, yet permits us to approach gradually, through the ages of eternity to the secret of omnipotence. How vain, therefore, to assume from the few facts which biological science has already attained and classified, that we have even caught one glimpse of the profound mystery of life.

HAIL AND HAILSTORMS.

Our exchanges give accounts of several hailstorms which have occurred in various parts of the United States, and we are in receipt of several communications concerning the principles which govern the formation of hail, and containing some inquiries in regard to them.

Among these, a fair correspondent from Otsego Co., N. Y., has asked us whether a genuine hailstorm was ever known to occur in the night. Several others write us in a way that shows a confusion in their minds as to what is to be considered a hail storm, and what is not.

We will answer several of these together by saying that the sleet which falls in cold weather, and, in some regards, resembles hail, is not genuine hail. If a granule or globule of sleet be examined, it will be found to be generally of uniform texture throughout, being simply an ice globule. A hailstone, on the contrary, is formed, generally, of alternate layers of ice and snow, arranged somewhat like the layers of an onion, around a white nucleus of snow.

It is stated in the books that hail rarely occurs in the night. In our own experience, a hailstorm has *never*, to our knowledge, occurred at night. Our numerous correspondents, who reside in regions liable to the occurrence of hailstorms, will confer a favor by informing us if they have seen genuine hail between sunset and sunrise.

These storms usually occur during the hottest weather, and in the daytime, generally, if not universally, accompanied by electrical displays of great activity. It is quite certain, therefore, that electricity is, either as a cause, or effect, or concomitant, connected intimately with the production of hail.

During the occurrence of two hailstorms, which occurred at this point this season, we examined some of the stones which fell, and, whether owing to the warmth of the pavement, acting to speedily melt them, or to some other cause, the form of the stones did not present the usual pear-shaped form very distinctly.

The Transactions of the American Institute, for 1864, contain an account of a hail storm which occurred in Paris on the 29th of March, of that year, in which the stones had an absolute conical form. The base of the cone was slightly concave, and the sides were roughened by minute, six-sided, transparent pyramids, inclined toward the base. Some pyramids, also, emerged from the base. The weight of these cones varied from 180 to 250 milligrammes—about from 28 to 38 gr.,—and the diameters of the bases varied from 8 to 10 millimeters, or from about 3-10 to 4-10 of an inch; while the hight was from 10 to 13 millimeters, or from 4-10 to 5-10 of an inch. The hail, was, therefore, remarkable in nothing except the form of the stones.

The combination of causes which produce hail are very imperfectly understood. There must, however, be contact of cold air with warm, moist air, but how the intense degree of cold necessary to change the condensed watery vapor into ice, so rapidly, is produced, is yet a mystery. All the theories yet put forth are based upon hypothesis, and it is difficult to see how facts can be obtained which will give a reasonable solution of the phenomenon.

The freezing takes place at points inaccessible to man and the lumps of ice are precipitated upon the earth, frequently in such a manner, and of such a size, as to show that they must have fallen from high altitudes.

The theories alluded to are so familiar to most of our readers, that we will not dwell upon them, but will say in conclusion, that the most plausible of them appears to us to be that of Redfield, which supposes the hot and cold airs to be mingled and carried to high and intensely cold regions by the action of a vortex or whirlwind, from whence the congealed moisture is precipitated in the form of hail.

THE PRACTICAL APPLICATION OF THE SLIDE VALVE AND LINK MOTION TO STATIONARY, PORTABLE, LOCOMOTIVE, AND MARINE ENGINES.

The above is the title of a new book from the pen of William S. Auchincloss, C. E., which is a work of too great importance not to receive at our hands more than the brief notice usually accorded to new publications.

The author tells us in his preface that

> the main object of his treatise is to place in the hands of the mechanical engineer and draftsman, a simple method for determining the proportions suitable to any link motion, without the assistance of an expensive and cumbrous model or the delays incident to its manipulation. Secondarily to supply the student of steam engineering with a comprehensive view of those causes which regulate both the form and dimension of the cylinder, slide valve, and eccentric. This portion of the work has grown incidentally out of the first; for as the link merely combines the action of two eccentrics, it was obviously necessary that the functions of one of these should be clearly understood before an attempt was made to develop the laws of their joint action.

The author modestly expresses the hope that these Parts I. and II. will not prove entirely devoid of interest to the skilled designer, but that they will at least receive a hasty survey, for the sake of the light they throw on the general subject through the medium of Part III. The author may dismiss all fear that any part of his able work will fail to interest either skilled or unskilled readers. We have seldom had the pleasure of reading a work, in which the author has been able to express himself with greater clearness, or has reached the real difficulties of his subject by such well-selected methods of approach. There is in the body of the work no shadow of an attempt to sacrifice perfect plainness of speech to a desire to display the learning of the author. He has, from the outset, conscientiously kept but one purpose in view; namely, to choose only those methods of demonstration which would best enable his mind to come in contact with the minds of his readers. To this end he has never let style or pompousness of expression take precedence of perspicuity, and has been willing to adopt any method of illustration, however simple, provided it would best subserve the purpose. In this way he has stamped his personality so strongly upon his work that one feels, after perusing his work, as though he had held a conversation with the author, instead of reading a book.

He is fully aware, at the outset, that

> engineers, accustomed to consider the model as absolutely indispensable to the proper adjustment of a link motion, will be wont to look with skepticism upon all efforts made to solve the problem by other means,

and admits that

> so far as these feelings are entertained against an algebraic or trigonometric solution they are well based; the number of variables entering into the problem, being too great for the powers of algebraic expression.

He has, therefore, adopted geometric construction as the basis of his system, and has shown great skill in its development. But while in his treatment of the subject the author has judiciously avoided all abstruse modes of expression, he has added, in the appendix, a mathematical investigation of the subject of the crank and piston motion.

The results of the investigations and discussion enable the author to construct a travel scale, by which all problems connected with the slide valve can be directly solved by simple measurement, and without any complicated construction or calculation.

The author commences his work by a brief but sufficiently comprehensive discussion of what is to be correctly understood by the term work, and the methods of estimating it. He then takes up the subject of mean effective pressure, and shows that

> the character of the connections between the boiler and steam cylinder, their length, degree of protection, number of bends, shape of valves, etc., must all be considered in forming the initial pressure in the cylinder, while the mean effective pressure will depend upon the point of cut-off of the steam, and the freedom with which it exhausts.

He does not attempt the discussion of the proper point at which steam should be cut off, that being foreign to the purpose of the work; but considers it throughout the treatise as predetermined, with the exception of certain limitations prescribed by certain valve motions.

This is followed by a mean pressure, volume, and temperature table, in which the stroke, being taken as a unit, and the initial pressure in lbs., with the temperature in degrees, Fah., and the corresponding relative volume being given, the mean pressure for various points of cut-off may be at once taken off.

> If from the mean pressure we subtract the mean value of the back pressure, or that which may arise from imperfections in the exhaust usually taken for low-pressure engines, at from one to two lbs. per square inch, the resulting pressure will be the mean effective pressure in pounds exerted on each square inch of the piston.

This, in connection with a large number of experiments made by Mr. Gooch, in 1851, with the locomotive *Great Britain*, forms the basis for another table of mean effective pressures. The author here, as well as in all other parts of the work, illustrates by an actual example performed in accordance with the principles laid down, the proper application of the principles to the solution of problems.

The next subjects considered are the speed of piston, diameter of piston, and its stroke. Here it is plainly shown that the diameter of the piston to drive a given horse-power depends upon the mean available pressure and its speed, the latter, of course, left to be decided by the judgment of the designer, as formed upon a due consideration of each individual case. The author, therefore, contents himself with giving the quantities most frequently found in ordinary practice. Of course the stroke of the piston is derivable directly from the speed of the piston, but the circumstances which should limit the stroke are referred to in this connection, accompanied by tables of the revolutions made by driving wheels of a locomotive at given speeds, for various diameters, and the number of revolutions of cranks of marine and stationary engines, for given stroke and (approximate) piston speed.

As all work performed depends primarily upon the mean effective pressure in the cylinder, and as this mean effective pressure so far as the engine proper is concerned, depends chiefly upon the point of cut-off and the freedom with which the exhaust takes place, the author justly remarks, that

> the area of the steam port ranks next to cut-off in its controlling influence upon the proportions of the valve seat and face. It may, therefore, be considered as a *base* from which all the other dimensions are derived in conformity with certain laws. Its value depends greatly upon the manner in which the port is employed, whether simply for admitting the steam to the cylinder, or for purposes both of admission and exit. In cases of admission it is evident that the pressure will be sustained at substantially a constant quantity by the flow of steam from the boiler. But in cases of exit or exhaust, a limited quantity of steam, impelled by a constantly diminishing pressure, forces its way into the atmosphere with less and less velocity. If, then, the engine is supplied with two steam and two exhaust passages, the ports will be correctly proportioned when the areas of the latter exceed those of the former, by an amount indicated by careful experiment. When, however, one passage performs both duties, it should have an area suitable for the exhaust, and be opened only a limited amount for the admission of steam. Very excellent results have been found to attend the employment of an area equal to 0·04 of that of the piston, and a steam pipe area of 0·025 of the same, when the speed of the piston does not exceed 200 feet per minute, but widely different factors are demanded by higher speeds, like those peculiar to locomotives.

The experiments of Gouin, Le Chatelier, Clark, Gooch, and Bertera, are then considered, and a table constructed for the relative proportions of port area and steam pipe area, expressed in decimal fractions of the area of the piston for various speeds of the piston.

> Having determined the area of the steam port, the next step is to resolve it into its factors, length and breadth. When a small travel of the valve is essential, the length should be made as nearly equal to the diameter of the cylinder as possible: then the port area, divided by the length, furnishes, of course, the value of the breadth. *The extent to which the valve should open this port for the admission of the steam will equal from 0·6 to 0·9 of the breadth*, and the *minimum* travel, that which, with a given cut-off, just opens the steam port the amount of this limit. The *maximum* travel is governed by expediency, the general tendency of an excess over the minimum is to render the events of the stroke *more* decisive, the cut-off takes place with greater brevity, avoiding unnecessary wire-drawing of the steam and the release opens rapidly, affording a more perfect exit. Where the travel is small these good qualities should be secured by increasing this term, until the valve gives an opening equal to, or greater than, the width of the steam port. With a large travel no such attempt should be made, since it would inevitably sacrifice much work in friction and cause a far greater loss than gain.

The form of the upper valve edge here comes in as an important combination, and it is shown that a proper curvature is preferable to the more common angular form for the exterior edge.

Having thus established an intelligent basis from which to deduce the motions of the valve and its attachments, namely, the point of cut-off, and the area of the steam port resolved into its factors of length and breadth, the author proceeds to discuss the means whereby the proper motions may be ascertained and secured. In doing this his method is admirable. He begins by supposing the valve to be actuated by a crank, its pin playing in a slotted crosshead attached to the eccentric rod, and also supposing the crank on the main shaft to be actuated by a slotted crosshead acting on the crank pin. This divests the problem of all complications arising from angularity of the crank and eccentrics at half stroke, occurring when the ordinary connections are used, they being reserved for subsequent study, when the general principles of the primary motion shall have become well understood. For convenience the cylinder is always regarded as being on the *right-hand* side of the main shaft, and the point of the crank pin circle *nearest* to the cylinder as the zero or starting point of the stroke. Then follows a table of positions under these conditions, with examples showing its application. From this point of departure the author proceeds gradually forward, clearing away obstacles and rendering the ascent easy to the most complicated portions of the subject.

We have dwelt upon the earlier portions of the work because we are convinced that only by a proper appreciation of the judicious selection of the elements of cut-off, and steam port area, as a basis, from which all the required motions are most easily traced, will the reader be prepared to follow the author through his subsequent train of reasoning with pleasure or profit.

