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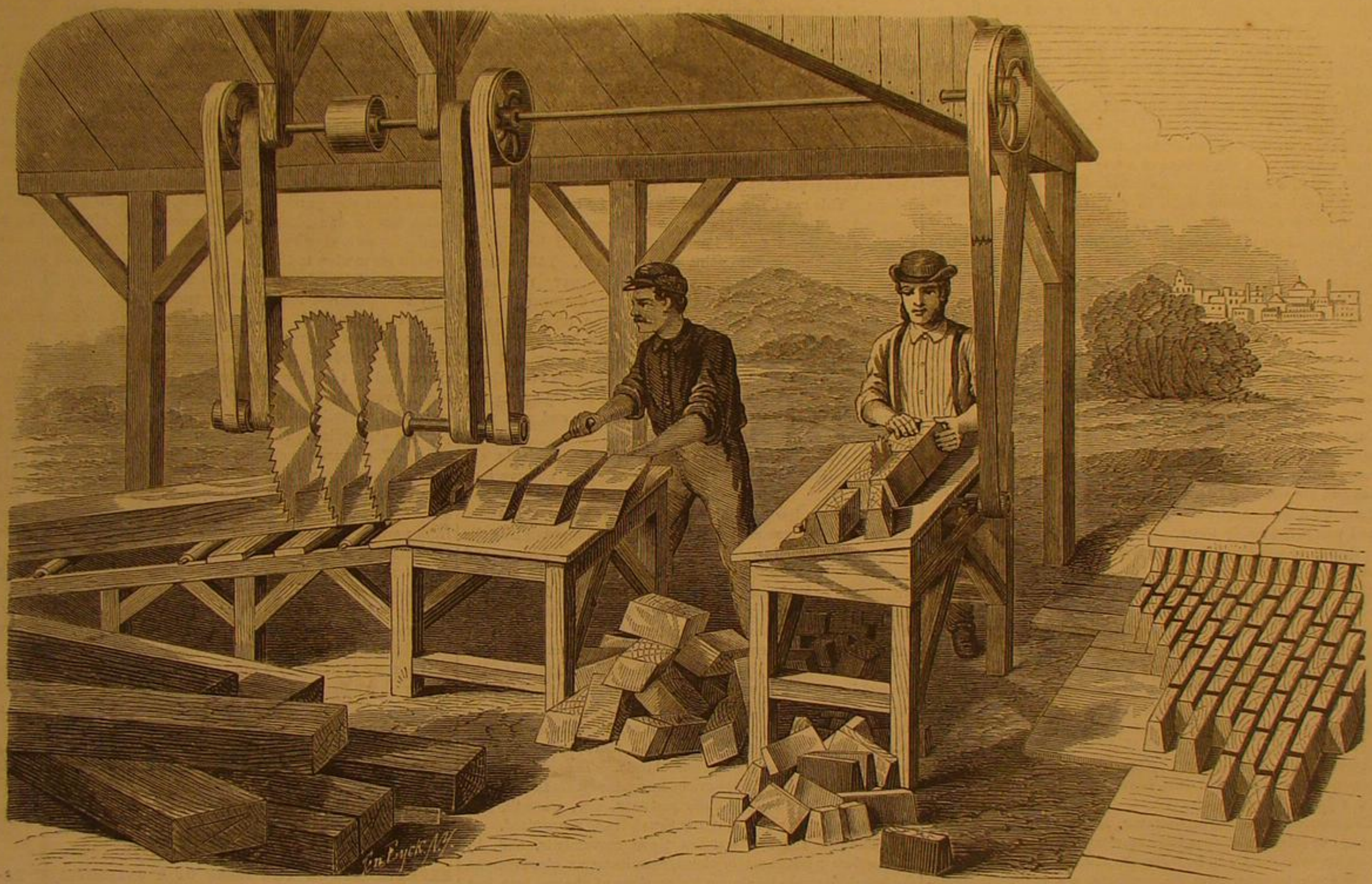
The Ballard Pavement.

Wood pavements being in public favor, we look upon the invention, represented by our engraving, as of much importance. The foundation for this pavement is prepared in the usual manner, with a covering of plank of suitable thickness, and in sections of the country where gravel is abundant and easily obtained, a concrete foundation of proper thickness, well rolled, may be used if desired.

The broad-based, wedge-shaped blocks are placed upon the foundation, in rows across the street, the rows touching each broken or displaced by heavily-loaded teams, and the constant wear and pressure of travel.

Nails are not necessarily used in putting it down. No bands, strips, or fastenings, which tend to early decay, are used in its construction. The blocks cannot work upward or laterally. Sand and gravel cannot work underneath them. Few or many blocks may be taken up and replaced, without in the least disturbing those remaining. The strips or pickets used in other pavements, and found objectionable by their frequently working upward, loosening the concrete filling, and saw may be fed with rollers. It will also be noticed that this form is secured without waste of material, or extra sawing, and that the use of pickets is obviated, thus lessening the amount of sawing required in the construction of other wood pavements.

The inventor has had large experience in laying wood pavements of the kinds most in use, and he brings this experience to bear upon the construction of the improved pavement he has devised with a view to the correction of their radical defects.



THE BALLARD PAVEMENT AND MODE OF CUTTING THE BLOCKS WITHOUT WASTE OR EXTRA SAWING.

other at their base, forming wedge-shaped interstices across the street; and square spaces (on a line with the street), one inch in width, are left between the ends of every two or more blocks, as may be desired; these spaces breaking joints with those in the adjoining rows; and the spaces between the sides and ends of the blocks are then filled with fine, clean gravel, cement, and coal tar, thoroughly rammed into them.

Such end filling, running in irregular lines, at right angles to the continuous regular lines of the side filling, interrupts the surface of the pavement both ways, thus affording an excellent and sure foothold for horses' feet. The continuous bearing surface of the broad-based, wedge-shaped blocks, combined with the wedge-shaped interstices running across the street, and also in combination with the square spaces at irregular intervals lengthwise of the street, filled with concrete thoroughly rammed into them, not only firmly wedges the pavement both ways, forming an unbroken keyed arch of great strength and firmness, but also renders it impervious to water, which would enter between the ends of the blocks, were they set with their ends contiguous, without any filling so rammed between them.

The more wear upon this pavement the more compact it becomes. Both blocks and filling being wedge-shaped from top to bottom, every shrinkage will be supplied by a downward movement of the filling. The effect of travel is to constantly produce this downward movement of the concrete filling, wedging the pavement tighter and tighter with each movement; whereas, without the wedge-shape form of block and filling, the spaces are the same in size from top to bottom and a movement does not tighten but loosens, there being no principle of the wedge involved as in this Ballard pavement; The Ballard block being broad-based, the foundation is not thereby weakening the general structure, are not used in this pavement. The flooring and blocks may be treated by any known process for preserving wood from decay.

The construction of this pavement, in all its parts, is so simple, that any portion of the work may be performed by common laborers, and the pavement laid with great rapidity. Its cost is no more, well laid, than that of any patented wood pavement in which a suitable and like quality of lumber is used.

We believe that a pavement, well laid, of the broad-based wedge-shaped blocks, to stand but four inches high, keyed with the well rammed concrete filling, as above, will make a stronger and more lasting pavement than made of any other blocks in use to stand the usual hight—six inches.

The lumber for the blocks may be sawed at the lumber mills, any convenient length, any size from three inches to the full size of the log or timber one way, and should be seven inches the other way. The feed table of the machine for sawing off the blocks, is inclined at right angles to the line of the cut of the saws, which gives the top and bottom of the blocks the proper angle to form the bevel to two sides of two blocks; as represented under the gang of swing saws in the engraving; and the splitting saw table has a like inclination, giving the same bevel to the other two sides of two blocks when split, also represented in the engraving. So that with the feed tables at an inclination of one inch to the foot, by one sawing and one splitting, two finished blocks are produced, wedge-shaped, to stand six inches high, four inches wide at the base, three inches at the top, and of a length equal to the width of the lumber, either side of each block having the same inclination, one side leaning with the fiber, and the other slightly oblique to it. This splitting

This invention is covered by a number of United States patents, issued in 1869 and 1870, embracing the wedge-shaped blocks, wedge-shaped interstices, and wedge-shaped key, or filling, among the claims. Patents have also been issued, through the Scientific American Patent Agency, in England, France, and other foreign countries. Further information can be had at the office of the "Ballard Pavement Co.," No. 117 Broadway, New York.

CANDLE STAMP.—It is marvelous, writes the *Scientific Review*, to observe what trifling articles may form the subject of a useful invention; the stamping of candles, for example, would appear to be a very unimportant matter, yet Mr. Schleidner, of Paris, has designed a special machine for the purpose. The candles are placed on an inclined plane, from which they successively slide into the notches of two similar wheels, or rings, which, at each revolution of the driving pulley, bring a candle under the stamp. This stamp, suitably engraved, is heated to an unvarying temperature, by steam or otherwise, so that upon pressing lightly upon the candle it melts the fatty matter, leaving the candle stamped with a very clean impression, obtained without shock or stain. The candle then leaves the notches, falls upon another inclined plane, and passes thence into a box.

BAUR or chrome steel is not only one-third stronger than any other steel, but can be produced at small cost, from the fact that when worn out, as in a steel headed rail, it has a market value, as it can be made over again, which is not the case with Bessemer or any other cast steel. It will also weld without borax or flux, and when burnt can be redeemed on the next heat

LIGHT AND VISION—MORE ESPECIALLY HOW LIGHT IS CONVERTED INTO THOUGHT.

[Being one of the Cooper Union Lectures for the Advancement of Science and Art, delivered in the Great Hall of the Cooper Institute, in New York, on the 26th of February, 1870.]

BY H. KNAPP, M. D.

Light and Vision form too vast a subject for a single lecture. I shall, therefore, confine myself to the exposition of one question of paramount interest connected with it, namely, "*How is light converted into thought?*"

This problem is not new. On the contrary, it has a history dating back to the works of the earliest philosophers; while it still engages the untiring efforts of the greatest naturalists of the present day. Let us consider what were the course and practical results of this long series of investigations, engendered and kept alive by a question of apparently little practical importance.

As the origin of all ideas may be traced to impressions on the senses, the highest of them, sight, is consequently the most fruitful source of ideas, and its organ, the eye, the broadest channel for conveying impressions to the brain. All speculation on thought, therefore, had to take into consideration, above all, how an impression of light is transformed into an idea. This is the reason that, at all times, light and vision have concentrated the efforts of the greatest naturalists and philosophers. The opinions on vision entertained by the prominent thinkers of every century had so great an influence on the general opinions concerning all material and spiritual matters, that the history of the theory of sight constitutes a faithful mirror of the history of philosophy.

The perceptions of sight and hearing are distinguished from those of the other so-called lower senses, by the remarkable fact that, in the former, the objects perceived act from a distance on the organs of sense; while, when we feel, taste, smell something, the perceived object comes either in solid, liquid, or gaseous state, in contact with the terminal fibers of the sensitive, gustatory, and olfactory nerves. How is it possible for me to open my eyes, and instantly take in the sensation of a landscape of almost infinite extent, whilst not the smallest particle of it touches any organ of my body? I see a mountain far away. This is a commonplace observation, you say; but if I ask how this observation is at all possible, and how it is accomplished, you will, most likely, be just as much puzzled as the illustrious philosophers of antiquity, the medieval mystics, and the profound and learned scientists of modern civilization.

The old Greeks asked themselves, above all, this question: Does the mountain I see yonder come to me, or do I go to the mountain? Their opinions differed; some held to the one, some to the other, some to both at the same time. Democritus and his adherents supposed that a subtile substance, light dust, detached itself from objects, penetrated into our eyes, and was perceived by them.

Others believed that light dust emanated from our eyes, impinged upon the surface of objects, and caused a sensation of the latter by either returning to the eye, or remaining always in connection with it.

Plato started with the axiom that only homogeneous substances are capable of acting upon one another. Light dust must therefore, said he, not only be detached from the object, but also emanate from the eye. Both meeting midway between the object and the eye, cause, by their contact, visual sensations of light, color, and form.

The great philosophical mind of Aristotle refuted all these theories, and replaced them by another coming nearer to the truth. If a subtile light dust, argued he, detached itself from the object, it would require a certain time to travel to the eye. The perceptions of sight, however, are instantaneous. We open our lids, and at once the remotest objects would, were this hypothesis correct, be the more clearly seen, the nearer they are to the eye. But the truth is, we see them indistinctly when they are held close by. If, on the other hand, light emanated from the eye, the eye would, above all, see itself; and it being the origin and source of light, would also illuminate the darkness.

His theory was the following: Between the visual object and the eye there exists a subtile substance, capable of assuming different states. In the state of activity, it becomes transparent and excites the eye, as light; in the state of rest it becomes opaque, and produces in the eye the sensation of darkness. Both states, light and darkness, combined in different degrees, produce the variety of colors.

The Aristotelian was the theory generally received, up to the time of Kepler, in 1604. This great naturalist applied the principle of an invention of Porta, viz., the well known camera obscura, to the explanation of the act of vision. He said the eye represents a natural camera obscura, having a system of transparent collective lenses (cornea, crystalline lens, aqueous and vitreous humors), walls blackened inwardly, and a receptive screen, the retina. When the eye like the photographer's camera, is turned toward an illuminated object, an image of the latter is cast upon the retina. Kepler reviving the theory of Democritus, explained vision as follows: Images, detached from the visual objects, enter the eye and place themselves upon the retina. There they are touched by the spirits of the optic nerves, which then communicate their impressions to the soul whose seat is in the brain. From the report of the optic nerve spirits, the soul draws a conclusion or passes judgment, and this constitutes the notion or idea we have of the object. In case the soul, while forming an idea of a thing, does not rely on the report of the spirits of the optic nerves alone, it sends the spirits of the sensative nerves into the ends of the fingers, ordering them to examine the same object by the touch. After the reception of their report, the soul forms a judgment on the statement of two witnesses, in order to guard itself against the fallacy of one sided impressions. Thus Kepler held the three periods which constitute the act of vision, definitely apart, though his manner of conception and interpretation appears, now-a-days, rather childish.

The first and second periods of vision, the physical condition of the formation of the visual images, and the physiological process of receiving and conducting the light impression to the brain, have been explained, thanks to the progress of science, in a surprising manner. But we must confess that our knowledge of the third period of vision, the psychial work of forming the idea, is still in its infancy. Kepler was able to explain the first period of vision by the physical laws of optics, but his century was not yet prepared to comprehend the second period of vision, the physiological sensation of light: he resorted to personifying, as the human mind is accustomed to do, whenever its knowledge is unripe. He needed the spirits of the nerves, which constituted, as it were, the emissaries of the head of the government—the soul. With regard to the latter, we also, the enlightened citizens of the nineteenth century, must resort to personifying no less than Kepler, one of the founders of modern astronomy. A real or scientific comprehension of the nature and faculties of the soul will not be possible until the anatomy and physiology of its seat, the brain, are satisfactorily understood. Our knowledge of the brain, however, and methods to inquire into its structure and functions, are like those of a boy, who, impelled by scientific proclivities, beat a watch to pieces with a hammer in order to learn what was contained within the little case. To former centuries the eye was a case as dark and incomprehensible as the brain still is to the present. Let us, therefore, proceed to consider how we have discovered the structure and functions of the eye.

Kepler supposed that the retina was the percipient membrane of the eye, because it corresponds to its focal plane, that is, to the point of union of rays coming from distant objects. This can be easily demonstrated by turning an eye, removed from an animal, toward a luminous object—for instance, a candle—a small image of which will be plainly visible upon the opposite point of the eyeball. This retinal image, however, showed one quality which gave rise to a good deal of discussion, from the time of its discovery to the present epoch—I mean the reversion of the retinal image. The same peculiarity obtains in images cast by any collective system. In the pictures of the camera obscura all the objects are inverted. When in the retinal images everything stands upside down, how then is it that we see objects in the natural upright position? This was the universal and puzzling question.

Berkeley, in 1709, was the first to give a reasonable explanation. He argued: The earliest conscious observations of a child are the movements of its own hands. If you watch a baby a few months old, you will notice the queer and manifold movements of its hands and fingers, while its yet unsteady gaze is directed on them, and every now and then the fingers are brought to the mouth. These are the studies of the little creature. The hands and fingers cast images on the retina, which it learns to comprehend. It calls in aid the senses of touch and taste, and by unvaried comparisons of the impressions which the same object makes on different senses, it learns to refer these impressions to the same object. In this way it acquires a notion of the different qualities of a thing. Some of these qualities can only be furnished by one sense; for instance, light, colors, taste. Others may be perceived by two and more senses; for instance, the position and size of objects. The hand brings itself and things within its grasp, in contact with the lips and other parts of the body. Their positions, size, warmth, consistency, and other qualities, are thus felt and recognized. At the same time the eye watches these movements, and, by numberless repetitions of these simultaneous observations, the mind learns to bring the impressions of the eye into harmony with the impressions received from the nerves of feeling. Constant habit establishes a law, and it is not astonishing to find such a law also in the sensations of the retinal nerves. Each nervous fiber receiving, at all times, the image of an object invariably from the same direction, cannot but refer an impression to a luminous object placed in the like direction. This law is so compulsory, that irritation of the retinal nerves by other causes—electricity, injuries, etc.—is always judged in the same way as referring to luminous objects, which would have cast their images on the parts of the retina excited by the electric current, the injury, etc. If you press quickly with your finger on the temporal side of your eye, you will perceive a luminous flash over the nose. In this way all the impressions of the retinal nerves are referred to objects without the eye, lying in the opposite part of the field of vision. Physiologists call this invariable mode of interpretation of retinal impressions by the mind, the law of projection of the retina. Being a law of nature, it admits no arbitrariness of judgment, no divergence of its meaning, no exception. If any part of the retina is excited by rays of light, pressure, or electricity, the mind always sees a luminous object in a definite direction, which is determined by a straight line drawn from the excited point of the retina through a point near the posterior pole of the crystalline lens, called the optical center, or the nodal point of the eye.