We wish we had space to here review the subsequent portion of this able treatise, but we assure the reader that we have never opened a work relating to steam which seemed to us better calculated to give any intelligent mind a clear understanding of the department it attempted to discuss. The work is profusely illustrated with diagrams and plates, and the travel scale, the offspring of the thought and study which originated the work, is affixed.

The work is published by D. Van Nostrand, No. 23 Murray street and No. 27 Warren street, New York.

THE HARTFORD STEAM BOILER INSPECTION AND INSURANCE COMPANY.

The following report of steam boiler inspections by this company in the month of May, is made to its directors:

During the month 265 visits of inspection have been made and 437 boilers examined—359 externally and 204 internally—while 23 have been tested by hydrostatic pressure. The number of defects in all discovered, 53—28 of which are regarded as especially dangerous. These defects were as follows: Furnaces out of shape, 7; fractures in all, 219—5 dangerous; burned plates, 27—1 dangerous; blistered plates, 39—3 dangerous; incrustation and scale, 65—3 dangerous; external corrosion, 67—4 dangerous; internal corrosion, 6; internal grooving, 1; water gages out of order, 20; blow-out apparatus out of order, 3—1 dangerous; boilers without blow-out apparatus, 4; safety valves out of order, 13—2 dangerous; steam gages out of order, 36—4 dangerous; boilers without gages, 12; manholes without mouth-pieces, 6—2 dangerous; boiler heads not properly stayed, 9—2 dangerous; boilers condemned as unsafe and beyond repair, 2.

We are frequently asked what is to be understood by "furnaces out of shape?" We suppose that few persons familiar with steam boilers fail to understand this. It is well known that the furnace of a steam boiler is subjected to intense heat, and consequently the iron is liable to excessive expansion. Where injudicious firing is done this is especially true, and we not unfrequently find sheets contorted their joints badly strained, and a complete overhauling absolutely necessary for safety.

Injudicious firing is a very prevalent evil. Where coal in large lumps is piled upon the grate nearly or quite to the crown sheets, the furnace cannot be otherwise than seriously injured. Formerly such practice was regarded economical, but it is now well understood that the most economical fires are those where the coal is small, and evenly scattered over the grate. In short, thin fires, more frequently fed.

Objection may be made to frequent feeding, on the ground that fire sheets are injured by a current of cold air impinging against them.

The time required to feed a fire, managed as described above, is very short, while in the old-fashioned way, the doors must be kept open some minutes to remove the slag that has accumulated on the grate bars; and further, the draft is always more or less impeded.

Internal corrosion is a difficulty frequently met with; it is deceptive and dangerous, and can only be detected by careful internal examination. We have found sheets badly defective in this respect, when the exterior of the boiler appeared sound and in good condition. This difficulty arises from impure water, and is common to a considerable extent all over the country. We are informed by the English companies that it is common there, especially in the mining districts. We have recently received from them photographs of plates, pitted and corroded to an alarming extent.

Water gages, it will be seen, are far from infallible; they are valuable, as a visible means of indicating the hight of water in a boiler, but they should not be relied to the exclusion of gage cocks.

What we would say to engineers is, Look well to all the appliances and attachments of your boiler, they all need your constant attention. It is neither guaranteed nor expected that they will do your work for you, especially if left to themselves for months and years together.

Incorrect steam gages are too common, and in the reports for this month are several, 15 or 20 pounds out of the way. We have commented on this subject so often that we will now merely ask, How many who are now running steam boilers would be willing to increase their pressure 20 pounds steadily, especially if they are now running all that they dare?

The company employs for its inspectors competent men, who, by experience, are familiar with the construction and management of steam boilers, and know where to look for weak points and defects.

NEW RULE ABOUT PATENT OFFICE DRAWINGS.

Hereafter, in accordance with the new rule of the Commissioner of Patents, all drawings sent to the Patent Office will be returned to the applicant or his agent, unless they are artistically made. The principal reason for this regulation grows out of the fact, that duplicate drawings are to be photographed—one copy to be attached to the patent, and other copies are to be used for the convenience of the examiners in charge of the respective classes. The Commissioner advises applicants to employ competent artists to execute their drawings, which is also a good suggestion.

The promulgation of this new rule leads us to remark, that recently there has grown up a practice on the part of some agents to file miserably prepared drawings, simply for the reason that their slip-shod method of doing business has forced them to adopt the cheapest possible plan. The consequence is, that the portfolio of the office are encumbered with a mass of rough outline sketches, which are neither artistic nor creditable to the office. The Commissioner, evidently, does not mean to encourage this disregard of artistic merit. He has a right to insist that all drawings hereafter to be filed shall possess a certain degree of excellence, and to faithfully illustrate the invention in detail.

To the North Pole by Balloon.

A new and daring experiment is noted by the *Pall Mall Gazette*: "The invariable failure which has hitherto attended nautical expeditions to the Arctic regions has induced two Frenchmen, Messieurs Tissandier and de Fouvièlle, to undertake the enterprise of reaching the North Pole in a balloon. The machine in which the bold adventurers are about to embark on their perilous journey, and which is appropriately named "Le Pôle Nord," is now being completed in the Champ de Mars, which the government have placed at their disposal for the purpose.

The monster balloon, beside which even the famous Géant would seem a mere toy, will contain over 10,000 cubic meters of gas, and is composed entirely of a cloth manufactured from caoutchouc, which will allow of great expansion in the rarefied strata of the atmosphere. The seams uniting the different pieces form a total length of three English miles. The car, a marvel, it is said, of strength and lightness, is constructed to carry ten passengers, 4,000 pounds of ballast, and provisions for a month.

The East River Bridge.

The plan of the East River Bridge, as proposed by Mr. Roebling, has met with with the approval of the Board of U. S. Engineers, appointed to examine it, and of the Government, and has been fully adopted by the Board of Consulting Engineers, consisting of Horatio Allen, Wm. J. McAlpine, J. J. Serrell, Benj. H. Lathrop, James P. Kirkwood, and J. Dutton Steele, who have made to the Directors of the Bridge Company their final report, of which the following is the substance: The plans, including foundations, towers, and superstructure have been laid before the Board by Mr. Roebling at various times between February 16 and April 26, and from him they have received the fullest information touching all the details. Having completed the examination of the plans and the investigation of the combinations and proportions proposed, the Board deemed it an appropriate part of their duty to examine the structures of the same general character erected by Mr. Roebling across the Monongahela and Allegheny, at Pittsburgh, in 1846 and 1860; across the Niagara Falls in 1850, and across the Ohio, at Cincinnati, in 1860. They have thus had an opportunity of learning the successive steps in bridge building, which, beginning with a span of 822 in 1854, and one of 1,057 feet in 1867, all standing this day—a practical demonstration of the soundness of the principles and proportions on which these structures have been erected, and rendering unnecessary, at least for spans of 1,000 feet, any other demonstration, and affording the best source of information as to the practicability of taking another step in a span of 1,600 feet. The bridge proposed by Mr. Roebling, a steel wire cable suspension bridge, 1,600 feet between the towers, 135 feet above the water, will be, in the opinion of the Board, a durable structure of a strength sufficient to withstand six times the strain to which it can under any circumstances be subjected, that it will bear the action of the greatest storm of which we have any knowledge, and that the method of joining the parts cannot be surpassed for simplicity and security in the result.

Editorial Summary.

THE TENNESSEE CENTRAL FAIR.—It will be noticed, by reference to our advertising columns, that this association proposes to hold a fair at Murfreesboro, Tenn., and offers liberal inducements to exhibitors of all classes of improved labor-saving machinery for mechanical, agricultural, and household purposes, and to producers of "blooded" stock, and all varieties of superior seeds for garden and farm. The liberal offer to receive the articles and have them exhibited without the expense and loss of time necessary for a personal visit from the owner, is a new and attractive feature in this class of exhibitions, and manifests a progressive and liberal spirit upon the part of the officers, which should be promptly and freely responded to by all who are interested in building up a community of social and financial good feeling between the two sections of the Union, and who desire a market in that fertile and fast-improving region of country. We hope the efforts of the directors will meet with a liberal response.

M. BIONNE has submitted the following opinion upon the nature of comets to the Academy of Sciences: "Comets are bodies which describe spirals originating in a nebula terminating in the sun; each spiral may be considered as an ellipse. Formed of the incandescent matter of the nebulæ, comets would appear to be the regulators of the grand movement of celestial bodies, the agents of that vast transformation of calorific work into mechanical work, and would come at the end of their course to lose themselves in the atmosphere of the sun, to which they would serve as an aliment."

THE NEW OCEAN CABLE.—The steamship *Great Eastern* is now engaged for the second time in laying a cable across the Atlantic ocean, this time, however, from the coast of France. The latest account represents that everything was proceeding favorably. The ship was 294 knots out of Brest, and had paid out 310 knots of the cable, the signals through to the shore continuing perfect. This affair is proceeding with all the quiet of a determined success, and we hope soon to learn of the safe accomplishment of the undertaking.

TURPENTINE.—The Bridgeport (Conn.) Iron Works are now engaged in making several large stills for the Wood Distilling Company for the manufacture of turpentine. This company has purchased several thousand acres of wood land in North Carolina, and have erected turpentine works, which are now successfully running near Bridgeport. The charcoal is said to be a valuable product of the distillation of the wood.

FORTY-SIX new discoveries of rich silver deposits are reported in the White Pine district, causing considerable excitement in that region. The shipments of bullion from thence latterly have averaged from $70,000 to $80,000 per week. The mining facilities will soon be doubled, and it is estimated that $500,000 will be shipped in July.

GRINDSTONES.—A correspondent says: "The grindstone is a self-sharpening tool, and after having been turned for some time in one direction (if a hard stone) the motion should be reversed. Sand of the right grit applied occasionally to a hard stone will render it quite effectual."

THE Dale Silk Company, of Paterson, has obtained seventeen skilled weavers from Lyons, and quartered them in the company's houses, preparatory to entering extensively into broad-silk weaving. American dress silks are selling in New York at $5 a yard.

THE Puget Sound lumber trade has increased very rapidly of late years. Upward of fourteen hundred vessels were loaded with lumber from the mills on the Sound within a year past, and there is a demand for new mills to supply the California market.

GUN-cotton explodes when metallic sodium or metallic potassium is brought in contact with it. The amalgams of these metals do not produce the same effect. Finely divided, arsenic requires percussion before it explodes the cotton.

THE canebrakes of the South are being cut down, steamed, baled, and sent to New England, where the fiber is made into wrapping paper.

AN effort has been making to change the location of the Allerton Steam Fire Engine Works, now at Naugatuck, to Norwalk.

INTERFERENCE CASE---DECISION OF THE COMMISSIONER OF PATENTS.

Commissioner Fisher has just rendered a decision in the interference case of Townsend *vs.* Fowle, for an improvement in submarine drilling apparatus, which reviews the general theory of interference so full and clear that we give the decision complete.

Cases of interference may be naturally divided into two leading classes. The first comprises those in which the applicants are both original and independent inventors, and the only question for decision is, which was the first inventor? The parties in this class of cases may be, and usually are, widely separate, and have no connection whatever with each other. The coincidence of invention is accidental, or rather results from the fact that the improvement is one which is demanded by the state of the arts, and one which many men are seeking at the same time to discover or develop.

The question of priority in these cases is usually one of easy solution. It is to be determined by ascertaining which of the parties first reduced the invention to practical form, either by a drawing sufficient of itself to enable an artisan to make the thing invented, or by a sketch accompanied by a written description, or by model, or full-sized machine. I should be unwilling, in such cases, to accept mere conversation as proof of invention, however explicit in details, unless such conversations were directed to workmen to construct the machine, and it was actually built at the time from such directions.

The second class of interferences comprises those cases in which two men have been more or less connected in the work of invention when the relations of partner or employer, and employer or friend or fellow-workmen have in some form existed. When the invention, if it is the act of both, takes place at the same time, and when the real question is not so much one of priority as of originality; when, in short, it is charged or inferred that one of the parties is in fact claiming that which he has taken from the other to whom it rightfully belongs. This class may be again subdivided into three: First, where the parties are fellow-townsmen or workmen, or so situated that either might have known of the movements of the other. Second, where one party is the general employer of the other, and in the course of his work made some improvement upon the tools or method with which he works. Third, when the one has been specially employed by the other to assist in developing or embodying the very invention in controversy.

The cases which fall within the second class are by far the most difficult. The testimony is usually contradictory, and the parties surrounded by a troop of partisans, clerks, or workmen appear, and like the seamen of opposing vessels in a collision case swear directly in each other's faces. Each is at pains to deny every fact, material and immaterial, asserted by the other, until the judge is compelled to grope painfully through a mass of contradictory evidence to find some fact, as a base for a decision, which has escaped the fury of the conflict.

There may be some presumptions which will render it possible to approximate to the truth. It may be said in general that in cases falling under the first subdivision the evidence necessary to establish priority should be substantially the same as in cases of the first class, to wit: That he is the first inventor who has reduced the invention to practice. As to the second and third subdivisions it may be safely asserted that the presumption is that the workman is the inventor in the former case and that the employer is in the latter.

When workmen are employed in large establishments it is a natural and common mistake for employers to suppose that they are entitled to the brain work as well as the hand work of their employés; that if a valuable invention is made as in some measure it is their product, being that of the mind of their servant, they have acquired such a title to it as to be able to consider themselves the inventors. This is especially the case when the employer has conversed with the workmen during the progress of the work or has exhibited any interest in its successful completion. They confound the supply of material with the supply of ideas, and sometimes confidently claim to be the inventors of mechanism which they would find it difficult to describe and impossible to operate.

But, where a man has conceived an idea and given to it more or less development, and employs a mere workman to put it into shape, it is obvious that much confusion is likely to follow, proportioned to the mechanical skill of the workman and the lack of it in the projector. So many suggestions and hints may be furnished by the workman that at last he ceases to remember the parentage of the underlying idea, and fancies that the whole machine is the product of his own invention. It must be rare, however, in such cases that the labors of the mechanic or model maker can raise him to a rank higher than that of joint inventor with him who has the original conception, while in the great majority of cases the safer rule is undoubtedly that laid down by the Supreme Court of the United States in the late case of Agawam Woolen Company *vs.* Jordan, where it is said, "When a person has discovered an improved principle in a machine, manufacture, or composition of matter, and employs other persons to assist him in carrying out that principle, and they in the course of experiments arising from that employment make valuable discoveries auxiliary to the plan and preconceived design of the employé, such suggested improvements are in general to be regarded as the property of the party who discovered the original improved principle, and may be embodied in his patent as a part of his invention."

The present case belongs to what has been called, in this opinion, the third subdivision of the second class. Fowle was a model maker. He had some experience in rock-drilling machines, in which he had made some inventions. He was without experience in submarine drilling or apparatus, and had never seen such apparatus at work.

Townsend was a submarine diver, and having opportunity to contract for the removal of rocks in Boston harbor, sought the services of Fowle for the construction of a model of a machine which should embody his invention. According to Fowle, he brought to the latter nothing but a desire to obtain a suitable machine without any idea of the means. In other words, he proposed a result to Fowle, and left him to devise means for effecting it.

According to Towsend, on the other hand, the idea when communicated to Fowle was already so far developed, even as to details, that nothing remained for the model maker but to embody the plan in metal without exercise of the inventive faculty. The testimony is very contradictory. Each party has proved his case to a demonstration, if the testimony of certain witnesses only is to be considered. Taking the testimony as a whole, however, I am of opinion that it strengthens the presumption afforded by the relative situation of the parties at the beginning of the controversy; that Townsend was the inventor and Fowle the artificer, furnishing, no doubt, some hints and suggestions; perhaps some decided improvements, but in the language of the case already referred to, "not amounting to a new method or arrangement which in itself is a complete invention."

The decision of the Board of Examiners is affirmed.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

At the late meeting of the New York Draftsmen's Association it was decided that the prize for the best original design for a capital, competition for which was open to all, be awarded on or about the first of July next. Three prominent architects of this city, members of the New York Chapter of the American Institute of Architects, were chosen, and have consented to act as judges. The prize is to be $10 and a diploma.

A contract has been concluded between the Baltimore and Ohio, and the Indianapolis, Cincinnati, and Lafayette Railroad Companies, for permanent business connections to and from the West *via* Cincinnati. This arrangement provides for through trains, rates, and proper facilities for the development of a joint traffic. The former company becomes largely interested in the securities of the latter. The arrangement is regarded as very important, particularly to the cities of Cincinnati and Baltimore.

The discovery of extensive clay beds at Syngack, Passaic county, N. J., has had an enlivening influence on that place. Some two or three hundred men are at work preparing for extensive operations in the manufacture of brick. Two or three acres of sheds are erecting, and a branch canal has been excavated to connect with the Morris Canal for transportation purposes.

An experiment has been made at Munich, for the purpose of determining if a railway-carriage wheel rolls regularly without sliding, so that by recording the number of revolutions of a wheel, the circumference of which is known, the distance accomplished could be accurately ascertained. The difference between the measurement by mathematical instruments and that obtained by noting the revolutions of the wheel, was found to be no more than 1-68,000 of the whole.

The street railway companies of Cincinnati have adopted the following expedient with the two-fold object of encouraging travel on their lines and of diminishing the opportunities for stealing on the part of conductors. All the tickets are numbered, and are like theater tickets in having coupons. The passenger retains one part with a number upon it corresponding to that which he gives up. All the tickets taken in a week are saved, placed in a wheel, and one is drawn out. The holder of the coupon whose number corresponds to that of the ticket, draws a prize of fifty dollars.

A submarine diver, who has recently been at work in the Shetucket river at Laurel Hill bridge, Norwich, Conn., says it is the worst place for diving he ever saw, the river bottom being covered with rocks. In one place there is a rock, the top of which is only five feet under water, while at its base there is a depth of thirty-five feet. Back of this is a cave of considerable size, the hidden beauties and strange formations of which, could the water be drawn off so as to make it accessible, he thinks would be one of the wonders of the age.

On June 24, Lord Houghton presided at a public breakfast given in London to fourteen English artisans who were about to sail to this country for the purpose of entering Cornell University. The speech of the learned chairman was full of encouragement and good advice for the enterprising young men.

In Wittenberg, Germany, an industrial exhibition was opened, and no less than 909 manufacturers, with 2,000 specimens of their industrial skill were represented on this occasion. The display was composed almost exclusively of products of German industry.

During August and September an international exhibition is to be held at Utrecht, Holland, of articles for daily household use,—the principal object being to bring to the knowledge of the workmen such articles of household use, furniture, dress, food, and work of different countries, as, at a low price, unite usefulness with solidity. Articles of elegance and luxury are excluded. The co-operative associations of the continent appear to be much interested in this scheme.

The Pittsburgh *Evening Chronicle* says that nearly all the coal shipped to New York and New England, amounting to 9,000,000 tuns per annum, is obtained from Pennsylvania. Of this quantity, 3,500,000 tuns are shipped to New York, and the balance, 5,500,000 tuns, is conveyed in sailing vessels to various ports on Long Island Sound, and ports beyond. The production of coal in Pennsylvania and Maryland in 1867 was over 16,000,000 tuns, and is increasing at the rate of 2,500,000 tuns, or fifteen per cent per annum.

Francis Joseph, Emperor of Austria, is quite a mechanical genius. He has recently found time to construct a clock, a very ingenious piece of workmanship, which he has presented to his mother, the Archduchess Sophia. There is attached to this clock a gaudily-plumed cock, which crows every day at sunrise.

The Maine lumbermen complain that the water was so high early in the season that the mills could not be run, and that now the water has fallen so rapidly that a large amount of logs on the way to market must lie over till another season.

A rink company has been organized at Hartford, Connecticut, and the rink is to be built at once. It will be 200 feet by 80, will cover 16,000 square feet of ground, hold 6,000 people in a public meeting, and, as a rink, is to accommodate 800 skaters and 3,000 spectators. It will cost $30,000.

Commissioner Wilson, of the Land Office, has received intelligence setting forth the discovery of a valuable mine of cinnabar, about twenty-five miles northeast of the city of San Francisco, in township north of range No. 1, east of Mount Diablo meridian.

The observatory of the Colby University, at Waterville, is to be erected the coming season. It will probably be built on the hill in the rear of the Maine Central buildings, as the college grounds are subject to much jarring from the passing of trains.

The returns of the several railroad corporations in the State of Massachusetts, show that 24,916,021 passengers were transported by them for greater or less distances during the year ending November 30, 1868, and out of this vast number not one was killed or injured while occupying his seat, although several were fatally hurt while attempting to get on or off the trains while in motion.

WOODEN RAILS.—A company has been organized, so we are informed, at Stevens Point, Wisconsin, to construct several miles of wooden track railway. It is proposed to use hard maple, and to treat it with some preparation to harden the wood and to preserve it from rotting.

The new railroad line is now open *via* the Harlem Railroad to Lebanon Springs and Manchester, Vt., and Montreal. The trains leave Twenty-sixth street at 7 o'clock A. M., arriving at Lebanon, at 3:16 P. M., connecting at Rutland with the Montreal train.

"Geissler's tubes" are now no longer provided with wires at both ends for the electrical discharge, friction alone having been found sufficient to render the gas contained in the tubes luminous.

The Commandant of the United States Armory, at Springfield, Mass., is sending away 100,000 muskets which our Government has sold to the Turkish Government.

Dispatches from Ottawa, Ontario, state that the evidence given before the Committee on the Huron and Ontario Ship Canal, establishes the fact of the importance and practicability of that great work.

A Commission has been appointed by the Secretary of War to consider the proposed location of the Hudson River West Shore Railway upon the public lands at West Point.

The President of the Des Moines Valley Railroad reports that over $100,000 will be collected in duties on railroad iron at Keokuk during the present season.

The British Postoffice Department has completed its arrangements for purchasing all telegraph lines in the kingdom.

A new tin mine has been opened in San Bernardo county, California.

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; beside, as sometimes happens, we may prefer to address correspondents by mail.

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

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

C. T. L., of Ind.—Expert operators are able to transmit from 15 to 20 words per minute through the Atlantic Cable. The velocity with which a current or impulse will pass through the cable has been ascertained to be between 7,000 and 8,000 miles per second; the former being the velocity when the earth forms a part of the circuit and the latter when the earth formed no part of the circuit.

R. and B., of Pa.—We know of no substance which can be used to coat an iron tank for water, that can also be applied with a brush, and not affect the taste of the water at first, unless it be soluble glass. Good white lead paint will do very well indeed, after the taste has disappeared, but it takes some time before all taste will disappear. We have not seen soluble glass applied to iron and cannot tell whether it will adhere strongly or be liable to scale off. If good we think it will work well and be durable.

J. T., of Mich., asks the proper speed for a circular saw of 50 inches in diameter to run and do a good business, and if a saw of that kind requires more motion in feeding fast than it does in slow feed? Answer. A 50-inch diameter saw should make 750 revolutions per minute and do a good business. Fast feed requires more motion than that of slow.

E. E. P., of N. Y.—You can use the second pump as you specify, but the larger the pipes the greater the friction. In order that the two pumps shall work equally well, the main pipe from which the second branches out, should be one and a half inches in diameter, and the connection should not be right-angled but curved.

J. V. S., of Ohio.—It is not generally the pressure that breaks the glass tubes of water gages. It is their inability to withstand changes of temperature. They should be made of the best annealed Bohemian glass tubing. A common fault is to make them of too thick glass, which is much more likely to break than thinner glass.