In ordinary vision the outward world is portrayed as a miniature panoramic picture on the retina, every point of which is referred by the mind to the corresponding point of the landscape spread out before the eye according to the law of projection. The mind has not the least cognizance of the way on which the light, exciting the retinal fibers, traveled. If a prism, or any other optical contrivance, be interposed between the luminous body and the retina, whereby the rays are deflected from their original straight lines, the mind knowing of no other code while judging the retinal images than the law of projection, sees the object in a wrong position. If the vitreous humor, lying before the retina, is not pure, but has some opaque spots in its tissue, they cast a shadow on the retina, which is mistaken for a dark object outside the eye, a floating mote, etc., according to its shape. Numerous errors are committed by relying solely on the impressions of one sense. They are called illusions, and many of them amuse or frighten people according to their nature.

If we recapitulate this chapter on the reversion of luminous object and retinal image, and the interpretation of the latter according to the law of projection, we arrive at the following summary:

The mind is in intercourse with the outward world by means of a pictorial language, photographed upon the retina. It has learned, in early youth, by habit and the co-operation of other senses than that of sight, to read this pictorial language according to a certain law, that of the projection of the retina, by which every point of the miniature panorama on the retina is referred to an object point, lying on the opposite side in the real landscape.

This sentence expresses in brief the opinion entertained by the most advanced natural philosophers of the present time regarding the art of vision. It gives a general idea, a rough outline of our subject, how light is converted into thought. But were I to stop here, I should have treated it very unsatisfactorily, leaving it immersed in a sea of obscurities. To dispel these we must advance farther into the temple of science.

The sun, the central body of our planetary system, is a glowing mass, surrounded by an atmosphere of glowing vapors. Light and heat emanate from it to create and sustain all animal and vegetable life on our little planet.

According to modern science, both light and heat are not real, physical particles, or molecules, detached from the incandescent body and propelled through space with almost inconceivable velocity, but they are a mode of motion, transmitted from one particle to another. The single particle makes but an exceedingly small movement, always like a pendulum swinging to and fro about its point of rest, but imparts its motion to the neighboring particle almost instantaneously. Thus the original impulse given by the glowing body to the nearest molecules, is transmitted to an infinite number of others with incalculable speed, and this transmission is called the propagation of light. Its velocity is approximately 200,000 miles in a second. The particles which are excited by the glowing substance to perform these vibratory movements, are supposed to be of the utmost subtilty, and to fill not only all space, celestial and terrestrial, but to pervade all bodies. They are called luminiferous or light ether. Their rarer or denser accumulation in different substances has a remarkable influence on the course of light. Through substances of equal density, light travels with the same speed, and the transmission of the vibratory motion from particle to particle is perfected in a straight line. This transmission is nothing else than what we call a ray of light —a sunbeam, if it comes from the sun. But any glowing body emits rays which travel through space in straight lines as long as their course is in the same medium. As soon, however, as the density of the substances changes, the rays of light are deflected from their original course.

When we accompany a ray of light as it proceeds from the sun, we have first to travel through an immense space, filled only with ether. The sunbeam passes through it in a straight line, until it reaches the atmosphere of the earth, which, being a denser medium, deflects it somewhat from its original course. After having traversed the atmosphere, it illuminates the landscape around our dwelling-place, and, reflected from the objects enters our eye, where, after various refractions, it ends in the retina.

[To be concluded next week.]

EXPERIMENTS ON THE HEAD OF A GUILLOTINED PATIENT.

At the time Troppmann was beheaded, a medical man in Paris, Dr. Pinel, made the startling announcement in one of the political journals, that death by the guillotine was the most cruel of all, as, through the suddenness of the process, life remained in the head of the criminal at least one hour after the execution. This statement was supported by physiological notions peculiar to the author; but, notwithstanding their heterodoxy, they might have been brought forward without any blame attaching to M. Pinel, had not he adopted the curious proceeding of publishing his note in a political journal instead of a professional one. At all events, the note produced the desired effect. The public mind was deeply moved, and a host of extraordinary histories went the round of the journals. Such sensational stories as Heindrich, the executioner, being bitten by the head of a *guillotiné*; of several heads, fallen into the same basket, having bitten each other, etc., were quoted from journal to journal, and struck with horror the good people of Paris.

Some of the medical journals entered a protest against M. Pinel's extraordinary physiological ideas, and the nonsensical stories to which they had given rise. Among others, M. Desprez, surgeon to the Lock Hospital, took the trouble to show the falsity of all this anti-physiological stuff. But MM. Evrard and Beaumetz, both medical men at Beauvais, have done more. They determined to make experiments on the head of a *guillotiné*, and the occasion was afforded them soon after the death of Troppmann, by the execution of a parricide at Beauvais. The results of these experiments were communicated in March last to the Medico-legal Society of Paris, and they are really well worth being noticed.

The head of the culprit was delivered to them five minutes after the execution, and was subjected to various processes which are most curious, and imply no small courage on the part of the investigators. First, MM. Evrard and Beaumetz tell us that the head was placed on a table covered with compresses, so as to show the amount of blood which would be obtained. The face was then bloodless, of a pale and uniform hue; the lower jaw had fallen and the mouth was gaping. The features which were immovable, bore an expression of stupor, but not of pain. The eyes were open, fixed, looking straight before them; the pupils were dilated; the cornea had already commenced to lose its luster and transparency. Some sawdust still stuck here and there to the face, but there was no vestige of any either on the inner surface of the lips or on the tongue. This is an important fact.

The opening of the ear was then carefully cleansed, and the experimenters applying their lips as closely as possible to the orifice, called out three times in a loud voice the name of the criminal. Not a feature moved; there was no muscular movement, either of the eyes or on the face. A piece of charpie, saturated with ammonia, was next placed under the nostrils; there was no contraction of the alæ nor of the face. The conjunctiva of each eye was deeply and several times successively cauterized with nitrate of silver; the light of a candle was brought within two centimeters distance of the cornea, and yet no contraction was observed either in the eyelids, eyeball, or the pupils.

Electricity was then resorted to as a more powerful means of excitement of the nervous system. One of Legendre's electric piles, with a current of moderate intensity, determined vivid contractions in such of the muscles of the face as were directly subjected to its influence. But was this evidence, say the investigators, of a feeling of pain expressed by the physiognomy? Certainly not: and this for two reasons; first, because, whilst the experiment affected the left side of the face, the muscles of the right side retained their expression of stupor, even when the opposite side was the most convulsed; next, because the electrized parts themselves resumed their cadaveric impassibility as soon as the electric current ceased to animate them.

The integuments of the cranium were then incised from the nape of the neck to the root of the nose; the bones of the skull were uncovered down to the zygomatic arches. In performing these incisions, say the investigators, many nerves were cut, of which the section would have been most painful; the muscles of the neck and temple were still alive, since they retracted energetically under the knife; notwithstanding, no contraction of the face, no reflex action was observed. At that time three-quarters of an hour had not yet elapsed since the execution. The skull was then sawn through, and the brain removed; the muscles of the face and those of the jaws continued to obey the electric current, as when the brain was unimpared. The integuments had then begun to get cold, and yet, with an intense electric current, the same muscular contractions were obtained half an hour after the extraction of the brain. Nobody will say that the brain still continued to act and think, though the muscles still responded to electric excitation. Beyond doubt the brain was as lifeless during the first part of the experiment as during the second. Indeed, at the very moment of the execution, through the sudden interruption of circulation, and consequent syncope, the brain was quite as unable to feel as to express its sensations.

This view MM. Evrard and Beaumetz base on the condition of the brain and its envelopes when examined. There was no fluid in the large arachnoid cavity; the vessels of the pia mater were almost bloodless, and filled with aëriform fluid; the lateral cavernous sinuses were absolutely bloodless. The ventricles contained scarcely a teaspoonful of fluid, and in no situation was the brain injected. These facts entirely overthrow what has been advocated by some with regard to the persistence of the cephalo-spinal liquid, and of cerebral nutrition.

The thoracic viscera were also examined. The heart was found to be enormous, and was seen to beat under the pericardium; the lungs shrunken, and of a blackish hue. There was an enormous dilatation of the right auricle, and the ventricle of the same side was also dilated and tense. The left auricle was remarkably small, hard, and retracted. The right auricle and ventricle were filled, not with blood, but with an airy fluid. Pressure reduced their volume to three-fourths of their apparent size. Whilst the contraction of the auricles persisted, those of the ventricles became less frequent. A quarter of an hour after, the auricle and ventricle were once more swollen and distended, and it seemed that air, solicited by the contraction of the auricle, came from the vena cava (which was bloodless and dilated), as well as from the brachio-cephalic venous trunks. An hour and a half after the execution, the contractions of the right auricle were still perceptible, though rare and weak; the right ventricle was then wrinkled, shrunken, and could not contract in the least.

The results of these experiments are in entire accordance with those which had already been obtained in 1803 by the Medical Association of Mayence, which had been led to investigate the subject by the same motives as had actuated MM. Evrard and Beaumetz. The experiments then made, such as calling out the names of the criminals in the respective heads, were much the same as those which I have just related.

The falling of the lower jaw, which takes place instantaneously, serves to explain (to a certain extent), according to MM. Evrard and Beaumetz, all the extraordinary stories of the heads biting each other which have recently been propagated as coming from Sanson and other executioners. The fact would be a mere coincidence, due to the position of the various heads in the basket. Besides, the experimenters assert that Heindrich, the present executioner, has positively assured them that he has never noticed this fact, nor indeed, any sign whatever of persistent life in the heads of *guillotinés.—Lancet.*

A TRIP OVER THE CENTRAL PACIFIC RAILROAD.

A contributor to the *American Churchman* thus graphically describes a trip over the Central Pacific Railroad:

The real difficulty in the way of engineering, in connecting the two oceans, occurs on the western side. It is all plain sailing on the eastern, till the road descends by a steep grade and through a pair of long tunnels into the Salt Lake Basin by Weber and Echo Cañons. The level plains of Nebraska, and the high table land of the Laramie Plains, by which the road ascends and crosses the Rocky Mountains, at an altitude of 8,000 feet, offered no difficulty to the engineer. The trouble on the Union Pacific was from the Indians—the warlike Sioux and Cheyennes—and from the fact of the great distance from supplies and material. But on the western side, the engineering problem was the great one from the start.

Immediately after leaving Sacramento the ascent begins, and the problem was to ascend the Sierra Nevada range to a hight of 7,000 feet within a distance of 80 miles.

There was no getting round the thing. The mountains stood there barring the way eastward. They would not get out of the way for a railroad, and the "passes," by which travelers in the old time surmounted the obstacle, are all from 5,000 to 8,000 feet at their hight above the sea level.

It was, indeed, the common talk in California that it was impossible to carry a railroad up the western face of the Sierra. Even good engineers considered the undertaking preposterous.

It is easy enough to mount it from the east, for the high table land of the "great desert" comes up to its eastern side from 4,000 to 5,000 feet. In fact, the Sierra Nevada is the western face of an embankment—the embankment being half a continent—and this, the guttered and storm-washed front of it towards the Pacific.

The point was to get up this rocky face to the table land it bounded, and to do that in a very short space, for the continent breaks off short and comes down sheer.

But California energy, using 10,000 patient Chinamen, solved the problem, and took the track up and over, along the mountain side, through deep and long tunnels, across rifted chasms in the rocks, over headlong torrents and by the dizzy edges of abysses thousands of feet down, and "around Cape Horn."

But even when the work was done, the snow avalanche, or the earth slide from the mountain round whose side, half up, the iron path winds twisting upward, might sweep the work away, or overwhelm the track, and make it useless for weeks or months.

There was a remedy also for this in the skill and determination of the men who did this work. They just roofed in their road for fifty miles!

They took the giant stems of the pines and braced them against the mountain side, framing them and interlacing them beam with beam. They sloped the roof sustained by massive timbers, and stayed by braces laid into the rock, and covered with heavy plank, up against the precipice, so that descending earth or snow would be shot clean over the safely housed track into the pine tops below; and so they run their trains in security under cover, and have conquered the snow in its own domain.

There is one drawback. These "snow sheds" shut out forty odd miles of the most magnificent scenery on the whole trip—notably Donner Lake, and the deep valley inclosing it, which lies straight down below the passing trains.

It was up this slope I traveled yesterday afternoon and evening. It takes two locomotives to persuade the trains to ascend. I found a place just after leaving Sacramento, on the foremost, and had a mountain ride, which I think must be unequaled considering the mountains and the horse.

First there was the Sacramento valley—oak opening all, which, to most of your readers needs no description. Only the oaks are a species not seen in Michigan or Wisconsin. California is rich in oaks, and these, scattered about as thickly as apple trees in an old orchard, are the live oak, small-leaved evergreen.

Then came the "foot hills" and a gradual change in the wood growth. The Manzanilla wood, with its shining stem and dark green glistening leaf, mingled with the oaks and the buckeye, which, in California, is a many stemmed bush, springing from a common root hung heavy with its pear-shaped fruit, filling up the space beneath the taller oaks and the nut pines.

Finally, we came into the realm of the *coniferæ*, and the tall stems sprang up smooth, branchless, and tapering, rearing their green coronals to the sky.

We are going up the mountains! In a valley on one hand lay a mining village—the most beautiful villages in the State are these mining villages now. Down the mountain side, on the other, ran the water, led in sluices like a mill race, around a point here and a bend there, and across a gorge yonder—the water to be used, under the mighty power its descent gives it, to tear the hill side down and wash the rocks to pieces in "hydraulic mining"—mining, that is, which consists in discharging a stream of water, with a head of a few hundred feet, full in the face of a hill side till it is knocked into bits!—bits which contain gold, of course, or are supposed to.

But these too are left, as we go clanking on through pitch-dark tunnels, and over trestle works that look like spiders' webs, and along the maze of dingy precipices; the engine, coughing and straining in the tug up the steepest grade yet ventured by any engineer.

The day died out before we reached the summit, but died into a cloudless moonlight so brilliant, so silvery white in the flood of light it poured across land and sky, that one sent no regrets after the sunset.

Moonlight in the mountains, and such a moonlight is something to be remembered for life. I lost all sense of the poor, every-day world, forgot so vulgar a thing as a railway car, even the clank of the engine seemed to come softened as from far away; and I was sailing over pine-clad mountains, silvery white, in an air of balm and fragrance, and, in fact, I think was about half asleep when my friend, the engineer, plucked my sleeve—we were doubling Cape Horn!

Round the jutting mountain wall, so called from its bold advance into the valley, and its precipitous face, the road winds like a ribbon. No human foot had ever trodden this hight, as far as man may judge, till the first "hand" was lowered down to lash himself to a tree and begin, with pick and spade and crow, to cut a shelf along the dizzy hight! Not even an Indian trail had ever passed where the long train was passing now. The foot sure savage had never ventured here. Three thousand feet sheer down lay the valley, in the moonlight like a lake, the mist slowly rising and swaying, silvered by the descending light. The feathery tops of the rock-anchored pines rose out of the mist far below. Across the valley the other mountain face frowned darkly, shaggy with bristling pines from base to summit.

That was one side.

On the other rose the almost perpendicular wall of the mountain, round which we were rushing on a shelf cut into the rock wide enough for the rails, of course—what need of anything more, when they are treble-spiked, and the rolling stock of the best, and the engineer the safest man to be found?

If we went off? If a broken rail should be ahead, if a rock should have rolled down beyond the curve yonder? Well, I suspect it would not make much difference, in that case, whether one was on the engine or in a car yonder. It would amount to the same thing, I think, when we all reached the valley together.

But there has never been an accident, and it is just such places as this that are most carefully guarded, and where all prudence and forethought and skill are engaged to be active.

I do not know that I have been able to give you half an idea of the magnitude of this undertaking, which has annihilated these weary desert spaces, and brought East and West together. If I have said much about it, it is because, after all, looking at it as I have, it seems to me the railroad across the continent, the double iron bands that tie Omaha and Sacramento each together, over the mountains, across vast deserts where human life finds nothing to sustain it, through the territories of tribes, too, a few years ago a terror to the whole border—it seems to me the railroad is really the most wonderful thing one sees, after all.

New Attractions for the Central Park.

The New York Historical Society is about to give the most gratifying proof of being alive to the interests of art and of the public improvement. According to the *Evening Post* it proposes to establish in the Central Park a Museum of History, Antiquities, and Art.

By an act of the legislature of the state of New York, the Central Park Commissioners are authorized to set apart, and appropriate to the Historical Society such portion of the grounds lying near the Fifth avenue, between Eighty-first and Eighty-fourth streets, as may be required for the erection of suitable buildings for this museum.

The plan contemplates the removal of the rich treasures of the society from the building in the Second avenue, which has long been too small for their proper disposition and display, to a new and larger building in the Park, where, under proper restrictions, they shall be readily accessible to the public.

In the department of history the collections of manuscripts, maps, charts, newspapers, coins, and medals, will make a most conspicuous and interesting feature.

In the department of antiquities the Abbott collection of Egyptian memorials, the Nineveh sculptures presented by Mr. James Lenox, and the numerous relics of the aborigines of the American continent, will attract great attention. These valuable curiosities have long remained packed in the society's present buildings, for want of space to open them for exhibition.

The department of art is that which will prove the most popular with the visitors in general, and this will contain, at the very beginning, the well-known collection of the New York Gallery of the Fine Arts, the Bryan collection, and the Audubon collection, constituting the nucleus of a gallery which, in time, we may confidently hope will be worthy of the city, and of the beautiful pleasure ground in which it will be placed.

The New York Historical Society, in taking this step, has entitled itself to the hearty suppport of this community and to the thanks of the lovers of art throughout the United States.

GLASS FOR WINDOWS.—A window glazed with ground glass is almost always unsatisfactory. The vitrified surface being removed, the smoke and dust discolor it, and make it difficult to be kept clean. White enamelled glass, having a semi-opaque figure upon a transparent ground, is more satisfactory. If the windows of a dining-room were filled with clear light pink glass, the effect of the room would always be pleasant and comfortable. The greatest care should be taken to avoid introducing dark colors.

THE first bar of tin ever made in the United States has been presented to the Secretary of the California Pioneers. It is eight inches long, four inches wide and two inches thick. The bar is appropriately inscribed.