T. C. P., of Ohio.—If we understand your communication, you are cutting off steam at half stroke, with a single eccentric, and get, as might be supposed, too much compression. A single eccentric cannot be used advantageously to cut off steam so early in the stroke. You should set your eccentric back and not cut off at less than two-thirds stroke. With the compression you will then have, you will not need to use lead.

C. M. R., of N. Y.—Your suggestions are mainly not new, but that steam might be advantageously adopted for towing boats in canals, properly constructed for that purpose, is beyond a doubt.

M. W., of N. Y.—You are right; a mechanic ought to read and study, as well as practice. You will find the best works on steam and engineering noticed in our new publication column as they appear.

B. M. R., of Pa.—The conducting power of a metallic rod is injured by partially burning it.

J. A. S., of Pa.—We do not wish to re-open the discussion on the theory of the tides. Your communication although ingenious and plausible is therefore respectfully declined.

W. H. W., of Ohio, asks, "if wheels of different sizes fixed to an axle will run on straight parallel rails without one of them slipping." They will not.

C. A. W., of Me.—The greatest strain on the gears of an engine lathe, is on the gear that runs the slowest.

G. D. M., of Del.—The construction of envelopes with a thread inserted in one end on the bottom, to facilitate in opening, is not new. It was patented in 1858. We returned your remittance by mail.

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.

Scientific Books to order. Macdonald & Co.,37 Park Row,N.Y.

Send to I. E. Sharp, Evening Shade, Ark., for particulars of best water-powers in the West.

Sheffield Scientific School, of Yale College.—Copies of the Fourth Annual Report for 1868-9 will be sent on application to Prof D. C. Gilman, Sec.

Who makes the best Rotary Pumps? Address Box 380, Pittsburgh, Pa.

Manufacturers of wire-drawing, and also of horseshoe-nail machines, address, without delay, Box 587, Baltimore Postoffice.

$2000.—Patent right, for the United States, for sale very low, of S. S. Hamilton's Weighing Scale, Patented Jan. 12, 1869, No. 85,816. Address, care Hemlandet, Chicago, Ill. S. S. Hamilton.

Mechanical Draftsman wanted. Address T. R. Sharp, New Castle, Del.

Mechanical Patent Reports, from 1790 to 1860, for sale. Address G. W. Tolhurst, Liverpool, Medina county,Ohio.

Boiler Wanted—About 50-H. P. Payment in Machinists or Boilermakers' tools. Address U. Eberhardt, Newark, N. J.

Bartlett's Instantaneous "Gas Lighter," for lighting and extinguishing street and elevated gas lamps. Witness its operation by the Manhattan Gas Co.,now lighting 7,000 lamps of New York city. J. W. Bartlett, 569 Broadway, New York.

Eggs kept fresh for a year. Rancid Butter rendered sweet. White and streaked butter made yellow. Milk and butter kept sweet, by new methods. Circulars sent free. Agents wanted. Address Practical Chemistry Co., No. 4 Arcade Court, Chicago, Ill.

Right of New England States, for sale cheap, for the best and cheapest improvement in Brick burning. Patented March 30, 1869. Send for a circular. J. M. McCarthy, Canal Dover, Ohio.

Wanted—A first-class molder in Loom, Dry, and Green Sand. Address Box 137, Rome, Ga.

Quimby & Co., Manufacturers and Inventors' Agents, Free Exposition Rooms (to Exhibitors and Visitors), 185 Chambers st., N. Y., have room for more new and useful light machinery, and other articles. On Exhibition and Sale, Models of Rare Inventions, and Novelties. Call or address.

J. T., Boston.—L. L. Davis' Spirit Level and Plumb is fully described in our last number. Address J. W. Storrs & Co., 252 Broadway, New York.

Mill-stone dressing diamond machine, simple, effective, durable. Also, Glazier's diamonds. John Dickinson, 64 Nassau st., New York.

Peck's patent drop press. Milo Peck & Co., New Haven, Ct.

The Best and Cheapest Boiler-flue Cleaner is Morse's. Send to A. H. & M. Morse, Franklin, Mass., for circular. Agents wanted.

Builders of bridges, railway cars, and other woodworkers will notice Steptoe, McFarlan & Co.'s advertisement, inside.

An engineer,about leaving for Europe (where he has first-class business friends), to negotiate a very valuable patent, is desirous of receiving one or two similar commissions. 1st-class firms only treated with References A 1. For particulars address H. M., Postoffice Box 6,New York.

Leschot's Patent Diamond-pointed Steam Drills save, on the average, fifty per cent of the cost of rock drilling. Manufactured only by Severance & Holt, 16 Wall st., New York.

For Sale—A Patent valuable to manufacturers of farm machinery. Will sell low, or trade for lands. Send address to H. S., Box 651, Cincinnati Postoffice, Ohio.

Gear-cutting engines—new patterns—cut every number up to 127, and 26 in. diam., made by A. H. Saunders, Nashua, N. H.

Cider Mills for sale, and rights to manufacture. Address H. Sells, Vienna, Ont., or Shaw & Wells, Buffalo, N. Y.

Scientific American—Old and scarce volumes, numbers, and entire sets of the Scientific American for sale. Address Theo. Tusch, Box 448, or Room 29, No. 37, Park Row, New York city.

For the best hammer and sledge handles, made of carefully-selected, well-seasoned, second-growth hickory, address Hoopes, Bro. & Darlington, West Chester Spoke Works, West Chester, Pa.

Tempered steel spiral springs made to order. John Chatillon, 91 and 93 Cliff st., New York.

The Tanite Emery Wheel—see advertisement on inside page.

For solid wrought-iron beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, etc.

Machinists, boiler makers, tinners, and workers of sheet metals read advertisement of Parker's Power Presses.

Diamond carbon, formed into wedge or other shapes for pointing and edging tools or cutters for drilling and working stone, etc. Send stamp for circular. John Dickinson, 64 Nassau st., New York.

Winans' boiler powder, 11 Wall st., N. Y., removes Incrustations without injury or foaming 12 years in use. Beware of imitations.

APPLICATIONS FOR EXTENSION OF PATENTS.

STEAM GAGE COCKS.—Albert Bisbee, Chelsea, Mass., has petitioned for an extension of the above patent. Day of hearing, August 30, 1869.

CORRUGATED BEAM.—Richard Montgomery, of New York city, has applied for an extension of the above patent. Day of hearing Sept. 25, 1869.

ROOFING COMPOSITION.—James West, Syracuse, N. Y., has applied for an extension of the above patent. Day of hearing October 11, 1869.

NEW PUBLICATIONS.

THE PAINTER, GILDER, AND VARNISHERS' COMPANION. Containing Rules and Regulations in everything relating to the Arts of Painting, Gilding, Varnishing, Glass Staining, Graining, Marbling, Sign Writing, Guilding on Glass, Coach Painting, and Varnishing, Tests for the Detection of Adulterations in Oil Colors, etc., and a Statement of the Diseases to which Painters are peculiarly liable, with the Simplest and Best Remedies. Thirteenth Edition, Revised. With an Appendix, comprising Descriptions of a great variety of Additional Pigments, their Qualities and Uses, to which are added Dryers, and Modes and Operations of Painting, etc., together with Chevreul's Principles of Harmony and Contrast of Colors. Philadelphia: Henry Carey Baird, 406 Walnut street. Price, by mail, free of postage, $1·50.

The number of editions which this work has reached is a sufficient guarantee of its excellence without our saying a word in its praise. Had we room we could, however, point out perhaps as many praiseworthy features in it as could be culled from any other work of its size ever published. The appendix contains much new and valuable matter, and it, as well as the body of the work, is copiously indexed.

THE CENTENARY.

Such is the title given to a new monthly just commenced at Charleston S. C. The first number contains eighty-four pages, and gives abundant promise of success, so far as literary merit is concerned, the articles generally very readable. It remains to be seen how far the Southern people will sustain a first-class magazine. We wish it success.

SPRINGDALE ABBEY is the title of a new book from the press of Claxton, Remsen & Haffelfinger, of Philadelphia. It consists of extracts from the diaries and letters of an English preacher. Edited by Joseph Parker, D. D. We have found the book very pleasant and very interesting reading, in which is also combined useful hints and instruction presented in a taking style.

THE ECLECTIC, for July, contains two fine pictures—Landseer and his Connoisseurs, and Gutenberg 1400-1468; also a very choice contents of articles selected from the leading European magazines. We regard "The Eclectic" as one of the best serials extant. Terms of "The Eclectic"—One copy, one year, $5·00. Address E. R. Pelton, publisher, 108 Fulton street, New York city.

Recent American and Foreign Patents.

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

FERTILIZER.—F. C. Renner, Ladiesburg, Md.—The object of this invention is to provide for public use a cheap and easily-manufactured composition, which shall possess superior qualities as a fertilizer for corn, garden truck, and other vegetables and cereals.

ELLIPSOGRAPH.—Andrew Smith, Dayton, Oregon.—The object of this invention is to provide for public use a simple, cheap, and effective instrument for drawing ellipses, and so constructed that it can be easily adjusted to produce figures of any practicable size and shape.

MANUFACTURE OF ILLUMINATING GAS.—Robert Alsop, Philadelphia, Pa.—The object of this invention is to produce an illuminating gas,by impregnating common atmospheric air with the vapor of suitable hydro-carbon fluids, and is carried into effect by the employment of suitable apparatus.

TEA AND COFFEEPOT.—Nathan Lawrence,Taunton, Mass.—This invention relates to metallic tea and coffeepots, and consists in an improved handle, which will not become so quickly heated as the handles heretofore made for such articles, together with an improved construction of the bottom, to prevent it from melting, and an improvement in the method of forming the body of the pot.

GATE.—Jeremiah Snell, Evans' Mills, N.Y.—The object of this invention is to construct a simple and cheap farm gate, which can be conveniently attached and operated, and which, when thrown open, will be entirely outside of the gate posts, no part of it projecting into the roadway, so that, by no possibility, can a passing carriage come in contact with it.

SLEEP PRESERVER AND MUSQUITO GUARD.—Robert Themar, Sheboygan, Wis.—This invention relates to that class of devices adapted to protect the face, hands, etc., from the attacks of musquitos and other insects, and has for its object to provide the public with a simple, cheap, and light guard, which can be carried in a valise or hat box, and which can be placed over the head and arms during sleep, or at any other time, for the purpose indicated.

MACHINE FOR MAKING TWINE, CORD, ETC.—James McIntire, Hopewell Cotton Works, Pa.—The object of this invention is, so to improve the construction of machines for making twine, cord, etc., that the spool shafts can always be kept in gear, so as to run evenly and continuously, while the threads shall be twisted harder,and shall be guided properly and kept at the right tension in passing from the spools to the reel, whereby a better article of twine, etc., can be produced than heretofore.

STOVE PIPE.—Abel D. Cook, New Madrid, Mo.—This invention has for its object to furnish an improved means by which the horizontal part of a stove pipe may be cleaned out without taking down the pipe, and without the chance of soiling or dirtying the carpet or room.

CHANDELIER REFLECTOR.—Charles F. Jacobsen, New York city.—This invention has for its object to furnish an improved double cone reflecting chandelier, for use in churches, theaters, parlors, and other public and private buildings, which shall be so constructed and arranged as to light the ceilings and walls, as well as the floor and body of the room, and which shall be so constructed as to soften the light, destroying the glare and diffusing it agreeably through the room, and at the same time be highly ornamental.

RANGE BOILER.—Andrew Bennett, Brooklyn, N. Y.—This invention has for its object to furnish an improved range boiler, the dome top of which shall be securely and strongly connected to the body of said boiler.

FIRE GRATE.—Leopold Bertsche, Jr., Allegheny City, Pa.—This invention has for its object to furnish an improved fire grate, which shall be so constructed and arranged that the bars, when burnt out, can be conveniently taken out singly and replaced with new ones.