Turning Irregular Forms.

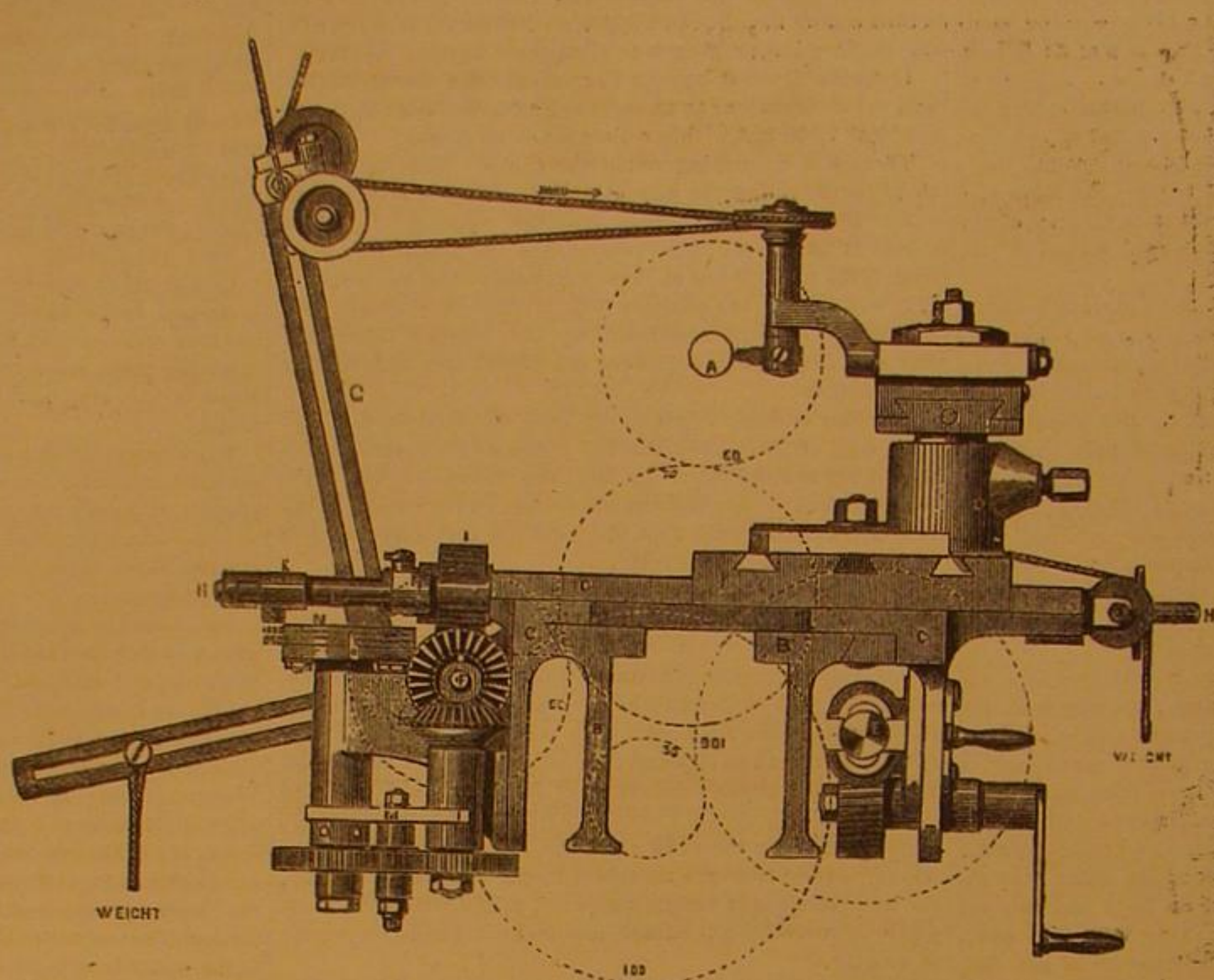
We illustrate from the *Engineer* an ingenious slide rest, designed by Mr. W. H. Northcott for turning articles of irregular sections. This system differs from the Blanchard and other lathes, because it is applicable to ordinary slide and screw-cutting purposes, as well as to turning irregular forms.

A is the center line of lathe spindle; B is the lathe bed, which carries a pair of ordinary headstocks; C is the saddle of the slide rest, which is caused to travel along the lathe bed in the usual manner by the leading screw, E; D is a rest-holder, bolted down on the surfacing slide, for receiving and carrying any convenient form of tool-holder and slide; an ordinary short slide and Willis' holder is shown in place and carrying a light fly-cutter. This cutter is driven from overhead by means of a cord or gut, which is kept strained in every position of the slide by means of the lever, G. The shaft, F, and the leading screw, E, are driven from the lathe head by suitable change wheels which of course vary according to the relative speeds required, but generally the shaft, F, at the back of the lathe bed runs at the same speed as the lathe spindle. The surfacing slide carrying D, is caused to move across the saddle by means of the screw, H, either by a handle in front or automatically by means of a worm-wheel, I, driven by a worm on the shaft, F, the motion of the worm, I, being communicated at will to the screw through a sliding clutch. The surfacing-screw, H, is continued past the worm-wheel and clutch, and at its end is fitted with a bearing and adjusting nuts, to run in a cross head, K, which cross head slides on guides, L, one each side of the screw. The shaft, F, carries a small wrought iron miter wheel which rotates with the shaft, but, by sliding along it, is enabled to follow the saddle anywhere along the bed. This miter wheel gears with a similar wheel below it, attached to a short stud or shaft, having its bearings in a casting fastened to the slide rest saddle. At the lower end of the vertical shaft is a spur wheel, one of a series of changes any of which may be used to obtain the required speed. There is also another longer vertical spindle placed at the back of the saddle, and which rotates in a long boss forming part of the same frame. At its lower end this spindle is also fitted to receive a change wheel, driven either directly from a wheel on the other spindle or through double or single intermediate carriers by the short, radial arm, M. The top of the long spindle has a large collar or disk, to which is fastened another disk or receiving plate, N. The fastening is made with two small bolts with T heads fitted into a circular undercut groove in the top plate, and passing through the collar below. The edge of one plate is graduated, and the other has a pointer attached to it, so that the top plate may be moved round any distance, and fastened by tightening the small nuts below. The top surface of the upper plate has a number of holes in it which are tapped to receive screws, and also a larger hole in the center. These holes serve for fastening the various shaper plates or cam plates to the disk. The sliding cross head, K, carries a suitable rubber, O, placed just below the bearing of the surfacing screw, and the shape of this rubber depends upon the shape of the copy-plate, being sometimes a flat bar, at others a roller, and sometimes an angular point. The surface screw, H, has its usual bearings in the metal of the rest saddle, but the collars to the front bearing are formed by four nuts which allow of any end play being taken up. The inside pair of nuts, however, must be screwed back when the irregular mechanism is in use, as the screw has to slide endwise in its bearings. On the lathe being started, the bevel-wheel on the shaft, F, drives the first vertical spindle, and this motion is communicated by the change wheels to the copy plate attached to the top of the long spindle. The shaper plate in rotating being pressed against by the rubber, O, causes the cross head, K, and screw, H, to reciprocate or slide endwise, and the reciprocating motion of the screw is of course partaken of by the surfacing slide and cutting tools carried by the slide. The velocity of this reciprocating movement will vary according to the shape of the copy-plate, and its shape will therefore govern the shape of the work produced. The rubber is kept in contact with the copy by a weight attached by a cord to the surfacing slide, passing over a small pulley in front. With the tools point-level with the center, with an eccentric circle for the copy-plate, and with equal rotations of copy and work, when the tool's point describes a figure much smaller than the copy-plate the shape produced is cardoid, or heart-like, and this shape becomes more decided, and finally becomes looped as the tool gets near the center. When the figure is of the same size of the copy plate, its shape is also the same, namely, an eccentric. When the figure is made much larger than the copy-plate its shape is still somewhat the same as the copy, but its eccentricity is not increased.

It will be understood that when articles of irregular transverse section only have to be turned, the work and copy-plate generally make equal rotations; when the position of the shape has to vary there must be some slight difference between their speed. But by giving the copy a very slow motion compared with the work, instead of the article being turned of irregular transverse section, it is turned circular, but of irregular longitudinal section. For example, by having a shaper-plate formed of a portion of a true spiral, tapering shafts can be produced. If the spiral copy have a rise of ½ inch, the large end of the shaft will be ½ inch larger in diameter than the small end, and the length of the taper will be equal to the distance traveled by the tool while the rubber has traversed the edge of the spiral copy-plate.

The drawing rollers of spinning machinery, handles for starting levers, bolts with countersunk heads, and many other articles frequently required in large numbers, can also be produced from suitably formed copy-plates; while for cabinet-making and for ornamental turning the applications of the mechanism are almost endless.

The device is interesting as its capacity is more extended than the Blanchard lathe, familiar to American mechanics.



SLIDE REST FOR TURNING IRREGULAR BODIES.

BORING INSECTS.

Many of the lower forms of animal life possess powers of boring which, considering the soft materials of which they are made, seem very surprising. It is hard for us to understand how such animals are naturally provided with tools adequate in some cases for penetrating into the densest timber; or in others even into the solid rock.

We find no difficulty in understanding how shellfish can bury themselves in the sand—the common cockle is an excellent burrower in this yielding material. The razor-shell dwells in a long tube in the sand which he has formed by his own labors, from which he can only be extracted by darting down it a long barbed rod. This penetrates his shell and he is withdrawn; but if this be not done with great rapidity he is enabled to escape, as he can move very quickly in his hole. There is another shell belonging to the same tribe as the razor-shell, which excavates for itself a hole in the solid rock. This animal has no English name; its Latin one is *Pholas*. It is to be met with in limestone rocks on the sea coast, into which it bores holes to a depth of several inches.

It is still a disputed point among naturalists as to how this boring is effected. Some think that the animal is enabled to secrete some acid which softens or dissolves the limestone, while others think that it is by the mechanical process of grinding that it is accomplished

The preponderance of opinion seems to lie now with the latter view. Another boring shell is the well-known ship-worm or teredo. This burrows into wood to a great depth, and many an otherwise good ship has been rendered unseaworthy by the attacks of this indefatigable borer. Of course a metallic coating to the vessel is a complete preservative against their attacks.

Our illustration represents a borer of a very different kind. The animal that accomplishes these excavations in the trunk of a tree is not a shell-fish, but an insect. The parent, when about to deposit her eggs, selects a tree of suitable size, and commences her operations on the bark. At the bottom of the illustration will be observed a small inclined hole, and at the end of this a beetle is to be seen; this is the little architect who, by the joint exertions of herself and her progeny, has so wonderfully penetrated the tree in every direction. Another hole, running horizontally across, will likewise be seen at the right of the figure, and in the end of this another beetle may be seen similarly engaged. When the exertions of the insect have prepared a sufficiently large hole she then commences to lay her eggs. But before proceeding to this subject, let us just dwell for a moment upon the magnitude of the work she has accomplished.

The hole bored into the heart of solid wood is about fourteen or fifteen times longer than the body of the beetle, and the animal must, by the help of its jaws, tear away and remove a bulk of timber more than twenty times its own bulk. We shall gain some idea of the amount of labor necessary for this, by considering what would be the corresponding work that should be executed by a man, were he to be equally adapted with the beetle for this kind of work. He would have in a few days to bore into a mass of solid timber a cylindrical hole, about eighty or ninety feet long, and about three feet in diameter.

The central part of the illustration shows another stage in the history of these tunneling operations. We will suppose that a beetle has finished the hole of which the two already described are the commencements. All along each of these will be seen little white spots; these represent the eggs which she lays as she proceeds. The long line in the center of the figure represents a part of the completed hole, along the sides of which the eggs are laid.

When the eggs of the beetle are hatched, the little anima' that comes from them is at that stage of its existence utterly unlike its parents. It is at first a little grub without legs, and quite as unlike a beetle as an earth-worm is unlike a house-fly; this is called the larva condition of the beetle; and it is equally true of every other insect, that in the early stages of its existence it is utterly unlike in appearance, in food, and habits, to the parents from whom it has sprung. Thus the dragon-

THE RAVAGES OF THE WOOD-BORING BEETLE.

fly, with which we are all so familiar, and which is such an ornament to our streams, was, when young, an unattractive and somewhat ferocious-looking grub, wholly resident in the water, over which, when mature, it skims, but which it never touches. The food, too, of the larva of the dragon-fly is quite different from that of the mature insect.

This being understood, we shall not be surprised to find that when the eggs of the beetle we are describing are hatched, the young that come from them are quite unlike their parents. They are small white grubs, rather uninteresting in appearance, but endowed with a most tremendous appetite and vast powers of digestion. The food which supports the little grub is the solid wood of the tree itself. It will be remembered that each egg was deposited on the side of the hole, and there it remains attached until it is hatched; thus the little creature finds, the moment it becomes conscious of its existence, the food which nature intended for it surrounding it in boundless profusion. At once it commences to eat the wood that is under it, and thus it speedily excavates for itself a little hole, the bottom of which gradually deepens as the insect proceeds. Its brothers and sisters, likewise hatched about the same time, commence each to eat their small hole, and thus from the main tunnel a number of small holes gradually extend through the trunk, all commencing, of course, from the hole originally made by the parent insect.

Now, as the little grubs progress onwards, they, at the same time, grow in size, and their appetite consequently increasing, the hole gets gradually larger, and this is, of course also necessary to allow for their increased dimensions. Gradually they proceed farther and farther from the center, and approach nearer and nearer to the outside of the tree; but just before they finally emerge, when they are just beneath the bark, a curious change comes over them. They have now grown to be as large as their parent, but still they are grubs; they have not donned the legs and wings which are necessary for the perfect beetle, but the tree which has housed and fed them in their infancy still affords them shelter till their final development. As they get near the bark they cease to eat, and fall into an inert condition; but all this time a wonderful change is taking place within their bodies—they cast off their skin and are transformed into perfect beetles. Speedily they emerge from the tree to find themselves in a new and wondrous world, and to use and enjoy those powers of flight which they have so recently and so curiously acquired. Truly this is a very astonishing history; we have seen one beetle boring into a tree, we see a hundred emerge from it; the solid substance of the trunk has afforded nourishment to the numerous offspring. There is no more interesting department of natural history than that which treats of the habitations of insects; and there is, perhaps, hardly any insect more interesting in this respect than this wood-boring beetle.

SUBMERGED BUOYS AS A BASIS FOR STRUCTURES IN DEEP WATER.

The following, from a letter from Mr. Thomas Morris, of Carlton Chambers, England, to *The Engineer*, appears to us to contain a good idea.

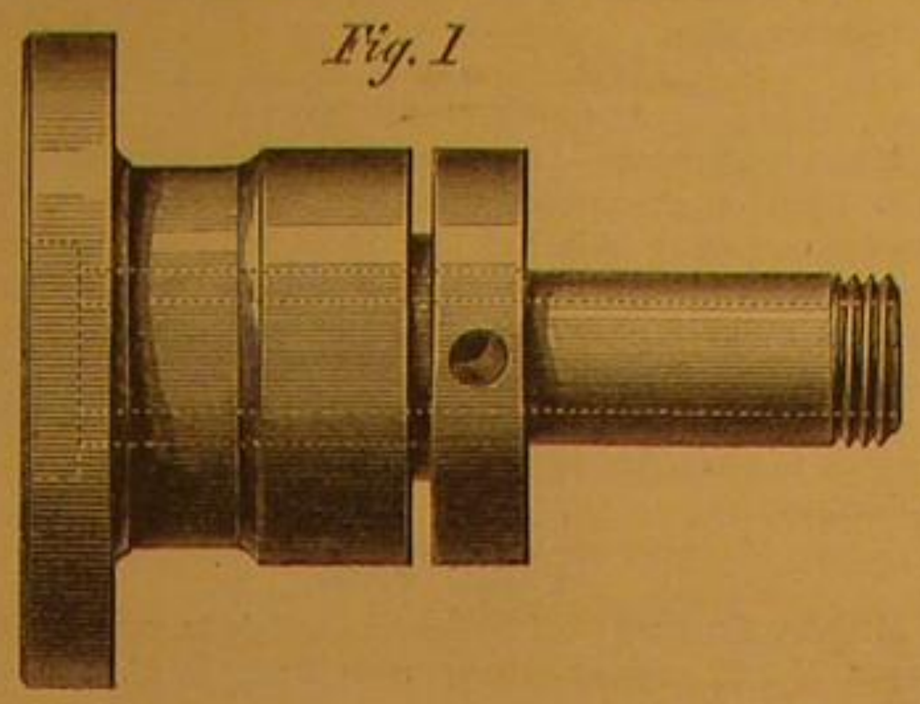
"The purposes and situations of structures in deep water are so numerous and various that every available principle becomes worthy of record. I suggest the application of submerged buoys to such uses, and my reasoning is this. If you have a water-tight vessel with a certain floating power, say equal to 100, and to that vessel you attach a weight equal to 110, and cast it into the water, both weight and float go to the bottom. But if they are connected by a line the weight alone sinks to the bottom, and as soon as it has found its resting place the descent of the float ceases. It becomes stationary above the weight, with the length of the line between them. In this situation the float possesses a remarkable property; the original weight having ceased to exert a sinking force, it can only be farther depressed by a new load greater than its ascensive power of 100. In still water a vessel wholly submerged has obviously great advantage in point of economy, perhaps four fold, over one partially immersed; but where the surface is agitated there is the further advantage that the submersion may be fixed at the dead water point, and uprights of small comparative sectional area alone be exposed to the action of waves. The figure shows a couple of these buoys applied to the cross section of a pier or jetty where the upright posts, horizontal bearers, platform, and parapet, being well connected and braced, would give firmness and the requisite degree of rigidity. It is supposed probable that some means of submerging the buoys may supersede the use of weights should the principle be practically adopted; and from the known effect of deep water currents, some kind of anchorage would be essential in situations exposed to their influence."