CHEMICAL COMPOUND FOR EXTRACTING PAINTS, OILS, GREASE, AND TAR FROM CLOTHS.—C. B. Skiff, Jersey City, N. J.—This invention has for its object to furnish an improved chemical compound, by means of which paint, oil, grease, and tar spots may be quickly and thoroughly removed from clothing, and other cloths, so as to leave no stain or spot upon the cloth.

FARM FENCE.—Cyrus Abbott, Iowa City, Iowa.—This invention has for its object to furnish a simple, strong, and durable fence, so constructed and arranged that the body of the fence may be supported free from the ground, so as not to be liable to decay from contact with the ground.

PICTURE NAIL.—Henry Hickman, Omaha, Neb.—This invention has for its object to furnish an improvement in picture nails, by means of which the cord will be securely held in such a way that the picture cannot be accidentally knocked down, and which shall, at the same time, hold the cord away from the wall and be in itself ornamental.

CULINARY VESSEL.—Henry Zachgo, Brooklyn, N. Y.—This invention has for its object to improve the construction of boilers, and other culinary vessels, in such a way that the cooking may be done in less time and with less expenditure of heat than is possible with vessels constructed in the ordinary manner.

SEED PLANTER.—George Banister, Hartford, Vt.—This invention consists in operating the machine by friction on a roller or wheel, and in the method of operating the slide, for discharging the seed, and in the plow and the method of gauging the same and covering the seed.

PREVENTING THE RADIATION OF HEAT.—James McFarland, Louisville, Ky.—This invention relates to a new and useful device for preventing the condensation of steam in steam pipes, in consequence of the radiation of heat therefrom, and for preventing the radiation of heat from steam pipes under all circumstances.

SEED PLANTER.—John B. Miner, Groton, Conn.—This invention relates to new and useful improvements in machines for planting corn and other seeds.

CULTIVATOR.—R. B. Parks and J. R. Parks, Neponset, Ill.—This invention relates to a new and improved cultivator, designed for cultivating crops grown in hills or drills.

BAYONET ATTACHMENT.—J. S. Alexander, Philadelphia, Pa.—This invention relates to a new and useful attachment to firearm bayonets, and is intended to facilitate the operation of soldiers in throwing up intrenchments, or excavating the earth for other purposes.

GATE.—L. W. Sibley, Ames, Iowa.—This invention has for its object to furnish an improved gate, which shall be so constructed and arranged that it may be opened by the advancing and closed by the dep arting wagon.

PLOW.—Daniel H. Hill, Union Springs, Ala.—This invention has for its object to improve the construction of plow frames, so as to make them stronger and lighter than the frames constructed in the ordinary manner, while at the same time causing the plows to run lighter and steadier.

TRUNK.—Henry Hickman, Omaha, Neb.—This invention has for its object to improve the construction of trunks, so that the size or capacity of the trunk may be adjusted as may be required, according to the amount of clothing or other articles to be put into it.

SCREW DRIVER.—William Hofer, New Haven, Conn.—This invention has for its object to furnish a simple and convenient screw driver, more particularly adapted for driving screws into soft wood; by means of which the screws may be driven quicker, and with less weariness to the hand of the operator than is possible when the screw driver is constructed in the ordinary manner.

MACHINE FOR CLEANING SAUSAGE CASES.—Martin Heusy, Burlington, Ohio.—This invention relates to a new apparatus for cleaning the intestines used for sausage cases, and is to supersede the ordinary scraping knives or sticks heretofore employed.

PAPER BOXES.—James L. Reber, Philadelphia, Pa.—This invention relates to improvements in paper boxes such as are shaped on one piece of paper to be folded and closed to secure the contents, without the use of any fastening material other than the parts of the paper where folded together.

CURD AGITATOR.—DeWitt C. Hall, Barnes' Corners, N. Y.—This invention consists of the arrangement in a vat having a metallic or other screen near the bottom of a sliding and rotating stirring apparatus, whereby the curd is agitated and the whey caused to pass off through the screen.

PEN AND PENCIL CASE.—J. H. Rauch, New York city.—This invention relates to improvements in telescopic pen and pencil cases (such as are made for being materially shortened for convenience in carrying in the pocket), intended to provide an arrangement whereby the extension and contraction of the pencil may be effected with fewer tubes, and less friction, and the finished pencil may be made of small diameter for convenience in carrying in the pocket and handling.

COFFEE-POTS, ETC.—Ira Yeamans, Brooklyn, N.Y.—This invention relates to improvements in coffee-pots tea-pots and other similar vessels for table use employed for holding liquids to be poured into drinking cups, and is designed to so arrange them as to avoid the necessity of raising or turning them for pouring, as required in the use of these vessels as now constructed. The invention consists in mounting such vessels in trunnions for turning in a vertical plane, the said trunnion supports being also capable of revolving in a horizontal frame.

GROOVING MACHINE.—Thos. Holt, New York city.—This invention relates to improvements in machinery for grooving stair stringers and other work in joinery and cabinet making. It consists in a rotary tool stock carrying saws and a planing tool for cutting the groove, arranged in a sliding frame to be traversed across the board to be grooved, the sliding frame being capable of adjustment to traverse the board at any desired angle. It also consists in certain devices accessory thereto.

PROJECTILE.—J. W. Hill, Jefferson, Iowa.—This invention relates to an improved construction of projectiles, having for its object to provide projectiles which will, after having traveled through a portion of their flight, discharge from a central bore, smaller projectiles, imparting to them in addition to the speed attained in being discharged from the gun an accelerated spend by a secondary charge within the shell. The part so discharged being also charged with a third part to be similarly discharged, or the same may be repeated a greater number of times, thus obtaining a capacity of shooting a great distance.

MACHINE FOR TURNING BOOT LEGS.—C. Collins, Warren, Ind.—This invention relates to a new machine for turning boot legs after they are sewed, to prepare them for the last, its object being to facilitate the turning process so that it can be rapidly carried on. The invention consists chiefly in an adjustable cylindrical support upon which the boot leg is drawn, and in arranging, within said cylinder, straps or rods that are attached to a treadle, so that they will, when fastened to the boot straps and when drawn down by the treadles, turn the boot leg over the upper edge of the cylinder.

PROCESS OF CURING MEAT.—Wm. H. Silberhorn, New York city.—This invention consists in the application by any approved means to pieces of meat of pulverized but solid salt, saltpeter, or other preservative substance, to be inserted in any way between the flesh and the bones, or into the flesh near the bones.

SUBSOIL PLOW.—James W. Murfee, Havanna, Ohio.—This invention consists in an arrangement of a horizontal wedge-shaped coulter for plowing and pulverizing the earth. This wedge is driven horizontally through the ground by being attached to an inclined and wedge-edged cutting coulter, which coulter is attached to the beam of the plow. The coulter is set as acutely with the horizon as practicable, so as to approach the line of the axis of the plow or hoe as near as may be, and the power is applied thereby as nearly in the direction of the axis of the wedge as possible. The standard of the frame is a continuation of the line of the coulter shank, and the angle which the handles make with the horizon or base of the plow point, should be a mean of the angles which the top of the point and front edge of the coulter shank make with the horizon, so that any power applied in the direction of the handles by the plowman will have the greatest effect on the point and shank.

CURTAIN FIXTURE.—J. D. Ayres, East Greensboro, Vt.—This invention relates to a new and useful improvement in the method of hanging window and other curtains, whereby they are rendered much more useful and much less liable to get out of order than when hung in the ordinary manner.

BREECH-LOADING FIREARMS.—John Adam Heckenbach, Mayville, Wis.—This invention relates to certain improvements in breech-loading firearms, and is more particularly intended for double-barreled guns, and will shortly be more fully described and illustrated in our columns.

BUSH FOR BUNGS.—David F. Fetter, M. D., New York city.—This invention has for its object to provide a lining or bushing for the bungs of barrels and other purposes, in such manner that it can be readily applied and securely fastened without injuring the wood or other material of which the barrel or other article is made. The invention consists in forming on the lower edge of the bush or lining a series of projecting bars or lugs, which, when the bush is applied, are turned out to fit under the wood.

WIRE-BENDING MACHINE.—J. N. Ayres, Stamford, Conn.—This invention relates to a new apparatus for straightening wire which is to be used for the teeth of horse hay rakes, and for other purposes, and has for its object to relieve the wire from the strain to which it is subjected in the machines now in use.

THREE-WHEELED VELOCIPEDE.—Lucas A. Sinclair, Bellevue, Ohio.—This invention relates to a new steering device for a three-wheeled velocipede, and to a new manner of constructing and arranging the frame of the same. The invention consists in arranging the rear axle in the slotted rear part of the frame, and in so connecting it by a pivoted arm with the front part of the frame, and by pointed levers with a steering handle, in front, that it can, by turning the said handle, be bodily swung into the slots of the frame.

VELOCIPEDE.—Abner L. Butterfield, Brattleborough, Vt.—This invention relates to a new manner of constructing the wheels of velocipedes for the purpose of making them stronger, and also to a new driving mechanism and brake attachment, all parts being so arranged as to produce a strong and convenient velocipede.

WATER INDICATOR AND SAFETY VALVE ATTACHMENT TO STEAM ENGINES.—James Brahn, Jersey City, N. J.—This invention relates to a new device for regulating the hight of water in a steam boiler, and for controlling the pressure of steam in the same, it being so arranged that it can, with a slight modification, be adapted to either service.

CHILDREN'S CARRIAGE.—John A. H. Ellis, Springfield, Vt.—This invention relates to a novel manner of arranging the springs on children's carriages for the purpose of making them answer at once as reach and as axle supports, so that the sills or reach heretofore employed can be done away with.

MACHINE FOR FELTING HAT BODIES.—L. Robinson, L. Conine, N.F. Hyatt, and D. W. Hyatt, Matteawan, N. Y.—The invention consists in an arrangement of machinery for felting the tops more evenly than can be done by the machines now in use. Also, for felting the sides on a block, so formed as to be inserted within the crown of the hat, the latter being turned thereon to cause the whole to undergo the felting operation.

HAND SEED PLANTER.—One of the most simple hand seed planters with which we are acquainted, is doubtless the invention of Mr. A. J. Williams, of Barnesville, Ga., who recently obtained a patent for it through this office. A friend who has tried one thus writes of it: "In operation it is quite as reliable and effective as the most complex machines, and possesses this advantage over them: the laborer is near to his work, and inspects it constantly and without trouble to himself. Every failure or inaccuracy in depositing seed is seen before the deposit—or want of deposit—is covered, and mistakes are thus seasonably rectified. As compared with the seed planter affixed to the handle of the hoe—an otherwise more complete instrument because of the combination—while this requires two laborers, or a second traversing of the ground by one, the labor is so greatly reduced by the lessened weight of the hoe, that the additional time required is fully compensated for. In fact, nnder the most favorable circumstances for each method of planting, I would give the preference to the Williams planter, in the belief that with it the greatest amount of work in the shortest time can be acomplished."

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING JUNE 22, 1869.

Reported Officially for the Scientific American.

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91,506.—STEAM CONDENSER.—B. C. Atkinson, Newburyport, Mass. Antedated June 8, 1869.
91,507.—STONE SAWING MACHINE.—L. E. Baldwin, Windham, Conn., assignor to the Connecticut River Quarry Company.
91,508.—HEEL CUTTER.—J. H. Bean, Marietta, Ohio., assignor to himself, Abram Pratt, and J. A. Tenney.
91,509.—COAL STOVE.—C. N. Bennett, Cincinnati, Ohio., assignor to himself, and A. T. Bennett.
91,510.—VELOCIPEDE.—G. Bergner, Washington, Mo.
91,511.—SCREW PRESS.—H. Blundell and Jno. McWilliams, Providence, R. I.
91,512.—MACHINE FOR SHEARING METALS.—Robert Briggs, Philadelphia, Pa.
91,513.—PNEUMATIC TUBE FOR TRANSPORTING GOODS.—Albert Brisbane, New York city. Antedated June 11, 1869.
91,514.—GRINDSTONE JOURNAL BOX.—T. W. Brown, Reading, Pa.
91,515.—BOILER FEEDER.—Henry I. Brunner, Nazareth, Pa.
91,516.—POCKET FOR EGG CARRIERS.—A. H. Bryant, Philadelphia, Pa. Antedated June 8, 1869.
91,517.—BASE BURNING STOVE.—W. M. Bush and Thomas B. Richards, Cincinnati, Ohio.
91,518.—WOODEN WALL FOR BUILDINGS.—Jos. Busser, Troy, Ohio.
91,519.—STOVEPIPE SHELF AND DRYER.—W. E. Canedy, Wauconda, Ill.
91,520.—COOKING STOVE.—A. E. Chamberlain, and J. B. Crowley, Cincinnati, Ohio., assignors to A. E. Chamberlain, O. N. Bush, and Franklin V. Chamberlain.
91,521.—ASH SIFTER.—Jos. Chisholm, Boston, Mass.
91,522.—LIQUOR-THIEF.—John F. Collins, New York city.
91,523.—STEAM GENERATOR FLUE BRUSHES.—Pat. H. Coyle, Newark, N. J.
91,524.—STEAM-DEVICE FOR WARMING RAILROAD CARS, AND FOR OTHER PURPOSES.—A. C. Crary, Utica, N. Y.
91,525.—HARROW.—Isaac Crum, West Chester, Ohio. Antedated June 8, 1869.
91,526.—MEAT-CUTTING MACHINE.—J. G. Divoll, Sonora, Cal.
91,527.—PRINTING TELEGRAPH.—T. A. Edison, Boston, assignor to J. H. Hills and Wm. E. Plummer, Newton, Mass.
91,528.—DOOR SPRING.—Stephen Elliott, Richmond, Ind.
91,529.—DISH WASHER.—Wm. H. Emerson, Dixon, Ill.
91,530.—LIGHTNING ROD.—Henry W. Farley, Oswego, Ill.
91,531.—MORTISING CHISEL.—Michael Feigel, New Utrecht, N. Y.
91,532.—COMPOUND RAILROAD RAIL.—Henry J. Ferguson, Manchester, N. J. Antedated June 7, 1869.
91,533.—VAPOR BURNER.—Louis Fischer, Brooklyn, N. Y.
91,534.—VELOCIPEDE.—L. B. Flanders, Philadelphia, Pa.
91,535.—VELOCIPEDE.—Allen Greene and Elisha Dyer, Providence, R. I.
91,536.—BASE-BURNING STOVE.—Joseph C. Henderson, Troy, N. Y.
91,537.—CEMENT FOR CALKING SHIPS, AND OTHER PURPOSES.—Edward Heylyn, Rochester, N. Y.
91,538.—CARRIAGE SPRING.—E. C. Hodge, Oneonta, and D. H. Mann, Delhi, N. Y.
91,539.—SKATE.—Alpheus S. Hunter, Newburg, N. Y. Antedated June 19, 1869.
91,540.—RAISED-LETTERED SIGNS, SHOW-CARDS, AND THE LIKE ARTICLES FROM PAPIER MACHE.—T. C. Jenks, Philadelphia, Pa.
91,541.—PAD FOR HORSES HOOFS.—Jonathan Johnson, Lowell, Mass.
91,542.—COOKING STOVE.—D. P. Kayner, Erie, Pa.
91,543.—OFFICE INDICATOR AND REGISTER.—Jas. M. Keep, New York city. Antedated June 8, 1869.
91,544.—WOOD SAWING MACHINE.—Isaac Keller, Randolph, Ohio.
91,545.—ROSETTE HOLDER.—I. C. Kelley, Monticello, Ind.
91,546.—HORSE POWER.—Peter Kline, Johnsville, Ohio.
91,547.—BOOT AND SHOE.—Wm. Leathe, Woburn, Mass, assignor to himself, S. B. Holden, and L. L. Holden.
91,548.—HORSE-RAKE.—Wm. A. Lewis, Joliet, Ill.
91,549.—GRAIN CLEANER.—Wm. A. Lewis, Joliet, Ill.
91,550.—VELOCIPEDE.—John Lund, Milwaukee, Wis.
91,551.—FOLDING WAGON-COVER FRAME.—Benj. G. Luther, Providence, R. I.
91,552.—CURING AND PRESERVING MEAT, ETC.—A. S. Lyman, New York city, assignor to himself, and David Lyman, Middlefield, Ct.
91,553.—COFFEE ROASTER.—Charles Mackh, Elgin, Ill.
91,554.—SWEET-POTATO FLOUR.—C. K. Marshall, New Orleans, La. Antedated June 8, 1869.
91,555.—DEVICE FOR CONVERTING MOTION.—T. A. Mitchell, Washington, D. C.
91,556.—BRUSH HEAD.—C. G. Moore and Levi S. Gambold, Coatesville, Ind.
91,557.—PROCESS FOR PRESERVING FRUIT.—E. R. Norny, McDonough, Del. Antedated June 10, 1869.
91,558.—STEAM PLOW.—James H. Northcott, Mechanicsburg, Ill.
91,559.—HAT AND COAT RACK.—J. E. Osborn, Chicago, Ill.
91,560.—HOT AIR FURNACE.—John S. Perry, Albany, N. Y.
91,561.—GRAIN SEPARATOR.—C. T. Phillips, Jordan, N. Y.
91,562.—CHURN.—A. M. Powell (assignor to himself, Wm. J. Matthews, and H. R. Johnson), Collinsville, Ill.
91,563.—COOKING STOVE.—S. H. Ransom, Albany, N. Y.
91,564.—SPADE BAYONET.—Edmund Rice, United States Army.
91,565.—UMBRELLA RUNNER.—Horace T. Robbins, Boston, Mass.
91,566.—SULKY CULTIVATOR.—John Robinson, Plainfield, assignor to Aaron Snell and Arthur T. D. Austin, Will county, Ill.
91,567.—FOOT COMFORTER.—Geo. W. Rothrock, Mifflin, Pa. Antedated May 25, 1869.
91,568.—BAG HOLDER.—Newton N. Rugg, Geneva, Ill.
91,569.—HOT AIR FURNACE.—Watson Sanford, Brooklyn, N. Y.
91,570.—BOOK-COVER PROTECTOR.—Alfred L. Sewell, Chicago, Ill.
91,571.—HORSESHOE.—Harrison Smith, Sandyville, and J. H. Evans, Bolivar, Ohio.
91,572.—CORN SHELLER.—J. P. Smith, Hummelstown, Pa.
91,573.—CARPET FASTENER.—J. V. C. Smith, New York city.
91,574.—WATER-CLOSET VALVE.—W. Smith, San Francisco, Cal.
91,575.—ENVELOPE MACHINE.—D. M. Smyth, Orange, N. J., assignor to D. Appleton, & Company, New York city.
91,576.—ROOFING COMPOUND.—Hiram G. Soules, Syracuse, N. Y.
91,577.—MACHINE FOR MANUFACTURING ROOFING.—H. G. Soules, Syracuse, N. Y.
91,578.—PAINT-OIL COMPOUND.—Wm. E. Tascott, Cleveland, Ohio.
91,579.—SLIDE FOR EXTENSION TABLES.—J. W. Teft, Buffalo, N. Y.
91,580.—TURBINE WATER WHEEL.—T. R. Timby, Saratoga, N. Y.
91,581.—GROUND ROLLER AND STALK CUTTER.—Phineas H. Tompkins and Elza Dougal, Van Buren, Iowa.
91,582.—HARVESTER RAKE.—Wm. H. Ward, Auburn, N. Y.
91,583.—LETTER BOX.—Frederick Wittram, San Francisco, Cal.
91,584.—BOAT-DETACHING APPARATUS. — W. M. Wood, Owing's Mills, Md.
91,585.—FARM FENCE.—Cyrus Abbott, Iowa City, Iowa.
91,586.—SPADE BAYONET.—John S. Alexander, Philadelphia, Pa.
91,587.—THRASHING MACHINE.—Joseph Allonas, Mansfield, Ohio, assignor to Cornelius Aultman and Henry H. Taylor.
91,588.—APPARATUS FOR MANUFACTURING ILLUMINATING GAS.—Robert Alsop, Philadelphia, Pa.
91,589.—VELOCIPEDE.—Samuel Anderson, New Orleans, La.
91,590.—LAMP.—Lewis J. Atwood (assignor to himself and Holmes, Booth, and Haydens), Waterbury, Conn.
91,591.—CURTAIN FIXTURE.— J. D. Ayres, East Greensborough, Vt.
91,592.—MACHINE FOR BENDING WIRE FOR RAKE TEETH.—J. N. Ayres (assignor to the Stillwater Company), Stamford, Conn.
91,593.—TYING-UP AWL.—Nathan W. Baker, Lynn, Mass.
91,594.—CLAMPS FOR JOINING CEMENT-LINED WATER PIPES—Phinehas Ball, Worcester, Mass.
91,595.—SEED PLANTER.—George Bannister, Hartford, Vt.
91,596.—RANGE BOILER.—Andrew Bennett, Brooklyn, N. Y.
91,597.—FIRE-PLACE GRATE.—Leopold Bertsche, Jr., Allegheny City, Pa.
91,598—STOVE TOP AND COVER.—Elijah W. Bigelow, Worcester, Mass.
91,599.—LOW-WATER INDICATOR.—James Brahn, Jersey City, N. J., assignor to himself and G. E. Cutter.
91,600.—FANNING MILL. — Henry Bruggeman, Petersburg, Ind.
91,601.—TOBACCO DRYER.—Leander Burdick, H. J. Chase, F. P. Isherwood, and W. S. Isherwood, Toledo, Ohio.
91,602.—VELOCIPEDE.—A. L. Butterfield, Brattleborough, Vt.
91,603.—LUBRICATING JOURNAL.—G. E. Clarke and Edwin P. Dickey, Racine, Wis.
91,604.—MANUFACTURE OF ENAMELED BRACELETS.—Abiel Codding, Jr., North Attleborough, Mass.
91,605.—WRENCH BAR HEADING MACHINE.—Loring Coes, Worcester, Mass.
91,606.—MACHINE FOR TURNING BOOT LEGS.—Cornelius Collins, Warren, Ind.
91,607.—FLOOD ROLLER.—W. J. Connell, West Unity, Ohio.
91,608.—STOVE PIPE.—Abel D. Cook, New Madrid, Mo.
91,609.—HINGE.—John J. Crooke, Southfield, and Lewis Crooke and Henry S. Crooke, New York city.
91,610.—PADLOCK.—Addison Crosby, Westfield, N. Y.
91,611.—BURIAL CASE.—Addison Crosby, Westfield, N. Y.
91,612.—FLOUR MILL.—Henry Cutler (assignor to S. N. Cutler and Company), Ashland, Mass.
91,613.—PITMAN.—Mexworth D. Drake, Scituate, assignor to W. E. Barrett, Providence, R. I.
91,614.—FABRIC FOR THE MANUFACTURE OF HATS, BONNETS, AND VARIOUS ARTICLES FOR USE AND ORNAMENT.—Prosper Erhard and Amelie Erhard, New York city.
91,615.—CHILDREN'S CARRIAGE.—Joel A. H. Ellis (assignor to Ellis, Britton, and Eaton), Springfield, Vt.
91,616.—BREECH-LOADING FIREARM.—Lewis T. Fairbanks, Worcester, Mass.
91,617.—STUBBLE AND SUBSOIL PLOW.—R. R. Fenner, Urbana, Ill.
91,618.—BUSH FOR BARRELS, ETC.—David F. Fetter, New York city.
91,619.—PROCESS AND APPARATUS FOR MAKING SHEET IRON.—George Weeden Francis (assignor to himself, Edwin Garfield, and Jeremy W. Bliss, assignors to themselves and George W. Williams), Hartford, Conn.
91,620.—MACHINE FOR PLASHING HEDGES.—David Gore, Carlinville, Ill.
91,621.—BEVERAGE.—Wm. H. Goss, Boston, Mass.
91,622.—CURD AGITATOR.—De Witt C. Hall, Barnes' Corners, N. Y.
91,623.—HAY RAKER AND LOADER.—F. W. Harlow, Hannibal, Mo.
91,624.—BREECH-LOADING FIREARM.—John Adam Heckenbach, Mayville, Wis.
91,625.—PLANER CHUCK FOR HOLDING BODIES OF DIFFERENT SHAPE.—Robert Henderson, Thomaston, Conn.
91,626.—FRUIT DRYER.—Henry Henley, Shoals Station, Ind.
91,627.—ORE WASHER AND CONCENTRATOR.—Wm. G. Heslep and Thomas A. Cochrane, Jamestown, Cal.
91,628.—DEVICE FOR CLEANING SAUSAGE CASES.—Martin Heusy, Burlington, Ohio.
91,629.—PICTURE NAIL.—Henry Hickman, Omaha, Neb.
91,630.—TRUNK.—Henry Hickman, Omaha, Neb.
91,631.—PLOW.—Daniel H. Hill, Union Springs, Ala.
91,632.—CONFECTION.—John Q. Hill, Worcester, Mass.
91,633.—PROJECTILE.—J. W. Hill, Jefferson, Iowa.
91,634.—SCREW DRIVER.—Wm. Hofer, New Haven, Conn.
91,635.—GROOVING MACHINE.—Thomas Holt (assignor to himself and Abram T. Merwin), Brooklyn, N. Y.