A CORRECTION.—In our description of the Bolt Cutting Machine, manufactured by the Howard Iron Works, Buffalo, N. Y., published on page 215, current volume, a typographical error occurred which might mislead some of our readers. In the fifth line the first word should be *three*, instead of "these," as the types made us say. The sentence should read "The machine herewith illustrated has three dies in the cutter head," etc.

IMPROVED PACKING STEAM DRYING CYLINDERS ON PAPER MACHINES.

We are informed that the invention we herewith illustrate has been applied to two hundred and twenty-five cylinders during the past year, and has been tested under pressure of seventy pounds with marked success.

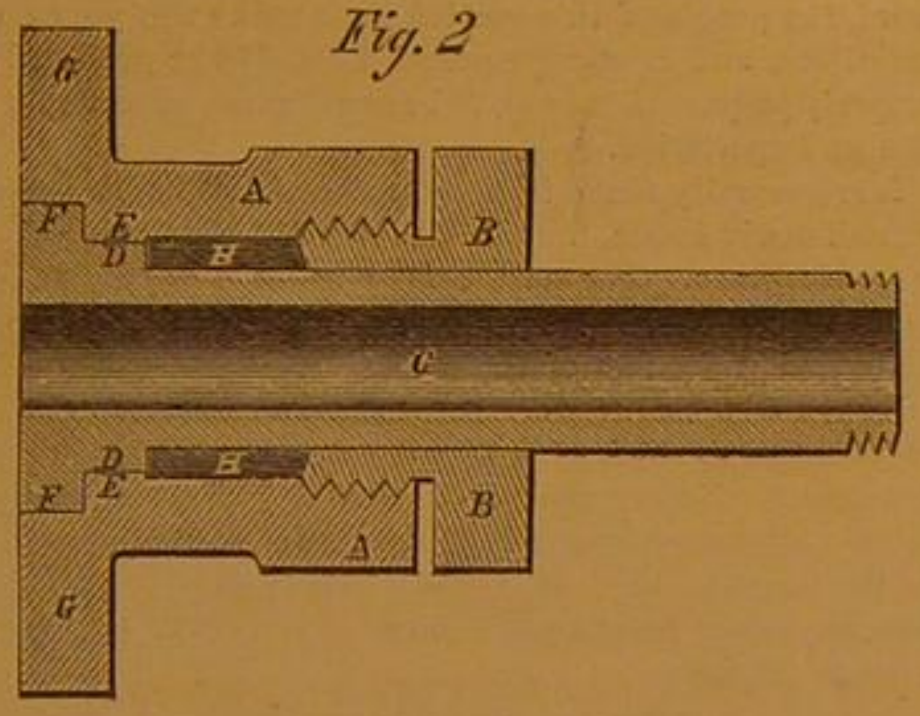
Fig. 1



The stuffing box is shown entire in Fig. 1, and in section in Fig. 2. A is the box containing the packing material, and B the packing nut. The box, A, has a flange, G, by which it is bolted to the end of the cylinder, with which it revolves; the steam induction pipe, C, remaining stationary. The box, A, is also provided with an internal shoulder, D.

The inner end of the induction pipe has two shoulders, E F, formed upon it. The packing, H, is of rubber, or any suitable material.

Fig. 2



The action of the device is as follows: When steam is admitted to the cylinder, the pressure therein of the steam acts upon the end of the pipe, C, to thrust it outward, whereupon the shoulder, E, compresses the packing, H, and keeps it tight.

Though originally designed for steam drying cylinders on paper machines, upon which it has been extensively tried, and proved to be very satisfactory, it is obviously adapted to various other uses.

Patented, through the Scientific American Patent Agency, June 8, 1869. For further information address W. B. Fowler, patentee, Lawrence, Mass.

A Valuable Invention.

A few weeks ago there appeared, in the SCIENTIFIC AMERICAN, an article calling attention to the great waste of labor involved by the present method of raising bricks and mortar to the upper stories of buildings under construction, and asking if it were not possible for the genius of our inventors to produce a remedy for the evil. *The American Builder* says this question has been answered in the most practical manner by a Chicago builder, who has invented a machine by which two men can easily and rapidly accomplish the labor of several, effecting a saving, not only in money and labor, but in time also.

The apparatus, which is destined to do away with the tedious practice of carrying the material for building up long ladders, endangering the lives of workmen, and involving such an amount of unnecessary work, is described as follows:

Two endless chains, made of any required length by a simple device, connected together at intervals of about a foot by iron cross-bars, pass at their lower extremity over a broad pulley or wheel, located as in an ordinary windlass, such as is usually employed in raising stone where a crane is used, and worked in a similar manner. The parallel endless chains thus connected pass over another broad pulley or revolving wheel, supported on four legs, much as a grind stone is usually placed. This upper pulley is put in any part of the building where the bricks may be wanted, usually in the inside. The ordinary hods are used to raise the bricks and mortar, with the addition of a broad, stout, iron hook projecting downwards at the end of that part of the hod containing the brick which is farthest removed from the shoulder when carrying. The hod, being filled, is hooked by the contrivance mentioned to one of the cross-bars of the endless chain, the handle pressing upon the lower cross-bars and acting as a lever to keep the hod firmly in position; and, as two men work the windlass is raised to any required hight. The hods can be placed as close together as their length will allow. The empty hods, in a like manner, are hooked at the top of the machine on the descending side and received by the workmen on the ground. Probably the best method of placing the machine is in the interior of the building, when the legs supporting the upper pulley over which the parallel endless chains are made to pass are placed so as to locate the pulley directly over an aperture through the loosely laid floor of the story where the material is required. These legs may be of any length, and the hods can be raised to the shoulders of the workmen who deliver their contents to the masons. The machine is already in practical operation, with the most satisfactory results, in a large building now erecting in Chicago, and two men raise easily four hods a minute to the fourth story. Of these hods three usually contain brick, and one mortar, thus furnishing all the requisite material for carrying on the work. The hods contain on an average sixteen bricks each, and consequently in a day of ten hours, two men can raise nearly twenty-nine thousand brick with the mortar necessary for laying them. The laying of two thousand bricks is, we believe, a good average day's work for a mason, and two men are by this device enabled to raise the material for fourteen bricklayers. Those acquainted with the business will readily perceive the advantages of the invention. Of course men are required to fill the hods at the bottom and empty them at the top, but by no means what has been the usual number for doing the work are required. The apparatus simply substitutes a vastly better method for raising the material.

Professor Chandler on the Purity of Croton Water.

The water supplied to the citizens of New York, at the liberal rate of sixty-five gallons to each person daily, is collected by the various branches of the Croton river from an area of 338 square miles in Westchester, Putnam, and Dutchess counties. The character of this water-shed is a sufficient guaranty of the purity of the water. The surface of silicious gravel rests on hard Laurentian gneiss, and is open pasture or woodland, with few swamps. No factories line the streams, which are liable to contaminate the water with refuse chemicals, and no towns or large villages exist anywhere in the district to pollute the waters with sewage. A recent survey of the water-shed has indicated fifteen points at which dams can be erected for the creation of large storage reservoirs, whose joint capacity would be 67,000,000,000 gallons, or a supply, at the present rate of consumption, for 1,000 days. One of these dams, 650 feet long, is now in process of construction at Boyd's Corner, in Putnam County, twenty-three miles from the mouth of the aqueduct. When this dam is completed it will flood an area of 303 acres, and the reservoir thus produced will contain 3,369,206,857 gallons, or a supply for fifty to fifty-five days of drought.

Examinations were made of Croton water which had been in contact with lead for different lengths of time, under usually occurring circumstances, of which the following are the results:

1. A gallon of Croton water from a lead-lined cistern, in which it had stood for several weeks, was found to contain 0·06 grain of metallic lead.

2. A gallon of water which had remained six hours in the lead pipes of the chemist's residence yielded 0·11 grain metallic lead, a considerable portion of which was visible to the eye, in the form of minute white spangles of the hydrated oxycarbonate($PbO,HO + PbO,CO_2$).

3. Water drawn from one of the hydrants of the School of Mines Laboratory, in the middle of the day, when the water was in constant motion, yielded traces of lead. This water reaches the school through about 100 to 150 feet of lead pipe.

These results indicate the source of many hitherto unaccountable cases of lead poisoning, and are of a character to alarm the residents of New York, and to lead them to adopt precautionary measures for protection against this insidious cause of disease.

Many have already introduced as a substitute for lead pipe the "tin lined" or 'lead-encased block tin" pipe.

Chinese Pottery and Glass.

Po Shan, in the Lanfoo valley, contains extensive potteries, three different kinds of ware being manufactured—the fine straw-colored porcelain, the common red ware, and a peculiar shining black ware, very light, that looks like metal (lead), and is valued in districts where fuel is dear, in consequence of its rapid heating qualities. The red paving tile and the large red water kongs are also made here. Yen-shing has extensive glass manufactories of which foreigners are little aware. I was much surprised at the quantity and excellent quality of the glass. There is a quarry in the immediate neighborhood, from whence is obtained the stone which, pulverized and smelted with nitrate of potassa, forms the glass. This stone is similar to granite, only of a beautiful lilac color. Nearly every house in the city of Yen-shing, is either a glass manufactory, or a shop where glass ware is sold. We found them blowing glass, running it into rods and plates, making window glass, bottles, beads, lanterns, and ornaments of every description. Some very beautiful opaque bottles of different shapes and finely painted I procured here. The glass seemed extremely pure, and sold at very reasonable prices; the rods of pig-glass about 30 inches long, and 1¼ inches in diameter, costing 30 cash a catty, or less that 1d. per pound. Saltpeter, much used in the manufacture of glass, is found in the vicinity of Po-shan-shien.—*J. Markham.*

Iceberg Alarm.

Mr. Charles Dion, of this city, proposes to place an apparatus on board of steamers and other vessels, so arranged as to sound an alarm on approaching the vicinity of an iceberg. The device is arranged on the bottom of the vessel, and is of such a nature that when the keel strikes any very cold strata of water the alarm is sounded.

It is well known that icebergs refrigerate the water around them to a considerable distance. Mr. Dion's instrument will exhibit the exact temperature of the water below the vessel at all times.

Correspondence.

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

Method of Restoring the Beauty of Silver Filigree Ornaments.

MESSRS. EDITORS:—The process of producing or restoring what is technically termed the "dead white" which constitutes the principal beauty of solid silver filigree ornaments, such as filigree earrings, pins, necklaces, etc., like the method of coloring gold filigree work, was once jealously guarded as a trade secret.

The more liberal spirit for imparting useful information, which characterizes the present age, may have already made it public; but I have never met with it among the many published recipes for cleaning silver, and in consequence send it to the SCIENTIFIC AMERICAN for the benefit of those still ignorant of it. It will prove useful to them, as ladies often carry their silver sets to the jewelers to have the original beauty restored. In a large city like New York, where every branch of business is carried on, the jeweler can always get an order executed when unable to do the work himself; but in the smaller towns and villages there are not the same facilities, and many a profitable job must either be declined from lack of ability or else sent to the city, causing unnecessary delay and expense.

The process for producing or restoring the dead white to silver is so simple that, when known, any workman of ordinary capacity can do it without difficulty in a few minutes.

Before attempting it, however, the work must be carefully examined to discover whether it has been previously repaired. Unskillful workmen—especially in the country—often resort to "soft solder" unnecessarily. If any "soft solder" (pewter) is found about the work, the process must not be attempted.

If the article is all right in that respect, pound together 3 parts charcoal and 1 of niter. Add sufficient water to form a paste. With a camel's-hair brush give the article a thin coat of the mixture, put it in a small annealing pan, and submit it to the fire until it becomes just red hot; then withdraw it from the fire, let it stand a minute, and turn it out into a weak solution of sulphuric acid (1 part acid, 10 parts water) in the boiling pan. Boil, pour off the acid, rinse; wash with warm water and soap, using a soft brush; dip in spirits of wine, and dry in box-wood sawdust. If any spots should still remain on the work, anneal it without the mixture, boil out and wash as before. Burnish the parts intended to be bright.

Do not use the common American saltpeter. The English refined niter, although it costs more, is really less expensive, as a smaller quantity goes farther, and does the work more effectually. Purchase at the wholesale druggists.

Never neglect to dip your work in spirits of wine, and dry in boxwood sawdust. You cannot dry it properly by wiping; a moisture will remain and the gloss is lost; while by dipping in spirits, all jewelry and silver ornaments may be taken immediately, thoroughly dry, and retaining their full luster.

ALEXANDER ALLAN.

Retardation of the Earth's Rotation.

MESSRS. EDITORS:—The SCIENTIFIC AMERICAN has recently given extracts from British sources, of scientific repute, containing speculations on supposed existing causes, tending to retard the earth's rotation on its axis. The London *Spectator* alleges the *friction* of the tidal wave, to which I briefly replied through the SCIENTIFIC AMERICAN, that the wave or swell following the moon in its westward course around the earth, would draw its supply for continued renewal from the advancing tide and receding from the wave easterly on the retiring attraction.

Hence the flow to cause friction, both to and from the wave, would be in favor of acceleration.

The transcript on page 204 SCIENTIFIC AMERICAN, from the *Edinburgh Review* is silent as to friction, but states that the tidal wave (*per se*) is a constant source of retardation, at the same time admitting the earth to have been a "molten mass millions of years back," and consequently would be in a condition to yield to the centrifugal rotation, and assume the spheroidal form as we now find it, and as required by its present rate of rotation.

The deviation from a sphere is what eminent mathematicians from Newton downwards have demonstrated due to a fluid state. That fluid state, or at least its equivalent for computation is present with us, by the continuous oceanic intercommunication all over the earth, conforming to the oblate speroid generated during the plastic condition of a molten mass "millions of years in the past."

T. W. B.

Pittsburgh, Pa.

Putting up Stoves---Wear of Front Driving Wheels of Locomotives.

MESSRS. EDITORS:—I have been running a stove for two years with the legs bolted on. I am sure of it for I set it up myself. It is the "Morning Glory," and was made at Albany, N. Y. Further, I once had to do with a stove, the legs of which were put on—I think, in a very proper manner—but perhaps not any better than to bolt them. The leg had not less than an inch upward draft, was fitted in the usual way, and with a projection at the top of socket for the leg to strike against when home, and prevent its getting stuck fast. The result was, the leg could not be taken off without raising the stove nearly an inch from the floor, and of course there was no danger from upsetting unless the stove was "toddled" up on blocks. Give stove legs or the sockets an upward draft, and very slight taper, and the legs will not come off without help.

I will suggest that H. R. Jones, who asks why the forward drivers of locomotives wear faster than the others, should look for an explanation to sand used forward of forward drivers, the second not getting so much of the grinding element. I once fired a locomotive that had but one sand pipe in order for *several years*, and the drivers upon that side were worn so much more than the other that it could be plainly seen, and felt too by the unpleasant side motion.

H. C. K.

Gardner, Mass.

A Comfortable Stove.

MESSRS. EDITORS:—I set up a comfortable stove as follows: First I put on the carpet sheet zinc, 50 by 32 inches. Next a soapstone, 44 by 24 inches, and 1¼ inches thick, and raised ½ an inch by wooden wedges, out of sight. On this I set my stove, without legs, which is 12 inches shorter and 8 inches narrower than the stone.

This is pronounced by all who try it to be the most perfect concern to warm feet by that they have ever met with.

W. P.

Cornton, Vt.

Yopon Trees.

MESSRS. EDITORS:— I noticed an article in your valuable paper, No. 9, present volume, from Prof. H. E. Colton, on yopon trees of Carolina.

Now, I presume as he did not make mention of it in any other States than the Carolinas and Louisiana that he was not aware of the fact that it exists so abundantly in Texas.

The yopon is one of the natural productions of this State, to be found in all of the coast and middle counties, from the Sabine to the Gaudaloupe rivers, and has been used as a tea or beverage by the inhabitants of this country for many years, especially in the absence of imported drinks. During the late war, when coffee and imported tea could not be obtained in consequence of the blockade by the U. S. Government, the people of this section resorted to the yopon as a substitute, and it was pronounced by all who gathered and properly prepared it for use, to be equal, if not superior, to any foreign importation.

It is generally found in greater abundance and luxuriance on rich sandy loams, from five to twenty feet in hight, and is an evergreen. The main stem or trunk is of grayish color, and filled with beautiful red berries growing close to the limbs and at the root of the leaves.

I have seen hundreds of acres of land covered with this growth, and so thick as to be almost impenetrable for men or animals. Now if the yopon should ever become an article of commerce and profit, Texas will, no doubt, come in for the largest share, as it exists here in greater abundance than any other district yet known.

T. J. GRACE.

Osage, Texas.

The New Thames Tunnel.

A new tunnel under the Thames has just been finished successfully in London, at a cost of £16,000; and a third is contemplated. Mr. Barlow, the engineer, seems to have had less trouble in this work than his great predecessor, Brunel. The London *News* says of this tunnel, which is called the subway:

"The mysterious-looking thoroughfare admits of a very brief description. It is a well-constructed tubular iron bridge, about a quarter of a mile long, and seven feet in diameter, sunk bodily into the bed of the Thames, so as to be snugly embedded in the London clay through its entire distance. Nowhere is the subway nearer than twenty-two feet to the water, and in places it is as much as fifty feet distant—an important fact to bear in mind in comparing the subway with the old Thames tunnel, over the arch crown of which there were here and there but four feet to the water. The subway, in point of fact, dips at the rate of one in thirty. At present the Tower Hill station at the one end and the Tooley street station at the other, are more useful than ornamental, especially when the cage by which passengers are taken down is at the bottom. We use the word "cage" because of its resemblance to that familiar object of the mining districts, but it is in reality rather a nicely padded little apartment, semicircular in shape, and with cushioned seat for four or six. Into this the passenger enters, and the doors are shut. There is a rumble, a rattle, a consciousness of steady downward motion, and an intention perhaps to remark to your neighbor that it is all very pleasant; but any such reflection is nipped in the bud by the termination of the journey, which has occupied about the time it would take to count a dozen. The distance is only fifty feet. Through a small waiting room you enter a long, low carriage, with seats for seven on each side. The signal is given, the drum begins to revolve, the wire rope twines swiftly around it, the pretty omnibus answers to the strain, and in about sixty seconds the subterranean passage of the Thames has been accomplished. Safety is secured in the shafts by an unusually powerful clip; in the subway by the single line of tram-rails, upon which collision is impossible. We walked through the narrow, dark road yesterday, absolutely dryshod, and without any inconvenience from defective ventilation. At times, a listener in the center of the subway can hear strange noises, said to be the reverberations of paddles beating the river overhead, and the sounds of hammering and thumping on board vessels. The Tower hill fares at present are fixed at a penny and twopence, but they will probably have to be reduced by one half."

Important to Oil Men.

The Commissioner of Internal Revenue has decided that men who own oil lands or hold them under leases and who sink wells therein and work them until they are exhausted, and then sink others in the same manner and for the same purpose may be allowed to deduct the cost of sinking such wells in their income returns; that in such case the business seems to be the production of oil for sale, and the expense of sinking the wells, which are worthless when they are exhausted, is one of the necessary expenses of conducting it. He decides, however, that no such deduction should be allowed to men who sink wells not for the purpose of working them, but for the purpose of thus improving the oil lands and then selling them thus improved; that in this case the expense of sinking the wells is as much an investment as though it were expended in erecting a house on the same lands, and should be governed by the same rules.

Deaths in the Mines.

The official report of the number of persons killed in the collieries in Schuylkill county, from May 1 to December 31, 1869, was 57, which is one for about 67,800 tuns of coal mined; and 91 persons were injured, which is one for about every 42,400 tuns mined during that period. Taking the whole year in the same proportion, it would give 72 persons killed during the year and 115 injured.

No official report has been kept of the number of the injured that afterward died, but as far as we received answers to queries which we ("Miner's Journal Coal Statistical Register, for 1870), addressed to operators, about one sixth of the injured persons have died, which would give number of deaths caused by casualties in the mines in Schuylkill county, in 1869, at 91, leaving 96 injured that survived, in the product of about 4,883,000 tuns.

The causes of the deaths and casualties were as follows:

Persons killed	57	Maimed and injured	91
Falls of coal	22	Falls of coal	21
Falls of rock	2	Falls of rocks	3
Falls in slopes and shafts	9	Falling in rolls	2
Caught in screens and belts	3	Falling in slopes and shafts	3
Explosions of gas	4	Explosion of gas	36
Explosions of powder	9	Explosion of powder	9
Crushed by cars	3	Being crushed	8
By sundry causes	5	Sundry causes	9

Leaving 30 widows and 132 orphans.

These official statistics show that there were but four deaths and thirty-six injured by explosions of foul gas in the collieries in Schuylkill county from May 1 to December 31, a period of eight months, while the deaths from other causes were fifty-three, and the casualties fifty-five from other causes. These are important figures in the framing of a bill for the protection of the lives of miners in our collieries.

The proportion of deaths to 1 for 103,000 tuns mined, holds good throughout England, Scotland, and Wales, for 1867.

The number of deaths in 1868 in England, Wales, and Scotland has been reduced within a few years. Falls of the roof kill more in the mines than explosions of fire damp.

We append the proportion in the different districts for 1868:

Northumberland	1 death to	175,000	tuns
South Durham	"	176,000	"
North and East Lancashire	"	118,000	"
West Lancashire and North Wales	"	82,000	"
Yorkshire	"	113,000	"
Derby, Nottingham, Leicester, and Warwickshire	"	128,000	"
North Stafford, Cheshire, and Shropshire	"	99,000	"
South Stafford and Worcestershire	"	95,000	"
Monmouth, Gloucester, Somerset, and Devonshire	"	96,000	"
South Wales	"	98,000	"
In Schuylkill county, 1869	1 for	67,800	"

A few years ago the number of deaths in England was greater than the average number in Schuylkill county in 1869.

These figures show the necessity of legislation for the better protection of the lives of miners in the collieries. It was legislation that largely reduced the number in the English and Scotch collieries.

Steel in the United States.

The *Protectionist*, speaking of the progress making in the manufacture of steel in the United States, says:

"Within the last six years it has been demonstrated that the steel-producing qualities do exist in American iron, and many of our best edge-tool manufacturers and machinists testify that steel, both cast and rolled, made in Pittsburg, from American iron, is fully equal to the best English makes.

"The steel-producing capacity of the works in and around Pittsburgh alone is estimated at seventy-five tuns per day. This industry may, therefore, be deemed an accomplished fact, and brief as its history is; it has already exercised an important influence in controlling foreign prices."

It is shown that American axes, shovels, spades, hoes, etc., have entirely taken the place of foreign tools. Nothing equal to them in shape or finish is made abroad, and they are now largely exported. American butts and hinges of all kinds are cheaper and better, and entirely excludes all foreign goods. In cutlery of all kinds, the medium American qualities, of which the largest bulk enter into consumption, are cheaper and better than those of foreign importation; only he very low and worthless grades, or the very expensive and luxurious styles can now be imported.

A New Safety Buoy.

A curious application of the spontaneous inflammability of phosphureted hydrogen gas, when brought in contact with the air, has been made to a life-saving apparatus and to buoys.

Something like a fuse is attached to the buoy, composed of a proper mixture of phosphide of calcium. In case of a man overboard, the life preserver is thrown into the water, the moment the fuse becomes wet it begins to give off a gas which takes fire in the air, and the wetter it becomes the more gas and the brighter the light produced.

The light can be made to last an hour, so that persons swimming can easily find, and attach themselves to the buoy, and the rescuing boats have a beacon to which to direct their course. It is proposed to have a number of such life preservers on every large ship.

The phosphide of zinc could be used as a substitute for the calcium compound, and the invention is capable of application for a display of fireworks on the water.

The Explosion of Kitchen and Circulating Boilers.

At the last meeting of the Executive Committee of the Manchester Steam Users' Association, held on Tuesday, the 22d of February, at the offices 41 Corporation street, Manchester, Thomas Schofield, Esq., Cornbrook, taking the chair in the absence of the President, Sir W. Fairbairn, C.E., F.R S., etc., Mr. L. E. Fletcher, chief engineer, briefly referred to the number of fatal household boiler explosions that have recently occurred. This meeting had been specially convened for the purpose of considering the annual report to be laid before the body of subscribers at the approaching general meetings, but, owing to the number of lives which had been lost by the explosion of these household boilers during the recent frost, it was thought important to circulate at once some suggestions with regard to the cause of these disasters, with the hope of preventing their recurrence should the frost return. Under these circumstances the subject was only briefly touched on, the Chief Engineer hoping to treat it more fully, with the aid of illustrations, in his next ordinary monthly report.

The cause of kitchen or bath boiler explosions is very much misunderstood, and hence the constant recurrence of these disasters. They are wrongly ascribed to the introduction of a few drops of cold water into a red hot boiler. They are attributed to the thaw, whereas they are the result of the pipes being sealed by the frost. That the sudden introduction of cold water into a red hot boiler will not cause an instantaneous generation of pressure sufficient to produce an explosion, was shown by repeated experiments, fully described in the Chief Engineer's report for January, 1867.

The boilers that explode on the occurrence of frost are on the circulating principle. They are connected by two pipes to an overhead cistern, the result of which is that on the application of a fire to the boiler, as soon as the water becomes heated it rises through one of these connecting pipes, while the cold water, by its gravity, descends in the other, so that a constant circulation is kept up as long as the fire remains in action, the boiler and pipes are full, the passages open, and there is any water left in the overhead cistern. As long as these pipes are open they form a natural safety valve, and afford a pressure due to the hight of the column of water, and no more; but as soon as the frost seals them up, the pressure accumulates as long as the fire burns, when explosion becomes merely a question of time. This is the simple cause of these disastrous explosions, and that being so, it is clear that all that is needed to prevent them is to adopt the very simple precaution of fixing to every circulating boiler a reliable safety valve, that will not be affected by the frost. A drawing of a safety valve, recommended for this purpose, was given in one of the Association's printed monthly reports three years since, when attention was called to the subject, in consequence of a number of fatal explosions that occurred during a frost at that time. The valve recommended was of the external pendulous dead weight construction, and, having no lever, hinged joint, wings, or spindle, was not at all liable to derangement; while hundreds of similar valves of larger size, on steam boilers, have worked satisfactorily under the inspection of this Association for years. These valves should be fixed in the front of the range, being brought out, if necessary, by means of a connecting pipe, so as to be always in sight and accessible. They should be kept clean and bright —treated as an ornament, and then they can be depended on; but safety valves, if stowed away in a dark corner, and left out of sight for years, prove in nine cases out of ten, especially when of the ordinary lever, hinged-joint construction, to be stuck fast and useless just when they are wanted. These safety valves are very inexpensive; any brass founder should be able to turn them out, and every householder should have one applied, or some other simple contrivance for preventing the accumulation of pressure during all states of weather. It is possible that there may be other contrivances more convenient than the safety valve, and it is proposed to return to this subject on a future occasion, but from the number of fatal explosions which have recently occurred it is important to call public attention to this subject immediately, and if it is once fairly recognized that the cause of these explosions is a gradual accumulation of pressure, it will not be long before some suitable measures are contrived to meet it. To set a boiler in a kitchen alongside of a brisk fire without a safety valve, or something equivalent thereto, is very much like putting a cask of gunpowder into the oven to bake.

Solid Beer.

The age produces some queer paradoxes, and none more so than in the results of manufacturing science. In former days, says the *Food Journal*, it was the custom to buy bread and even beef by the yard; but we believe that it is only in the present day that we can get our beer by the pound. By a very simple process, introduced by Mr. Mertens, the wort, after being made in the mash tub of malt and hops in the usual manner, is sucked up by a pipe into a large vacuum (exhausted by an air pump), and then persistently worked round and round, while the moisture is evaporated. The wort emerges from its tribulations with a pasty consistence, and is allowed to fall from a considerable hight into air-tight boxes, in which it reposes like hard-bake. It soon gets so exceedingly tough that it has to be broken up with a chisel and mallet, and in that condition is easily sent abroad, or to any part of the world, for people to brew their own malt liquor. We have had the wort subjected to analysis, the results of which, in 100 parts, show that there is almost absolute purity: Gum, 64·219; sugar, 20·664; lupulin (the active principle of hops), 2·000; albumenous matter, 0·600; mineral matter, 1·500; moisture, 11·017.

On Red.

Red is the second and intermediate of the primary colors, standing between yellow and blue, and in like intermediate relation also to white and black, or light and shade. Hence it is pre-eminent among colors, as well as the most positive of all, forming with yellow the secondary orange and its near relatives, scarlet, etc.; and with blue, the secondary purple and its allies, crimson, etc. It gives some degree of warmth to all colors, but most to those which partake of yellow.

It is the archeus, or principal color, in the tertiary russet; enters subordinately into the two other tertiaries, citrine and olive, goes largely into the composition of the various hues and shades of the semi-neutral marrone or chocolate, and its relatives, spruce, murrey, morello, mordore, pompadour, etc., and more or less into browns, grays, and all broken colors. It is also the second power in harmonizing and contrasting other colors, and in compounding black, and all neutrals, into which it enters in the proportion of five; to blue, eight; and yellow, three.

Red is a color of double power in this respect also; that in union or connection with yellow, it becomes hot and *advancing;* but mixed or combined with blue, it becomes cool and *retiring*. It is, however, more congenial with yellow than with blue, and thence partakes more of the character of the former in its effects of warmth, of the influence of light and distance, and of action on the eye, by which the power of vision is diminished, upon viewing this color in a strong light; while on the other hand, red itself appears to deepen in color rapidly in a declining light, as night comes on, or in shade. These qualities of red give it great importance, render it difficult of management, and require it to be kept in general subordinate in painting; hence it is rarely used unbroken, or as the predominating color, on which account it will always appear detached or insulated, unless it be repeated and subordinate in a composition. Accordingly nature uses red sparingly, and with as great reserve in the decoration of her works as she is profuse in lavishing green upon them, which is of all colors the most soothing to the eye, and the true compensating color, or contrasting or harmonizing equivalent of red, in the proportional quantity of eleven to five of red, according to surface or intensity, and is, when the red inclines to scarlet or orange, a blue green; and when it inclines to crimson or purple is a yellow-green.

Red breaks and diffuses with white with peculiar loveliness and beauty; but is discordant when standing with orange only, and requires to be joined or accompanied by their proper contrast, to resolve or harmonize their dissonance.

In landscapes, etc., abounding with hues allied to green, a red object, properly posited according to such hues in light, shade, or distance, conduces wonderfully to the life, beauty, harmony, and connection of the coloring; and this coloring is the chief element of beauty in floral nature, the prime contrast and ornament of the green garb of the vegetable kingdom.

Red being the most positive of colors, and having the middle station of the primaries, while black and white are the negative powers or neutrals of colors, and the extremes of the scale; red contrasts and harmonizes these neutrals, and, as it is more nearly allied to white or light than to black or shade, this harmony is most remarkable in the union or opposition of white and red, and this contrast most powerful in black and red.

As a color, red is in itself pre-eminently beautiful, powerful, cheering, splendid, and ostentatious, and communicates these qualities to its two secondaries, and their sentiments to the mind.

Red being a primary and simple color, cannot be composed by mixture of other colors; it is so much the instrument of beauty in nature and art in the color of flesh, flowers, etc., that good pigments of this genus may of all colors be considered the most indispensable; we have happily, therefore, many of this denomination.—*Painter, Gilder, and Varnisher.*

The Leather Trade.

The *Bureau* thinks few, even among dealers in the article, are aware of the vast extent of the leather trade, and industries growing out of its use. Next to agriculture, it employs more capital and labor than any other interest of the country. Whatever, therefore, advances or retards its healthy condition and growth, is worthy of careful study and attention.

During the rebellion this industry, like many another, was greatly stimulated, being taxed to its utmost capacity to furnish supplies for the armies in the field. When the exceptional demand from this source was cut off with the close of the war, it was found that the foreign demand, upon which it had been accustomed to rely for the sale of its surplus products, had gone off to other markets, driven thereto by the inability of our dealers to supply its wants during those dark days of our history. The consequence was, that the flow of trade was checked, and over-production and stagnation supervened.

Some relief from legislation should undoubtedly be given to this branch of industry, in order that it may be enabled to regain a portion at least of its foreign trade, that with South America having been especially valuable. Our leather dealers were accustomed to receive from that portion of the continent, in exchange for their manufactured products, an article of hides, sole leather from which forms 90 per cent of the stock consumed in the country. These hides now pass into the hands of other parties abroad, who have supplanted our dealers in this profitable market.

With such a modification of the duties upon the raw material as will restore the exchange of products with Buenos Ayres, the leather interest may reasonably look for a restoration of prosperity far exceeding all former experience. The South has again become a valuable customer, and her demand is now for the better grade of goods, whereas, before the war, she only called for the inferior qualities. The astonishing recuperation of that section of the country has made itself felt in this branch of manufacturing industry, in a growing and healthy trade. Under these circumstances, it is not unreasonable to expect, in the course of five years, that instead of $225,000,000 as the total value of the leather manufactures of the United States, double that amount will be within bounds. The advantage that this country holds in respect to labor-saving machinery, upon which improvements are constantly being made, and the vast amount of capital that is only awaiting favorable conditions to be invested in this direction, indicate that in a few years American facilities will be such as that they can obtain and hold the markets of the world in leather manufactures.

This is one of those branches of industry which we want to see more extensively introduced into the West; and the farming community, by giving their attention to it, can turn their winter leisure to profitable account, as their brethren in New England have done for half a century.

Editorial Summary.

IN a recent number of the *Patrie* there appeared a panegyric on the French national arm. That journal said that since the various improvements which had been effected, the rifle had become one of the best in Europe, nevertheless, the service weapon was not finally decided upon. *Les Mondes* writes to know whether it is not true that two serious defects still exist. The first of these stated defects is that the needle does not strike the cartridge in a line with its axis, but eccentrically, and so often breaks. The second is that the cartridge when once inserted cannot be extracted, a grave defect, and likely to lead to accidents. We remember that after the battle of Mentana numbers of French troops were found wounded in the right hand. It transpired that their injuries were self-inflicted, but involuntary. The Chassepots had been loaded, had missfired, and their unfortunate bearers had attempted to force out the cartridge with their ramrods, at the same time forgetting to open the breach. The evil effects of forcing the cap of the cartridge against the sharp point of the needle by means of the ramrod may be imagined.

THE Commissioner of the General Land Office at Washington has received from Rockingham County, Va., specimens of crystallized Iceland Spar. They possess unusual transparency. This mineral when quite clear has a high value on account of its refracting qualities, which are such that it gives a double image of anything seen through it, and it is used in the construction of polarizing instruments. Hitherto it has always been imported by our opticians. The extensive use made of it in sugar refining for testing by polarity the strength of saccharine solutions, and in the various scientific and manufacturing processes in which the Nicol's prism is employed, need not be detailed. The Virginia quarry is said to afford abundant yield of most excellent quality.

THE PRESERVATION OF MILK.—The following recipe appears in *Cosmos:* "To every liter (— $1\frac{1}{2}$ pints, 5 oz.) of unskimmed milk, previously poured into a well-annealed glass bottle, add 40 centigrammes (about 6 grains) of bicarbonate of soda. Place the bottle (which must be well corked) containing the milk for about four hours in a water-bath, heated to 90°C. (194° Fah.) On being taken out, the bottle is varnished over with tar; and in that state the milk contained in it will keep sound and sweet for several weeks."

AN ANCIENT SILVER MINE IN GERMANY.—The recent earthquakes in Germany have occasioned the falling of a large mass of rock between Heidelberg and Weisloch, and the disclosure of a silver mine worked by the Romans. There is not much silver left, but the mine is rich in zinc minerals, which the Romans rejected.

M. SOMMER propounds a new theory of sleep: his idea is that sleep is simply a result of the deoxygenation of the system, and he believes that sleepiness comes on as soon as the oxygen stored in the blood is exhausted.

THE total area of the known or explored coal-fields in the civilized world, independent of our American coal-fields, are less than 20,000 square miles. When compared with the immense areas and extent of the latter, how small and insignificant the former appears.