91,636.—Tweer-Arch for Blast Furnaces.—John Horton, Rochester, N. Y.
91,637.—Curry Comb.—John Edward Insley (assignor to James Fallows and John Pfeifer), Philadelphia, Pa. Antedated June 11, 1869.
91,638.—Mining-sluice for Saving Sulphurets.—Orlando Jennings, North San Juan, Cal.
91,639.—Animal Poke.—Wm. Kelly, Saranac, Mich.
91,640.—Horse Rake.—Watson King, Springfield, Ill.
91,641.—Ore Crusher.—S. R. Krom, New York city.
91,642.—Pattern for Measuring and Cutting out Dress Waists.—J. M. Lent, Schuyler's Lake, N. Y.
91,643.—Gang Plow.—J. W. Lewis, Oregon City, Oregon.
91,644.—Roller-cutter for Plows.—J. W. Lewis, Oregon City, Oregon.
91,645.—Advertising Attachment to Tables, etc.—Landon Limerick and A. H. E. Stein, Louisville, Ky., assignors to James T. Hair and O. W. Richardson.
91,646.—Fan-attachment for Sewing Machines.—Thomas A. Lyle, Pittsburgh, Pa.
91,647—Compound for Salve.—Nicholas Lumsden and Frank Lessman, Oakland, Cal.
91,648.—Double-acting Pump.—F. A. Mack, Niles, Mich.
91,649.—Wheel-making Machine.—Thomas C. Marshall and H. W. Hawkins, Akron, Ohio.
91,650.—Self-clearing Watch Key.—William N. Martin, Providence, R. I. Antedated June 10, 1869.
91,651.—Portable Fence.—Peter McCollum, Fayette, Mo.
91,652.—Device for Preventing Radiation of Heat from Steam Pipes.—James McFarland, Louisville, Ky.
91,653.—Machine for Making Twine, etc.—James McIntire, Hopewell Cotton Works, assignor to W. C. Dickey, Oxford, Pa.
91,654.—Lubricating Oil from Petroleum.—Thomas E. Merrick, Cleveland, Ohio.
91,655.—Seed Planter.—John B. Miner, Groton, Conn.
91,656.—Machine Belting.—James Montgomery, New York city. Antedated June 18 1869.
91,657.—Subsoil Plow.—James W. Murfee, Havanna, Ala.
91,658.—Thrashing-machine Concave.—John Nichols, Battle Creek, Mich.
91,659.—Liniment for Horses, etc.—Patrick O'Halloran, New York city.
91,660.—Apparatus for Winding Maps, Songs, Curtains, etc.—J. S. Ostrander, Albany, N. Y.
91,661.—Cultivator.—R. B. Parks and J. R. Parks, Neponset, Ill.
91,662.—Printing Telegraph.—Geo. M. Phelps, Brooklyn, N. Y.
91,663.—Railway Switching Apparatus.—Daniel Pike (assignor to himself, J. E. Vose, and W. J. McCulloh), New Orleans, La.
91,664.—Wire Broiler and Toaster.—C. L. Prouty, Worcester, Mass.
91,665.—Pencil Case.—J. H. Rauch, New York city.
91,666.—Paper Box.—J. L. Reber, Philadelphia, Pa.
91,667.—Fertilizer.—F. C. Renner, Ladiesburg, Md.
91,668.—Breech-loading Fire-arm.—Westley Richards, Birmingham, England. Patented in England June 12, 1868.
91,669.—Casting Jug Tops.—F. B. Richardson, Boston, Mass.
91,670.—Felting Machine.—L. Robinson, L. Conine, N. F. Hyatt, and D. W. Hyatt, Matteawan, N. Y.
91,671.—Fruit Dryer.—Samuel D. Rogers and F. C. Selby, Allegan, Mich.
91,672.—Metallic Roofing.—C. C. Scaife, Pittsburgh, Pa. Antedated June 10, 1869.
91,673.—Picture Frame.—Geo. Schneider, Buffalo, N. Y.
91,674.—Fastening Together the Soles and Uppers of Boots and Shoes.—F. Le Roy Senour and H. L. Traphagan, Eaton, Ohio; said Traphagan assigns his right to said Senour.
91,675.—Water Meter.—H. C. Sergeant, New York city.
91,676.—Steam Pump.—H. C. Sergeant, New York city. Antedated June 17, 1869.
91,677.—Gate.—L. W. Sibley, Ames, Iowa.
91,678.—Curing Meat.—William H. Silberhorn, New York city.
91,679.—Velocipede.—L. A. Sinclair, Bellevue, Ohio.
91,680.—Compound for Extracting Oils, Paint, Grease, and the like from Clothes.—C. B. Skiff, Jersey City, N. J.
91,681.—Ellipsograph.—Andrew Smith, Dayton, Oregon.
91,682.—Velocipede.—C. H. Smith and G. D. Walker, Brooklyn, N. Y.
91,683.—Bracket Clamp.—G. W. Spaulding and G. R. Smith, Syracuse, N. Y.
91,684.—Method of Attaching Needles in Sewing Machines.—Greenleaf Stackpole, New York city, assignor to Stackpole Sewing Machine Co., Boston, Mass.
91,685.—Combined Buckle and Snap.—S. G. Sturges and W. E. Sturges, Newark, N. J.
91,686.—Organ and Melodeon.—Simeon Taylor, Worcester, Mass.
91,687.—Combination Organ and Book Case.—Simeon Taylor, Worcester, Mass.
91,688.—Bureau Bedstead.—David Trefry, Boston, Mass.
91,689.—Lining for Fireplaces.—Chas. Truesdale (assignor to William Resor & Co.), Cincinnati, Ohio.
91,690.—Writing-desk Calendar.—S. J. Tucker (assignor to J. A. Rush, for one half his right), Philadelphia, Pa.
91,691.—Turbine Water Wheel.—J. W. Upham, Worcester, Mass.
91,692.—Ash Sifter.—Wm. Vogel, Norwich, Conn.
91,693.—Pocket Knife.—Addison G. Waterhouse, San Francisco, Cal.
91,694.—Pneumatic Telegraph.—Arthur McNutt Wier and Marshall Arthur Wier, Elm Lodge, Newton Road, Bayswater, Great Britain. Patented in England, Aug. 29, 1867.
91,695.—Anti-Friction Roller for Shafting.—William E. Wilcox, Peoria, assignor to himself and T. H. Wills, Beardstown, Ill.
91,696.—Coffeepot.—Ira Yeamans, Brooklyn, N. Y.
91,697.—Culinary Vessel.—Henri Zachgo, South Brooklyn, N. Y.
91,698.—Fruit Picker.—J. H. Adams, Martinsville, Ind.
91,699.—Hay Spreader.—Reuben Adams and J. D. Sheetz, Heidleberg township, Pa. Antedated Dec. 22, 1868.
91,700.—Feed-water Heater for Steam Engines.—Jas. Armstrong, Bucyrus, Ohio.
91,701.—Shell Fuse.—J. D. Bacon, New York city.
91,702.—Velocipede.—J. C. Beaumont, Wilkesbarre, Pa.
91,703.—Match Box.—L. W. Beecher, Westville, Conn.
91,704.—Steam and other Whistles.—A. S. Bird (assignor to herself and Peter Peugeot), Buffalo, N. Y.
91,705.—Hose Carriage.—Wm. Boate, Philadelphia, Pa.
91,706.—Step Ladder.—Charles Edvard Boman, San Francisco, Cal.
91,707.—Pneumatic Device for Forcing Liquids.—C. F. Bowman and Stephen Slyker, Wilkesbarre, Pa.
91,708.—Braiding Attachment for Sewing Machines.—A. H. Boyd, Rockville, Mass.
91,709.—Fire Extinguisher.—Z. Breed, Weare, N. H.
91,710.—Grain Separator.—John Brightbill, Lebanon, Pa.
91,711.—Hydrostatic Scale for Weighing Cargoes.—J. R. Burville, Springfield, Ohio.
91,712.—Beehive.—Geo. Calvert, Upperville, Va.
91,713.—Pipe and Tobacco Box.—L. G. Carr (assignor to himself and A. M. Walker), Philadelphia, Pa.
91,714.—Wagon Seat.—I. H. Chappell, Decatur, Ill.
91,715.—Churn Dasher.—J. W. Cheney and Brown Ingalls, Shelbyville, Ill.
91,716.—Handle for Crosscut Saws.—Wm. Clemson, Middletown, N. Y.
91,717.—Combined Thrasher, Separator, and Clover Huller.—Adrian Cornell, Newtown, Pa.
91,718.—Cultivator.—R. D. Craft, La Porte, Ind.
91,719.—Rail for Railway.—J. F. Cranston (assignor to himself, T. A. Curtis, and J. W. Labaree), Springfield, Mass.
91,720.—Last.—C. O. Crosby, New Haven, Conn.
91,721.—Plow.—W. H. Cummings and H. L. Childs, Barnsborough, Iowa.
91,722.—Mouse Trap.—Anthony G. Davis, Watertown, Conn.
91,723.—Gate.—L. S. Deming, Newington, Conn.
91,724.—Nut Lock.—L. L. Dewoese, Canton, Ohio.
91,725.—Safety Valve.—S. B. Dougherty, South Bergen, N. J.
91,726.—Fruit Jar.—H. S. Draper (assignor to himself and J. A. Jordan), Rochester, N. Y.
91,727.—Cultivator Joint.—W. A. Dryden, Monmouth, Ill., assignor to himself and J. M. Turnbull.
91,728.—Photographic Card Holder.—W. E. Eastman, Derby Line, Vt.
91,729.—Felting Machine.—Rudolph Eickemeyer, Yonkers, N. Y.
91,730.—Hat-stretching Machine.—Rudolph Eickemeyer (assignor to Eickemeyer Hat Blocking Machine Company), Yonkers, N. Y.
91,731.—Feather Renovator.—C. H. Farnham, Canterbury, Conn.
91,732.—Signal and Switch for Railways.—Daniel Fitzgerald, New York city.
91,733.—Door Lock.—E. P. Fowler, Brooklyn, and C. J. Clements, Mott Haven, N. Y.
91,734.—Velocipede.—J. Fraser and Jonathan Austin, New York city.
91,735.—Farm Gate.—D. C. Frazeur and W. D. Cocklin, Sidonsburg, Pa.
91,736.—Railway-rail Joint.—John Fritz and R. H. Sayre, Bethlehem, Pa.
91,737.—Alphabetical Instruction Puzzle.—E. F. Gilbert, Lyons, N. Y.
91,738.—Spring-bed Bottom.—Robert A. Goodyear, Binghamton, N. Y.
91,739.—Water Wheel.—D. H. Gould, Troy, N. Y.
91,740.—Iron-roof Purlin.—George Halstead, Buffalo, N. Y.
91,741.—Hand Stamp.—F. I. Hart, New Haven, Conn.
91,742.—Paper-cutting Machinery.—Jonathan Hatch, South Windham, Conn.
91,743.—Coal Bucket.—Lewis Hayner, Clifton Park, N. Y.
91,744.—Animal Trap.—Charles Henert, Washington, D. C.
91,745.—Bridge.—J. G. Henszey, Philadelphia, Pa.
91,746.—Cornice for Window Curtains.—Chas. W. Hill, New York city.
91,747.—Harness Pad.—John Hughes, Newark, N. J.
91,748.—Paper Bag and Material Therefor.—Abiezer Jameson, Trenton, N. J.
91,749.—Bedstead.—D. H. Jennings and James Bounds, Bridgeport, Conn.
91,750.—Pump.—W. F. Jones, Syracuse, N. Y.
91,751.—Medical Compound.—Wm. N. Jordan, Cambridge, assignor to J. A. Baldwin and G. R Waterman, Boston, Mass.
91,752.—Machine for Upsetting, Punching, and Cutting Tires.—J. C. Jordon, Watertown, and Ellis Doty, Janesville, assignors to Doty Manufacturing Co., Janesville, Wis.
91,753.—Striking Movement for Clocks.—J. H. La Bau, Brooklyn, N. Y.
91,754.—Coffee-Pot.—Nathan Lawrence (assignor to Reed and Barton), Taunton, Mass.
91,755.—Guide Rolling Hoop.—Eric Lindholm, Brooklyn, N. Y.
91,756.—Boot Crimp.—Cyrus Lomax, Paoli, Ind.
91,757.—Harvester.—G. G. Lyman (assignor to himself and J. F. Lyman), Independence, Iowa.
91,758.—Toy Steam Engine.—Philander Macy, Rochester, N. Y.
91,759.—Machine for Making Ginger Snaps and Crackers.—John McCollum and Joseph Parr, New York city.
91,760.—Propelling Apparatus.—Loring Moody, Malden, Mass.
91,761.—Lever for Operating Water Closet Pans and Valves.—G. R. Moore, Philadelphia, Pa.
91,762.—Car Wheel.—H. W. Moore, Jersey City, N. J.
91,763.—Draft Cock.—A. J. Morse, Boston, Mass.
91,764.—Shingle Machine.—Asa Newell, Jordan, N. Y.
91,765.—Rock-Drilling Apparatus.—John North (assignor to himself and W. T. Holt), New York city.
91,766.—Roller Case for Maps and Charts.—J. S. Ostrander, Albany, N. Y.
91,767.—Head Block for Saw Mills.—Darius Parkhurst, St Louis, Mo.
91,768.—Medical Compound.—Hugh Pool, Montgomery Co., Tenn.
91,769.—Low-Water Indicator.—E. D. Pritchard, New York city.
91,770.—Steam Engine Condenser.—Franklin Ransom, Buffalo, N. Y.
91,771.—Ditcher.—Wycoff Robbins, Hancock county, Ill.
91,772.—Device for Treating Hides.—Herman Royer, San Francisco, Cal.
91,773.—Gage for Dressing Millstones.—Robert Ruston, Rockville, Ind.
91,774.—Last.—I. N. C. Saville, Worcester, Mass. Antedated March 3, 1869.
91,775.—Elevator.—George Scott, Louisville, Ky.
91,776.—Butter Chest.—F. S. Sears, Charlestown, Mass.
91,777.—Clod Fender.—George Seeger, J. W. Loveless, and J. W. Throp, Clark's Hill, Ind.
91,778.—Lamp Burner.—Frederick Shaller (assignor to himself and J. B. Longley), Hudson, N. Y.
91,779.—Seat for Vehicle.—S. S. Simmons, Watsonville, Cal.
91,780.—Machine for Finishing Paper Boxes.—Richard Smith, Sherbrook, Canada.
91,781.—Lasting Iron.—A. J. Smith, Canal Dover, Ohio.
91,782.—Spice Box.—H. E. Smyser, Philadelphia, Pa., assignor to "Weikel & Smith Spice Co."
91,783.—Gate.—Jeremiah Snell, Evans' Mills, N. Y.
01,784.—Machine for Sewing Brooms.—Greenleaf Stackpole (assignor to himself and H. C. Covert), New York city.
91,785.—Bath Tub.—M. A. Stevens, Hartford, Conn.
91,786.—Corn Fertilizer and Planter.—J. M. Stoner, Greenville Lodge, Pa.
91,787.—Coffee and Tea Pot.—T. B. Stout and Jos. Stout, Keyport, N. J.
91,788.—Lathe for Finishing the Driving Wheels of Locomotives.—H. D. Stover, New York city.
91,789.—Thill Coupling.—Otto Tackmann, Yonkers, N. Y.
91,790.—Hay Spreader.—J. A. Talpey, Somerville, Mass.
91,791.—Method of Manufacturing Welded Wrought Metal Tubing.—Stephen P. M. Tasker, Philadelphia, Pa.
91,792.—Water Wheel.—Samuel Teachout, Troy, N. Y.
91,793.—Musquito Guard.—Robert Themar, Sheboygan, Wis.
91,794.—Clothes Wringer and Mangle.—B. O. Thompson, Chicago, Ill.
91,795.—Hand Chopping Knife.—Fred'k M. Untiedt, East Orange, assignor to himself and Wm. Martin, Newark, N. J.
91,796.—Ventilator for Ships.—W. W. Vanderbilt, New York city.
91,797.—Horseshoe Nail Pointer.—W. T. Vann, Macomb, Ill.
91,798.—Potato Planter.—Lansing Van Wie, Bethlehem, N. Y.
91,799.—Seed Sower.—Teunis Vreeland, Wataga, Ill.
91,800.—Steam Generator for Combustion.—A. J. Warren and D. W. Wilson, West Eau Claire, Wis.
91,801.—Device for Preventing Incrustation in Steam Generators.—John Webster, Chelsea, England.
91,802.—Cultivator.—W. J. Wells, Sidney, assignor to himself and W. H. Neal, Toledo, Ohio.
91,803.—Detachable Stovepipe Clothes Dryer.—Hiram Whitney, Chicago, Ill.
91,804.—Railway Car Axle Box.—W. E. Wilcox, Peoria, assignor to himself and T. H. Wills, Beardstown, Ill.
91,805.—Grain Separator.—S. M. Wirts and L. Swift, Hudson, Mich.
91,806.—Centering Awl.—Nathan Woodbury, Woodstock, Vt. Antedated May 28, 1869.
91,807.—Trace Buckle.—Alvah Worster, Hannibal, N. Y.
91,808.—Trace Buckle.—Alvah Worster, Syracuse, N. Y.
91,809.—Harness Loop.—Alvah Worster, Hannibal, N. Y.
91,810.—Combined Drawer Pull and Label.—Jeremiah Quinlan, New York city.