MANY small basins of coal exist in the midst of the Rocky Mountains, not directly connected with the great coal-field along its eastern base, and we are ready to hear any day that some of these basins contain anthracite coal.

THE most powerful fog-whistle in America, is at Cape Fourcher, N. S. It can be heard fifteen miles in clear weather and twenty-five with the wind.

THERE are in America and Europe more than 250 manufactories of rubber articles, employing some 500 operatives each, and consuming more than 20,000,000 lb. of gum per year.

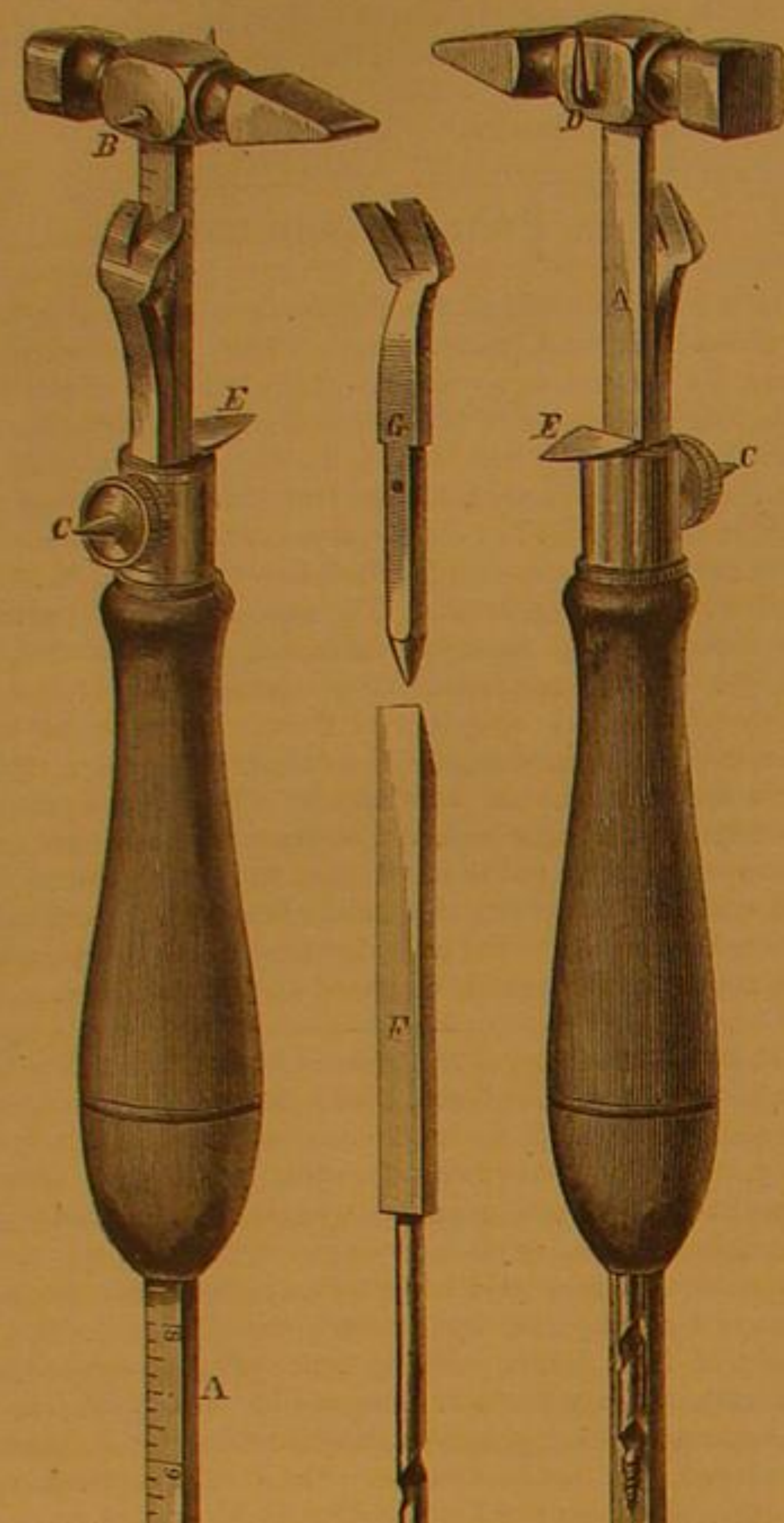
M. HESLING states, in the *Journal de Pharmacie et de Chimie*, that even long before milk becomes sour there are generated in it very small organized spores of an Ascophora species.

OUDEMONS has succeeded in making an alloy of zinc and iron. The new metal, which contains 4·6 per cent of iron, is remarkable for its whiteness and tenacity.

STOCKWELL'S IMPROVED COMBINATION TOOL.

This is one of the numerous family of tools designed to economize space and material, by making the parts applicable to various uses. It is a combination of a tack hammer, square, rule, screw driver, claw, marking awl, chisel, gimlet, can opener, compasses, and washer cutter.

The nose of the hammer is made flat on the bottom, and set at right angles with the shank, A. The shank is made of steel, and divided into inches and eighths of an inch. This construction gives the square and the rule. On one side of the hammer head is a point, B, and a similar point is made on the head of the milled set screw, C. By loosening this screw, the shank, A, may be drawn out or thrust in to adjust these points to different distances, so that circles of various sizes can be marked out with them, as with compasses.



On the opposite side of the head is a pointed hook, D, which, in connection with the blade, E, forms the can opener. The pointed hook is thrust through the tin plate, as near as may be to the center of the top of the can, and the blade, E, being pressed down through the tin, a sweep of the handle cuts out a circular disk, through which the contents may be taken out.

The end of the shank, A, opposite the hammer head, is formed into a screw driver. Loosening the set screw, C, allows the shank to be taken out of the handle, when the chisel and gimlet, F, may be taken out. When either the chisel or gimlet are required to be used, they may be placed in the handle and held by the set screw, C, as the shank, A, is held when the hammer is used. G represents the claw, which has at the opposite end a marking awl. This can also be used by fixing it in the handle with the set screw. By turning the handle so the knife will be on the same side as the point, or hammer, it can be used as a washer cutter for pump valves, wagons, etc.

The whole forms a neat, compact, and convenient implement for domestic use, and would form an excellent addition to a tourist's or traveler's chest, in countries remote from the usual facilities for repairs of small articles afforded by civilization. It is useful also for coachmen and teamsters, comprising, as it does, a tool requisite for repairing carriage harness, etc.

Patent allowed, through the Scientific American Patent Agency, April 12, 1870. For further information address G. W. Stockwell, inventor, Lock Box 43, Natchez, Miss.

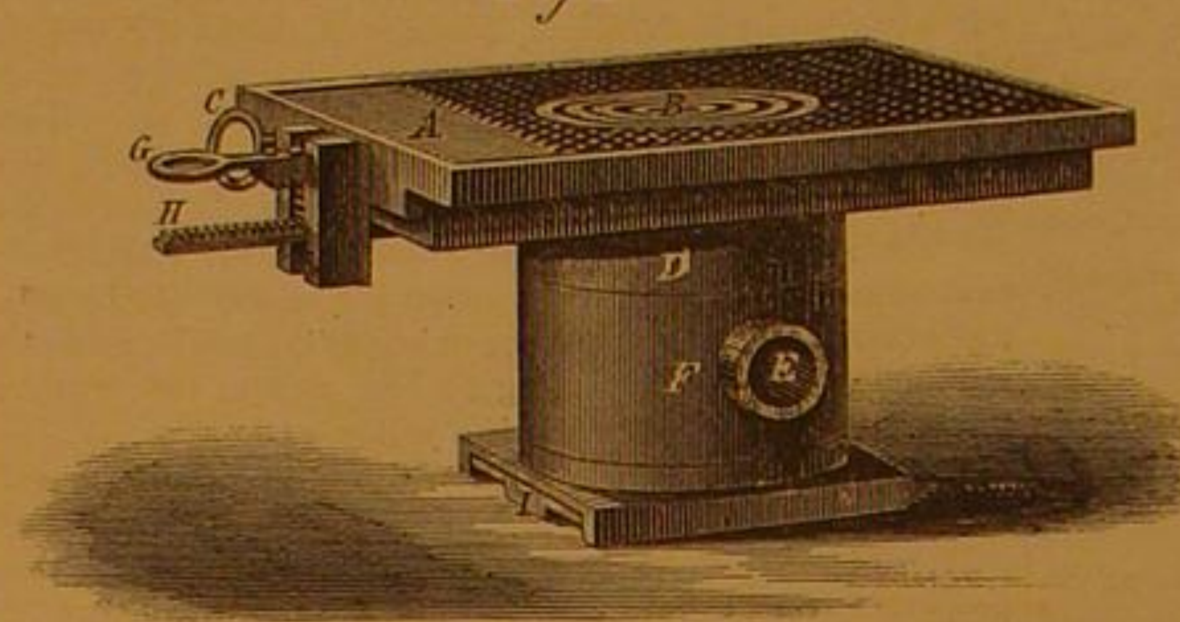
Paper Hangings.

Impressed gold papers, printed with finely-engraved brass dies, have been lately introduced, and for workmanship cannot be surpassed. Apart from their richness, there is no attempt at shadow, which should always be avoided. The ground colors are laid in a careful and superior manner, and a soft good effect is obtained. The specimens of flock paper are the reverse of the impressed gold; for as in one case the gold leaf is pressed by a warm cylinder into the ground color of the paper, so the relief effect accompanied by real shadow is produced by printing the block in size and flocking the same, repeating each process several times until the desired relief is formed. The pattern is then in relief in white flock upon a sized white paper ground. It is very easily applied to the wall, and especially suitable for panel decorations; it may be finished after being sized with ordinary glue size, and one coat of paint to prevent absorption in any tint of distemper color, or finished in paint, and relieved with color and gold according to taste, finished as the style of the room or staircase may require. The newest French paper-hanging patterns are raised in relief, and some have edging of gold as embroidery, producing the exact effect of *appliqué* work.

KAY'S PATENT REVERSIBLE SLIDE VALVE AND SWING GRATE.

It is a well-known and acknowledged fact among all blacksmiths, that much time is necessarily lost in changing from a smaller to a larger heat. This fact is easily accounted for when we remember that, by the construction of other tweer irons, the opening in the tweer plate, through which the blast issues, remains unchanged, however much the force of the blast may be increased, so that, while the fire directly above the place from which the blast issues may be at a melting heat, it is only spread by ignition from the center and not by a direct blast under every part of it; and even when the desired surface of fire is obtained, while it may be of sufficient heat to smelt the iron directly above the opening, the parts adjacent to the center may not have reached the desired heat, thereby giving an uneven and unsatisfactory heat to the whole. This is only partially obviated by frequently turning the iron, a very difficult and laborious operation when the piece is either large and cumbersome, or of inconvenient shape for thus turning.

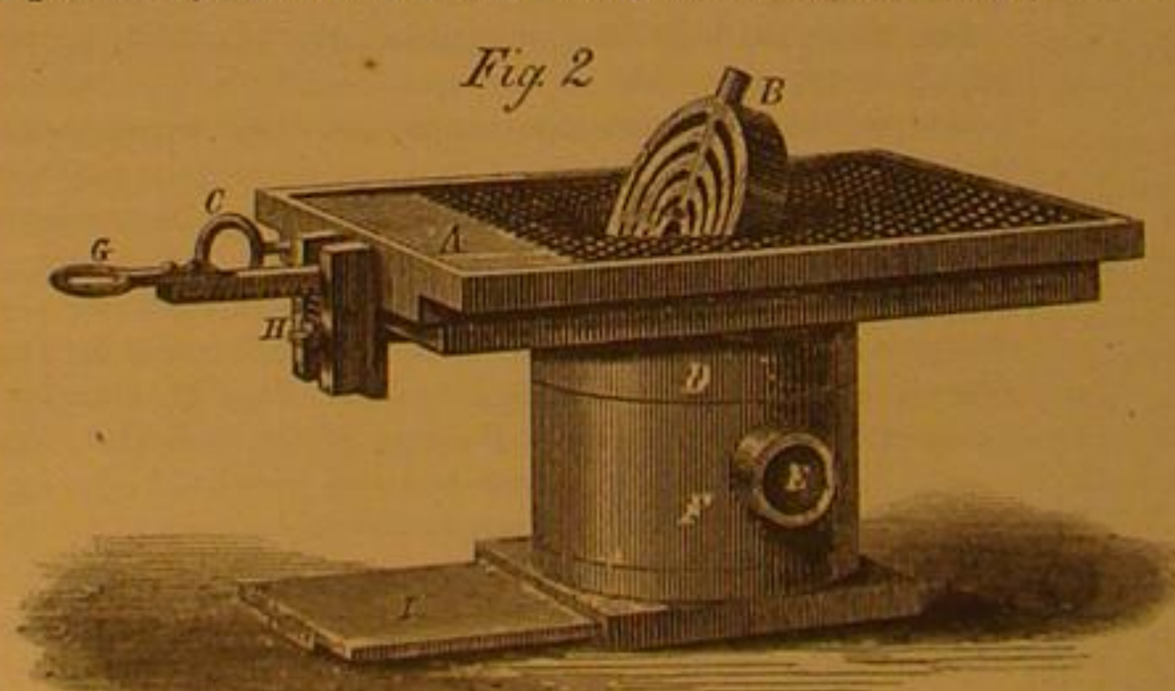
Fig. 1



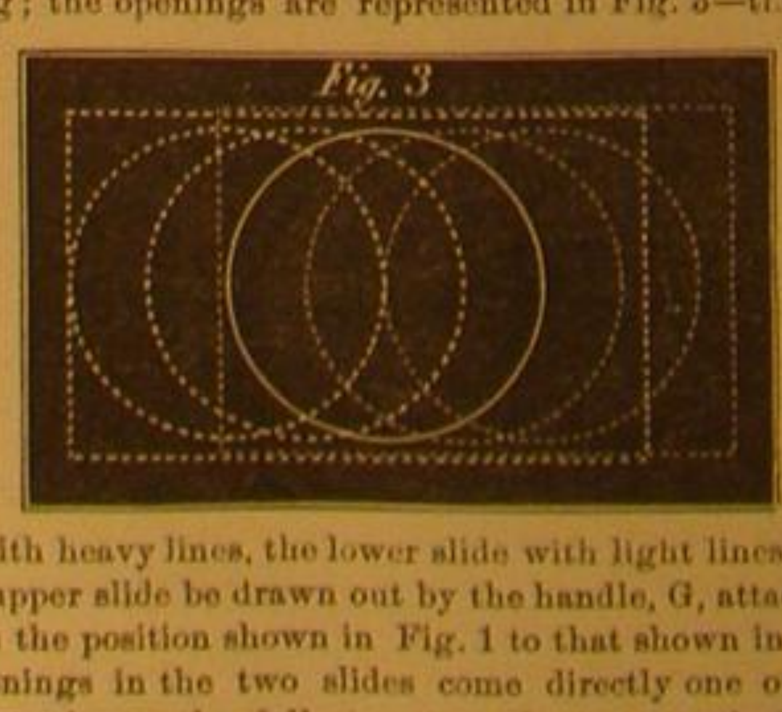
The apparatus of which we give an engraving has been, we are informed, thoroughly tested, and found to not only obviate the difficulties above mentioned, but by it a larger or smaller surface of fire, with an even blast under every part of it, can be obtained. It can be used with Lehigh pea coal as well as with the Cumberland or sea coal, now generally used, thereby giving to the blacksmith the peculiar and well-known advantages of a Lehigh fire, of which, those using a tweer have heretofore been deprived.

Fig. 1 represents the apparatus closed. A is the upper plate which forms the bed of the fire, and in which is placed a swing grate, B, pivoted so that the grate may be turned as occasion may require, to the position in Fig. 2, it being held in position by a rod, C, working through the bed, and fitting

Fig. 2



into the grate. Beneath the grate is the chamber, D, into which wind is admitted, through the adjustable collar, F, from the blower, by means of the pipe, E. Between the air chamber and the grate are arranged two slides, to each of which a rack, G and H, respectively, is fixed, and between the two racks a pinion is arranged, so that by moving one of the slides the pinion is turned, causing the movement of the other slide in the opposite direction. Through the two slides is formed a circular opening of the same diameter as the grate opening; the openings are represented in Fig. 3—the upper



slide with heavy lines, the lower slide with light lines. Now if the upper slide be drawn out by the handle, G, attached to it, from the position shown in Fig. 1 to that shown in Fig. 2, the openings in the two slides come directly one over the other, opening to the fullest extent the communication between the air chamber, D, and the grate, B. In Fig. 2 the pin, C, has been drawn out, in order to allow the grate, B, to revolve and empty the ashes and scales through the opened slide, I, to the floor beneath, whenever the fire needs clearing; when this is not needed, but only the greatest amount of blast is required, it will not be necessary to change the position of the pin, C, and the slide, I; but by merely drawing out the handle, G, the blast and surface of the fire may be enlarged to any extent desired. In this movement the opening commences at the center, each slide opening from the center; the space opened is double the movement of either slide, and when the slides are opened to any required space, as denoted by the broken lines in Fig. 3, the wind is admitted centrally on to the grate, and the force of the blast spread equally under the fire by means of a cross piece in the collar, F; by which, as will be readily seen, a circular blast of any desired size, may be obtained, always enlarging from, or diminishing towards, the center of the fire, so that the blast is directly under the whole of the fire, rendering one part as hot as another, and giving an even heat to the whole. Every tweer is furnished with three grates—one for spreading the fire, one for concentrating it, and one of a pyramidal form, in order to allow the ashes and fused metal to slide off and not obstruct the blast by filling up the gratings while welding heavy pieces. This device is also a very cheap one; its price being, we are told, only twelve dollars.

This invention was patented June 8, 1869, by Joseph Kay, 34 Pearl street, New Haven, Conn., to whom all orders may be addressed; or to Mr. H. B. Bigelow, machinist and boiler maker, Grapevinepoint, New Haven, Conn., where it may be seen in operation.

Construction of Sky Lights.

The *Architectural Review* says: "the square sky light, properly constructed has advantages over the spherical or any circular form, being more thoroughly water-proof and far more easily set than the latter. As to the suitableness of the spherical form, to shed light in the back part of a store, we do not think it equal in *effectiveness* to the square sky light, although it is, to a certain extent, effective enough.

"While noticing this subject we would also refer to sky lights as applied to the lighting of several stories of a building. The number of stories must be taken into account and the hight of each and all collectively; whether there are any obstacles to the admission of the light perpendicularly; or if there be, at what angle it could be conveniently admitted. Another consideration is the amount of space over which the light is to be distributed, and whether it can be aided by blending with the light from any other source. All these points must be considered, and the best mode adopted accordingly.

"When we wish to admit a direct light from above to two or three stories, a square opening is best; having its four sides inclined upwards to an angle of, say, thirty-five degrees; and also having the well-hole or opening in each successive floor increased at a angle of ten degrees; thus giving to the lowest story the fullest benefit of the expansion of rays.

"On each floor (except the last) the well-hole should be inclosed with framed glass sides, the wood-work of which, as well as of all the curbs and trimmings, should be painted white, and if porcelain paint, all the better; for the reflection and refraction of light thus gained is a great object.

"The spherical dome or circular forms are not well adapted for practical use, the glass being cylindrical, the light is naturally concentrated and not reflected in its course as in the former instance; besides the construction is more difficult and expensive; as each light must be curved to its required shape, and the glass necessary for this purpose is of the ordinary thickness, and liable to breakage; while the other is entirely free from such danger. When the space to be lighted is but one story, the best mode is to bring the light through one side of a raised roof, using the rough plate glass, and placing the same at a slope of about twenty degrees from the perpendicular. The hight is regulated according to circumstances; for ordinary purposes they are two feet six inches; the roof to be raised to an inclination of from ten to twelve degrees, and plastered on the under side perfectly white to the same angle with the roof, until it meets the level ceiling. The opposite side, from the glass to the ceiling, should be continued down the same slope with that of the glass, until it meets the ceiling, and the ends are usually made to this same slope, all plastered white and finished to a polished surface.

"Sky lights of this form can be placed at intervals, according to circumstances, and multiplied to any number. They are the simplest, and also the most available, when applied to a single story.

"In some cases, where it is desirable to have a superior finish to the ceiling, a sash is placed on a level with the lower surface, and glazed with embossed glass of any desired figure."

By digesting metallic zinc in iodide of ethyl we obtain a volatile liquid which takes fire spontaneously in the air. It can be distilled in an atmosphere of hydrogen, and if this gas be made to pass through the liquid it will carry off some of the zinc-ethyl, and when ignited will burn with a magnificent white flame. It is probable that ordinary illuminating gas would answer as well as hydrogen for this experiment, The light produced in this way can be employed to take photographs, but its actinic properties are not equal to the effects produced by burning magnesium.

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NEW YORK, SATURDAY, APRIL 23, 1870.

Contents:

(Illustrated articles are marked with an asterisk.)

AN ANGLO-AMERICAN TURKISH BATH.

Reader, you have, without doubt, heard something about Turkish baths. You have probably read more or less about them; but did you ever take one? *We* have. The "gentle spring's etherial mildness" had given us a cold. The cold brought with it a daily headache. Not one of those attacks which, though severe for a short time, yield to a cup of tea, and a nap on the sofa; but a lurking treacherous ache, that came unannounced, always accompanied with a qualm at the stomach, and then left, to return again when least wanted—if it be possible to suppose degrees of desire for that which is utterly undesirable.

"The Turkish bath is the thing for you," said a friend who has tried it extensively, and who—having probably never been sick in his life—has been cured of everything by this universal remedy. We took his advice, and the ticket with which the advice was accompanied, which in due time secured the bath.

Presenting our ticket at a little ante-room of the building in which the Anglo-American Turkish bath is administered, we were presently shown into a little stall, in which privacy was secured by a thick curtain. This would hardly seem necessary, unless it is to carry out the general principle of graduation, which underlies the administration of a Turkish bath, as the subsequent operations and manipulations constituting the entire process, gradually increase in vigor, until they arrive at a pitch where feelings of delicacy, having decreased in precisely the same ratio, nearly vanish.

We found in our stall a long linen towel, which we were directed to wrap round our loins, when we had completed our disrobing. This towel is an embarrassing affair to a novice, who has not inventive talent to adjust such primitive costume in a permanent manner. Having wrapped it about us as well as we could manage it, we fell to wondering what would be the next step in this new experience. Thrusting our head out at one side of the curtain, we found a swarthy Mongolian standing sentinel at the door of our cell. This individual had a pleasant expression of countenance, but his clothing was as meager as our own; though so much more gracefully and securely adjusted, as to make us blush for our own want of taste in matters of dress. We immediately put ourselves under instructions, and succeeded in getting the thing on, in a manner that we fancied would not wholly disgrace a primitve barbarian.

We were then inducted by the man and brother who had us in special charge at this stage of the proceedings, into—Whew!—a room heated to 120° Fahrenheit, where we felt as though we would at once expand and burst open, like a roasted oyster.

With what gratitude we looked upon our Mongolian friend, who at this instant relieved us of all our oppressed feelings by clapping upon our head a large sponge, filled with tepid water, which ran down our beard and o'er our scanty robe, now sadly in need of re-adjustment, but not so extensive in its environment as to absorb much time in the operation.

In this room we took a seat, and put our feet in a small tub of hot water, opposite a small boy, young in years, but much older than ourselves in experience of the Anglo-American Turkish bath. This old boy informed that he "took it offun." We inquired had he rheumatism? "No." Had he gout? "No." Did he take the baths to relieve the system of former mercurial treatment? "No. He took them for pleasure." We looked at his feet. They resembled infant boiled lobsters. We looked at our own; they appeared like large boiled lobsters. Nevertheless, we experienced a sort of pleasure in inspecting them, analogous to that experienced in youth, when reading of martyrs compelled to walk over red hot plough-shares. We came to the conclusion that the sufferings of those martyrs had been mentally exaggerated. We now deemed it quite possible to encounter anything in the way of heat without much pain.

At this instant appeared at the door another barbarian, clad in a pair of calico pantaloons of the latest cut, only extremely short at both ends. We judge the legs could not have been more than eight inches in length. He was a grim and gaunt barbarian with a mustache, and an eye that seemed to glow with eager anticipation. Like the spider in the fable, this attendant invited us into his parlor, and like the fly in the fable, we accepted his invitation. We found the tesselated marble floor of this apartment so hot that we could not rest our feet upon it, but the barbarian placed under them a wet towel, which felt good and comfortable.

Glancing at a thermometer which hung near, we found it marked full 140°. The barbarian turned down an hour glass, of the extreme accuracy of which we feel some doubts, and left us to watch it and the thermometer. Whether the labor of this watching was so severe, or whether it was because the room was so warm, we soon found ourselves dripping with perspiration from millions of pores. We tried to recall our physiology, and to speculate upon the source from which all this fluid was drawn, but found ourselves capable of nothing but watching the thermometer and the hour glass.

From this not unpleasant Inferno, barbarian No. 2 took us into a little room where we saw the last of our primitive raiment. Here we were placed prone and shampooed. That is, we were rubbed and scrubbed by the barbarian; were pulled and hauled and touseled and pumped upon by a hose in the hands of the barbarian; were soaped, brushed and kneaded; our limbs were stretched and twisted, and our head was rubbed until consecutive thought was an utterly impracticable achievement.

Pop! went an explosion like a Kentucky rifle, at which we jumped up in alarm. We were reassured by the barbarian, who explained how the thing was done. This he did experimentally on his own person. The hand is held so as to form a sort of cup, which is filled with suds. Brought suddenly down upon the flesh it makes a loud crack, but does not hurt much. Down we laid again, and the barbarian fired a successive volley, ending in general firing, all along the line of our spine. Then we were again drenched by a discharge of hot water from the hose, and plunged into a large vat of pure water at 70°. We found the power of consecutive thought at once fully restored by this plunge, and immediately analyzing our sensations, found them to be wholly Oriental.

We felt an intense longing for fleet horses, and tents in the desert; for flocks, and herds, and opium pipes, and harems and sherbet and coffee; for loose trousers, and shoes with pointed and turned up toes, and a turban. We tried a word or two of Arabic, but whether it was from our ill pronunciation, or whether the barbarian was such only in the matter of his skin and dress, we could not make him comprehend us.

The free use of towels having removed the moisture from our cuticle—that is, the rudimentary cuticle which the Anglo-American Turkish bath permits to remain—we began to resume delicacy and dress in the form of a linen wrap, which we folded about our person, and we were then led to the cooling and drying room, where we were placed in an easy chair with a support for our feet, and abandoned to rest and dreams. Opium and coffee are not served, which is considered an improvement upon the Oriental custom, but a refreshing drink of hot lemonade is furnished in the first stage of the sweltering process.

From a period of blissful rest we were aroused to resume our every day dress and revisit the earth, which we were all the more ready to do from a feeling of intense hunger experienced at the moment.

Issuing from the establishment, we heard the bells striking 6 P.M., and could almost imagine the voice of the *muezzin* calling to prayer from distant minarets, and perfumes of "Araby the blest" blending with the less aromatic odors of our metropolitan atmosphere.

STEAM BOILER INSPECTION.

It seems to be a settled fact that consumers of steam, cannot be relied upon to keep steam boilers in such a state of repair as to render them approximately safe. If any proof of this is wanted, let the reader search the files of any daily newspaper for records of boiler explosions, during the past year, and their causes, so far as ascertained. We avow that no intelligent man, who understands the nature of steam, and the common causes of boiler explosions, can make such an investigation without adopting the view that ignorance and avarice are still so powerful in their influence upon the acts of mankind, that no dependence can be placed upon individual effort to secure life and property from the danger arising from impaired and unsafe boilers.

It also seems to be generally admitted that, in order to secure such safety as is attainable under the conditions pertaining to the general employment of steam as a motor, some system of inspection is necessary; but there are conflicting views as to the best method.

It is maintained by some that the most effectual mode would be to vest the power of inspection in those interested to discover faults. Thus it has been proposed in Chicago to give the matter of inspection over to the care of a boiler insurance company. A petition has been signed in that city by many respectable owners of boilers, praying that the inspection performed by the company mentioned may be legalized. Whether the company desire to be clothed with this additional power we are not informed; but in any case the change proposed seems to us impracticable, and unsuited to secure thorough and impartial performance of duty.

Inspection, to be valuable, must be general in its application, and particular as to each boiler, without fear or favor, on the part of the inspector, whose powers must necessarily be somewhat arbitrary. A liberal salary ought to be paid each inspector, so that not only men competent for the post tion can be obtained and retained in office, but so that the office of inspector may be rendered sufficiently valuable to secure the honest performance of duty. The office should, moreover, be permanent, and only to be vacated by resignation or impeachment for by neglect, or the too arbitrary exercise of duty.

The system of boiler insurance is deservedly increasing in popularity, and has done a great deal of good from the dissemination of knowledge in regard to the real causes of explosion and modes of prevention. We think, however, a direct blow would be struck at the usefulness of boiler insurance, were the officers of companies of this kind legally authorized to perform inspection and make arbitrary requisitions upon boiler owners.

A system, whereby thorough and honest inspection can be secured, is very much needed, and we believe will never be attained except by the payment of liberal salaries to fully competent inspectors.

PRINCIPLE OF THE LEVER.

The lever may be defined as a straight or bent beam, resting upon a fixed support at any point between its extremities. When it is bent, the same general law applies to it as when it is straight; viz., that when the product of the length of a perpendicular drawn to the fulcrum, from the line of direction in which the power acts multiplied by the power, equals the product of the length of a perpendicular drawn to the fulcrum from the line of direction in which the resistance acts, multiplied by the resistance, the power and resistance will be in a state of equilibrium.

This may be expressed in a more general manner by the enunciation of the old doctrine of virtual velocities, which applies to all elements of machines, as well as to the lever This law may be stated as follows: When two forces are so situated that upon the addition of any increment of force to either, the respective distances through which the original forces will act, multiplied into their respective magnitudes, form equal products, the original forces will be in a state of equilibrium. We may add that the forces do not on that account fail to produce an effect. To suppose this, would be to suppose a cause without an effect. Now supposing two forces or weights to be balanced upon a lever, what is the effect produced by those forces? Certainly not mass motion; since it is the absence of mass motion by which the equilibrium is indicated.

Since we are debarred from the supposition that no effect is produced by the application of a force, the effect sought will be more likely to be found in the lever itself than elsewhere.

If we examine the lever, we shall see that the condition of equilibrium is attended with an alteration in its shape, which alteration is an exact measure of the forces applied. In other words, the deflection of a lever is the result or effect of the forces in equilibrio. But deflection implies change of molecular position. If the limit of elasticity in the material of which the lever is composed be not exceeded, it will resume its original form, upon the removal of the forces which deflect it, and the original molecular relations will be restored.

It would seem, then, that the true exposition of the doctrine of virtual velocities is to be found in the study of the molecular changes which take place in bodies, employed to establish that relation between forces.

Professor Norton of New Haven, whose experiments upon the laws of deflection we recently noticed, seems to have been studying this relation with much success; and he shows, we think, satisfactorily, that from two admitted principles of molecular action, together with the principle of the parallelogram of forces, may be deduced the law, that the intensities of forces applied to a lever are inversely proportional to their lever arms.

The two principles of molecular action involved, are thus stated by Professor Norton.

"1. If two integrant molecules of a solid body, which lie within the range of reciprocal action, be forcibly separated from each other a minute distance, a mutual attraction or repulsion will be brought into operation; and if they be urged nearer to each other by an equal minute distance, an equal opposite force of repulsion or attraction will come into play.

"2. The intensities of the forces thus originating, are proportional to the amount of the relative displacement of the two molecules, on the line connecting them."

At the eighteenth meeting of the American Association for the Advancement of Science, Professor Norton read a paper giving a mathematical demonstration of the properties of the lever, as deduced from the principles enunciated, which is too abstract, as well as too lengthy, to be adapted to our columns. We may however say, in conclusion, that his paper will do much to extend the belief, that in mass motion and molecular motion, we may find all the causes of existing natural phenomena, so far as those causes can be recognized and comprehended by the human mind.

THE WEST SIDE ELEVATED RAILWAY.

The construction of what is known as the West Side Elevated Railway, extending from the Battery to Thirtieth street, New York, has been a difficult piece of engineering. As our readers have hitherto been informed, the track is raised to the level of the second story of the buildings along the line, and is supported upon iron pillars of peculiar construction, the pedestals of which are embedded in the earth below the action of frost.

The pillars are not arranged in pairs, but are placed in single file on the central line of the road. They are branched at the top, and support continuous girders upon which the rails are laid.

The cars are propelled by endless wire ropes, actuated by a stationary steam engine and drum. The rope carries travelers placed at proper intervals, and rolling upon small rails. The travelers are composed of four miniature car wheels, and carry projecting studs, which, engaging with a lever arm on the car make the connection. The connection is broken by a lever movement when it is desired to stop the car.

The jar caused by the impact of the stud on the traveler is taken up by wire ropes wound upon spring drums, much after the manner of the main spring movement of watchwork.

Some experimental trips have been made over the road during the past week, at one of which we assisted. The trip from Cortlandt street to Twenty-ninth street—about three miles—was accomplished with ease in fifteen minutes, to the general satisfaction of the party present.

The Company are entitled to great praise for the perseverance with which they have met and surmounted difficulties, and a large proportion of the cost of the road, as it now stands, has accrued from costly and elaborate experiments. It is estimated that the expense of constructing the present section has been about one million of dollars.

It is proposed, we understand, to continue the road to Yonkers, about fourteen miles up the Hudson from the Battery. The present section of the road will, however, when opened to traffic, be sufficient to determine the financial success of the enterprise, and we should think it probable the future extension of the road to the proposed distance would be postponed until the working qualities of the present section can be fully demonstrated.

Our impression is, that the rapidity with which the transit from the lower to the upper part of the city can be made will render the road very popular, and the current expenses of working must certainly be much less than that of the horse car lines for the same amount of traffic.

As to the safety of the road to passengers there can be no doubt; in fact, there seems even less danger than in the horse cars, as the elevated railway cars are exempt from all danger of collision.

The engineer under whose direction the work has been done, is Mr. Charles E. Harvey, of this city.

THE PARIS OBSERVATORY.

The Director of the Paris Observatory cannot complain of want of work. The following is the programme of his duties as given by Louis Figuier:

"Unremitting direction of all the labors relative to pure astronomy involving the use of the meridian circle and equatorial; calculation of all the astronomical observations and publication of the results; organization of the geodetic survey; recording and publishing all observations made in the observatory relating to the meteorology and physics of the globe; reception, calculation, and classification of the meteorological observations coming from different points of Europe; editing and printing daily charts and bulletins giving a *résumé* of all observations, to be forwarded the same day to correspondents and to all the ports of France; direction of the observatory at Marseilles and constant relations with the observatory at Greenwich; and, finally, active participation in the labors of the bureau of longitude. Such is the programme, truly frightful, and such the tremendous responsibility devolving upon the direction of the Imperial Observatory at Paris."

The former head of the observatory was the famous Leverrier, but he contrived to render himself so obnoxious to all of the subordinates that they petitioned to have him removed, and were finally successful. He was summarily dismissed, and M. Delauny has been appointed in his place.

For a long time efforts have been made to get rid of Leverrier, but he was so popular with the Emperor and Empress that the ministers were afraid to move in the matter, and he was a man of such violent temper that everybody kept out of his way. They tried to keep him in check by appointing a board of advisers, without whose consent and recommendation nothing could be done. There was not a member of the board with whom Leverrier was on speaking terms. He refused for six months to have anything to do with this body; but finding that this would not do, finally, on the seventh month, attended a meeting. It is said that this meeting ended by three of the advisers kicking M. Leverrier out of the room.

All of the meetings he attended ended in a row, and the scientific men began to be very tired of such a state of things, and all of the assistants employed in the observatory sent in their resignations, accompanied by the worst accusations and complaints that could easily be imagined. There was nothing left after such an exposure but a summary dismissal.