REISSUES.

81,392.—Railroad Car Heater.—Dated August 25, 1868; reissue 3,509.—American Car-Heating Co., New York city, assignee, by mesne assignments, of W. S. McNeil and O. S. Cadwell, Jr.
78,958.—Construction of Drilling Jar.—Dated June 16, 1868; reissue 3,510.—J. C. Byran, Titusville, Pa., assignee, by mesne assignments, of Edward Guillod.
88,142.—Tempering Steel Springs.—Dated March 23, 1869; reissue 3,511.—J. H. Deniger, Bridgeport, Conn.
87,570.—Coffin Bier.—Dated March 9, 1869; reissue 3,512.—Patrick Joyce, Rochester, N. Y.
77,310.—Dray Saddle.—Dated April 28, 1868; reissue 3,513.—John O'Mahoney, Savannah, Ga.
30,357.—Plow.—Dated October 9, 1860; reissue 3,514.—M. G. Slemmons, Cadiz, Ohio.
37,985.—Sewing Machine.—Dated March 24 1863; reissue 3,515.—M. R. Smith, Armonk, N. Y.
20,192.—Expansive Bit.—Dated May 11, 1858; reissue 3,516.—W. A. Clark, Bethany, Conn.
23,361.—Machine for Pegging Boots and Shoes.—Dated March 29, 1859; reissue 3,517.—A. C. Gallahue, Riverdale, N. Y.
86,029.—Tire for Wagons.—Dated January 19, 1869; reissue 3,518.—B. F. Morey, Clinton, Ind.
42,954.—Door Latch.—Dated May 31, 1864; reissue 3,519.—Russell & Erwin Manufacturing Co., New Britain, Conn., assignees, by mesne assignments, of M. T. Lincoln.

DESIGNS.

3 555.—Frame of a Stove Door.—Alex. Wemyss (assignor to Stuart, Peterson & Co.), Philadelphia, Pa.

EXTENSIONS.

Machine for Cutting out Boot and Shoe Soles.—C. H. Griffin, of Lynn, Mass.—Letters Patent No. 13,072, dated June 12, 1855; reissue No. 1,610, dated January 26, 1864.
Reciprocating Railway Propeller.—Henry Boynton, of New York city.—Letters Patent No. 13,078, dated June 19, 1855.

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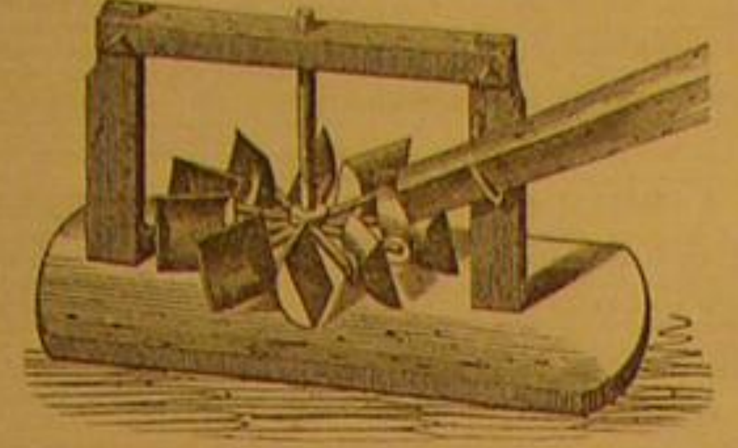

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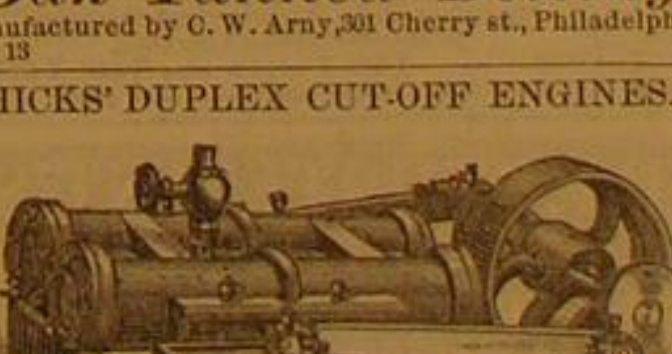

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