A gentleman, of New York city, who had occasion to go to the observatory in Paris to carry a present to M. Leverrier of the superb photographs of the moon, taken by Mr. Rutherfurd, relates his experience on the occasion. He was informed by the gatekeeper that M. Leverrier was within, and was directed to the proper stairway. He rang the bell, and instead of asking for Leverrier, sent for one of the assistants to whom he had cards of introduction. The assistant came, and when it was proposed to speak to Leverrier, so many objections were raised, and the assistant appeared so frightened that the visit was abandoned on condition that the photographs were to be handed in due time to Leverrier. Other copies properly directed were also left for Foucault and Faye.

The impression left on the mind of the American gentleman was that the assistants, all of whom he saw, were as afraid to pass Leverrier's study door as good Christian was to go near the castle of Giant Despair.

The visitor was entreated not to speak so loud and the place had the air of a prison rather than of a scientific establishment. But the worst picture of the affair remains to be told. Leverrier bagged the photographs of the moon, and tried to make better ones himself; and it was not until nearly a year afterward, when another print was sent directly to Foucault, that the pictures were presented at the French Institute and became known to its members. They attracted immense attention, and Mr. Rutherfurd received due honor for his valuable contribution to science. M. Leverrier, who was present at the meeting, also greatly admired the photographs, but said nothing about having pocketed three copies of them a year previous. No wonder that all France is delighted at his overthrow.

SHUT YOUR MOUTH.

This piece of advice is sometimes given in an abrupt and insulting manner, and occasions an outburst of temper that produces the opposite effect from the one intended; but when given kindly and on scientific grounds, it ought to be attended to and followed by all persons. Professor Tyndall has just told us of the dust particles, the spores, life germs, fevers, and miasms, that float in the air, and has said in tones of warning "Shut your mouth!"

The Board of Health, of this city, through one of its accomplished officers, Dr. R. C. Stiles, has published a most important report upon the dangers that lurk in closed rooms and crowded halls, and have also said to us "Shut your mouth!"

Finally, Mr. Catlin, author of "Notes of Travels among the North American Indians," has given us a book published by Wiley & Son, called "The Breath of Life," in which the same advice is freely given, sustained by ample facts and startling illustrations, for the benefit of all mankind—"Shut your mouth."

We cannot do better than to refer to these various publications, for the purpose of calling the attention of our readers to the importance of securing proper ventilation in their dwellings, and of acquiring the habit of breathing through the nostrils rather than through the mouth.

There is no doubt that "man's own breath is his greatest enemy," and every precaution should be taken to prevent its inspiration after it has once passed from the lungs. The report of Dr. Stiles contains the result of much original research, and displays a zeal in the service of good health, and an amount of exhaustive labor that is worthy of the highest commendation, and his results and statistics ought to be published in permanent form for the consultation and warning of all classes of society. The amount of carbonic acid produced by respiration has been variously estimated, but Dr. Stiles puts it at the rate of 1,032 cubic inches, or three fifths of a cubic foot per hour. From this the ratio of vitiation of the air in a given space can be easily computed " Every hundred persons would vitiate in three hours 4,200 cubic feet of air to the extent of 4·3 per cent of carbonic acid, or 18,000 cubic feet, to the injurious proportion of one per cent of carbonic acid."

The products of respiration are more dangerous than pure carbonic acid. It has been found that while two per cent of carbonic acid evolved in a chemical way could be endured, one per cent produced from the lungs rendered the air irrespirable. The volatile organic products of respiration concentrate the poison. The report of Dr. Stiles discusses the amount of carbonic acid produced by the combustion of illuminating gas, and shows by actual experiment that a single five-foot burner can produce 2·45 cubic feet of carbonic acid in one hour.

The danger from leakage in heating apparatus, the subtile nature of carbonic oxide gas, and from coal fires in open braziers, is clearly presented. "The poison attacks the red particles of the blood, and its prostrating effect is experienced long after the occurrence of exposure."

The methods employed in the determination of the amount of carbonic acid in the air are generally of too bulky or refined a nature to admit of easy transportation, and Dr. Stiles invented a neat portable apparatus that is worthy of notice. It consists of a wide-mouthed glass flask holding 150 cubic centimeters and graduated so that each division of its descending portion holds one ten-thousandth part of the capacity of the apparatus. A delicate glass bulb, holding a cubic centimeter of a solution of caustic potash, is introduced into the graduated flask after the air to be analyzed has been transferred to it, the mouth of the flask is immersed in water—the potash bulb is broken by a smart blow against the side of the flask—the water rises in the apparatus in proportion to the vacuum produced by the absorption of the carbonic acid by the potash, and the amount in 10,000 volumes can at once be read off. Fifteen minutes are all that are necessary to perform the analysis, and the accuracy of the results was found to be sufficient for all practical purposes by comparative tests according to other methods. With this simple contrivance, Dr. Stiles collected a large number of samples of air from churches, theaters, school houses, private dwellings, and tenement houses, which he has analyzed and tabulated along with similar results obtained by Pettenkofer, Roscoe, and others.

The following are the results obtained in schools of Brooklyn by the method of analysis described above:

	Carbonic acid in 1,000	Times the normal am't,
Public School No. 1	1·00	2·0
Public School No. 1, another room	1·05	3·0
Public School No. 15, Tenth Ward	2·00	4·0
Public School No. 15, another room	4·00	8·0
Clarke's Commercial College, 16 Court street	2·04	5·0
Clarke's Commercial College, another portion of room	0·05	1·0
Clarke's Commercial College, class room	0·75	1·5
College Grammar School, 18 Court street	2·00	4·0
College Grammar School, another portion of room	0·08	1·6
College Grammar School, another portion of room	1·33	2·7
College Grammar School, class room	0·66	1·3
Polytechnic Institute, third story	1·11	2·2
Polytechnic Institute class room	0·05	1·0
Polytechnic Institute, second story	0·66	1·3
Public School No. 13, Degraw street	3·01	6·0
Public School No. 13, another room	2·05	5·0
Public School No. 13, another room	1·66	3·3
Public School No. 27	2·07	5·4
Public School No. 27, another room	2·02	4·4
Public School No. 27, another room	1·02	2·4
Public School No. 29	1·06	3·2
Public School No. 29, another room	2·02	4·4
Public School No. 29, another room	1·04	2·8

In estimating the proportion of carbonic acid in the air of schoolrooms to that naturally existing in the atmosphere of the city, the latter is supposed to contain a constant average of 0·5 parts in 1,000.

The following analyses of the air of theaters have the credit which belongs to the distinguished experimenters against whose names they are recorded:

	Carb. Acid, in 10,000 Parts.	Times, the Normal Proportion.
LeBlanc, Opera Comique, parterre	15·04	3·76
Le Blanc, Opera Comique, gallery	28·12	7·03
Loppens, theater in Ghent, parterre	46·03	9·03
Loppens, theater in Ghent, gallery	53·06	10·07
Roscoe, theater in London, parterre	24·08	7·01
Roscoe, theater in London, gallery	30·04	8·07
Angus Smith, theater, parterre	40·00	8·00

Dr. Letheby is authority for the following averages, as given in the *Chemical News* for January, 1868:

Theaters in London	14·09	3·07
Theatres in Manchester	14·08	3·07
Theatres in Paris	33·00	8·02

The theaters examined in the course of these investigations were, in Brooklyn, as follows:

	Carb. Acid In 1,000 Parts.	Times, Normal Quantity.
Academy of Music, balcony	1·06	3·02
Academy of Music, gallery	1·00	2·00
Academy of Music, gallery	2·05	5·00
Park theater, gallery	1·04	2·08
Olympic theater, gallery	3·06	7·02
Hooley's Minstrels, gallery	3·02	6·04

In New York the following proportions were obtained:

Booth's theater, parterre	1·00	2·00
Booth's theater, parterre	0·75	1·05
French opera, 14th st., parterre	2·00	4·00
Wood's theater, parterre	0·06	1·02
Tammany theater, parterre	3·01	6·02
Bowery theater, parterre	7·06	15·02
Bowery theater, parterre	6·01	12·02
Bowery theater, parterre	2·05	5·00

The particles floating in the air and falling in the form of fine dust were made the subject of patient investigations. Specimens of dust from nearly all the places of public amusement in New York were examined by the microscope, as detailed on page 176, current volume, in a paragraph entitled "Opera House Dirt."

To avoid breathing all of this dust, Professor Tyndall recommends the use of a mouth piece of tufts of cotton, but such an arrangement, besides being unsightly, would soon become very wet and uncomfortable. Mr. Catlin's idea of keeping the mouth shut and breathing through the nostrils, is easy of execution, and more in accordance with scientific principles. Mr. Catlin states that the Indian mother presses the lips of her infant together as it falls asleep in the open air, and thus teaches the habit of breathing through the nostrils; while the careful, tender mothers of civilized life cover the faces of their infants in over-heated rooms with their little mouths open, gasping for breath; and he traces the increased mortality among infants very largely to this cause.

He says: "The air which enters the lungs is as different from that which enters the nostrils as distilled water is different from the water in an ordinary cistern or a frog pond. The arresting and purifying process of the nose, upon the atmosphere with its poisonous ingredients, passing through it, though less perceptible, is not less distinct, nor less important, than that of the mouth, which stops cherry-stones and fish bones from entering the stomach. It is a known fact that man can inhale through his nose, for a certain time, mephitic air, in the bottom of a well, without harm; but if he opens his mouth to answer a question, or calls for help, in that position, his lungs are closed, and he expires." It is a well-known fact that fishes will perish in a few moments in their own element if their mouths are kept open in any way—they must breathe through their gills or die.

Geologists tell us that at one period in the world's history, the amount of carbonic acid on the surface of the earth was vastly greater than it is at the present time; and in studying the structure of the animals of those early ages, it is found that they are provided with gills, or some special apparatus that enabled them to live in an atmosphere of carbonic acid. The accumulation of evidence goes to show that we cannot be too careful, not only in the quality of the air we breathe but also in the manner in which we draw it into our lungs. The nostrils are provided with a natural sieve and filter, and it is possible, on the principle of dialysis and the laws of the passage of gases through membranes, that the nitrogen and carbonic acid are excluded while the oxygen is permitted freely to pass. The warning of such authorities as Professor Tyndall and Dr. Stiles ought not to be disregarded, and we are disposed to concur in the sentiments expressed by Mr. Catlin, where he says: "If I were to endeavor to bequeath to posterity the most important motto which human language can convey, it should be in these words:

SHUT YOUR MOUTH."

COMPARISON OF TURBINES WITH OTHER WATER WHEELS.

We find the following translation from *Weisbach's Ingenieur- und-Maschinen Mechanik*, in *Van Nostrand's Engineering Magazine*, for April, which sets forth the relative advantages of turbines and other wheels in a very strong light:

A great advantage of turbines compared with vertical water wheels is that they work with any fall from 1 to 500 feet (German), while the latter cannot convert into work the power of a fall of more than 50 feet. It is true that the ratio of effective work of turbines varies for different falls; for example, for small wheels it is less with high fall than with medium or low fall, because in this case the resistances are proportionally greater than with larger wheels under medium fall. On the other hand, overshot wheels obtain a modulus from high fall of from 20 to 40 feet, which cannot be reached by turbines. Equal amounts of work are to be expected from both kinds only from a medium fall of from 10 to 20 feet; but if the fall is low, then turbines in every case give a greater modulus than undershot wheels under the same conditions. Poncelet's wheel can be compared with turbines for falls of from 3 to 6 feet only.

Turbines have another great advantage over vertical water wheels, in working with equal effect under different heads, and especially in not being hindered by back water, so that they work in water as freely as in air, and in some cases with greater effect. Vertical wheels always lose power if the head varies, although in no great degree, unless the fall is low or the wheel is in the water.

On the other hand, variations in the overfall upon vertical water wheels are attended with less loss of work than is the case with horizontal wheels. In an economic point of view this fact is in favor of the vertical wheel. If it is necessary to increase the effect of a vertical wheel already in motion, especially if it is one upon which the water acts mainly by pressure, it is done by supplying more water; and to diminish the effect the supply is partly cut off; in neither case is the actual modulus greater or less. The relation is altogether different in the case of a reaction turbine. This works with most effect when the sluices are wide open and when the charge of water is the greatest; now if less work, and therefore less water, is required and the sluices are partially lowered, it happens that the work is diminished by decrease of supply, but partly by the loss of the living force of the water or by diminution of the head, so that the effective force is lessened. This destruction of living force may be compared with the braking or dragging of a wagon, which is applied in going down hill, when there is an excess of living force. Consequently, while the lowering of a gate only cuts off superfluous water from a vertical wheel, which can be used for other purposes, in the case of the reaction turbine the shutting off a part of the overplus subtracts from the living force of the other part remaining in the wheel.

In pressure turbines which do not run in water, so that the channels are not entirely filled, the modulus of work is more favorable, since the water issues through the channels without causing an eddy.

There is not a great difference between horizontal and vertical water wheels in respect to the change of the velocity of revolution; in both the normal velocity may be increased or decreased about one fourth without material loss of effect. But there is certainly a very great difference in the magnitudes of these velocities. All vertical wheels, with the exception of the undershot (Poncelet's especially), have a maximum velocity of from 4 to 10 feet, while turbines generally have far greater velocities, varying greatly according to the heads. For this reason, and because they have smaller radii, turbines generally make many more revolutions than vertical water wheels. It follows that the choice between these depends upon the number of revolutions; in other words, upon the kind of motion, quick or slow, which is required in the motor. But it must be borne in mind that rapid motion in a machine is rather injurious than advantageous, on account of the great increase of hurtful resistances, such as friction and shocks; for this reason it is often better to increase the number of revolutions by means of some machine of transmission, and to employ the vertical instead of the horizontal water wheel.

If the load of a machine is variable, as in the case of tilt-hammers or rolling-mills, the vertical wheel is to be preferred; for, though it runs slower, yet on account of its greater mass it acts more as a regulator than the turbine, whose variable motion must often be equalized by a fly wheel. But for a constant load preference must be given to the turbine in this respect; because vertical water wheels, especially if of wood, often have a so-called "heavy quarter," *i. e.*, equal parts of the circumference are not of equal weight.

In an economic point of view, turbines rank at least equal with vertical wheels; and for high and medium falls and a great overflow they are preferable because they are cheaper. In respect to durability, also, the turbine must have the preference.

On the other hand, it must be remembered that turbines require a clear overflow, and that their effect can be hindered in a very great degree by sand, mud, moss, weeds, leaves, pieces of ice, twigs of trees, etc., which do no damage to vertical wheels. Finally, it is to be considered that turbines, particularly those with guide-curves, are more difficult to construct, and that departures from the mathematical rules of construction are followed by worse results than in the case of vertical water-wheels. This is the reason that so many turbines failed in the early trials, and that they are not yet as extensively employed as their advantages warrant.

WHERE AND HOW CORKS ARE CUT.

We condense from the *Druggists' Circular* the present account of the way in which corks are manufactured.

In Europe the greater portion of corks are cut in the towns and hamlets in the immediate vicinity of the cork forests, and in the seaports of Seville, Barcelona, Oporto, Lisbon, Bordeaux, Lyons, Marseilles, and Gibraltar. In Germany the small homeopathic vial cork is largely cut, while it is safe to say that in most of the leading cities of the civilized world, cork-cutting is conducted as a branch of industry.

Throughout the whole cork-growing region the wood is cut by hand into the various sizes for use. For the common varieties, children are largely employed, while men of experience are engaged in cutting the finer qualities. After trimming the wood, slicing, and cutting into convenient-sized squares, the corks are cut, and then assorted in qualities and sizes. When assorted, they are then packed in bales varying from one hundred to three hundred and fifty gross each, and are then ready for shipment. In Germany they are frequently put up in small bails of twenty gross each. When cut in this manner the sizes must be judged by the eye, and there is consequently a lack of uniformity of size as well as imperfection in roundness of the corks. This will readily be seen by examining samples of imported hand-made corks.

Previous to 1855 all corks were cut by hand, and the exportation of corks from southern Europe was immense. Since the application of steam machinery to cutting corks in this country, the importation of fore gn h nd-made corks has rapidly declined.

About thirty years ago an attempt was made by an enterprising New Englander to cut corks by machinery, and an establishment for that purpose was constructed in Boston; but they failed to carry out the project successfully. As near as I could learn, the failure of the machine was in delivering the corks with smooth ends and with sufficient rapidity. In 1855 cork-cutting machines were constructed that proved successful, and since that time the trade has been revolutionized. It was soon proved that corks could be cut more uniform with less waste of material, and with vastly greater rapidity. An average day's work cutting by hand, and having the wood already cut to the proper-sized squares, would rarely exceed ten or twelve gross, though in a few cases the most expert workmen would cut nearly twenty gross; while an average day's work by machine would be one hundred gross, and a single instance was told me of a lad that had cut one hundred and eighty gross in ten hours. The number cut by machine per day will vary with the kind of machine, and the dexterity of the workmen, as also the quality of the wood. There have been quite a number of cork cutting machines introduced from time to time, but I believe they are all of two general styles. The kind most largely used (I believe) is the punching and boring machine, originally invented by J. D. & W. R. Crocker, of Norwich, Conn., and since improved by them and others. This original machine cut only straight corks. Another machine was afterwards added which cut the taper cork. There have been some modifications of the machine and adaptations by other manufacturers, but it is believed that the credit for introducing steam machinery for cutting corks is due to the Messrs. Crocker. There are others who are entitled to praise for judicious modifications, but the writer omits names lest he should do injustice to some whose names are not known to him.

The principles of the two styles of machines used may be of interest, and I shall endeavor to explain them as clearly as possible. In the punching or boring machine there is a sharp steel cylindrical knife, revolving horizontally, being propelled forward to the block of cork-wood to be cut, and backward again, as rapidly as the skill of the operator desires it. The knife cuts through the block of cork-wood, and the cork cut by the operation passes through the cylinder and is carried off out of the way of the operator. This machine cuts only a straight cork, and it is ready for sale without any further operation, except sorting out those in which the wood is imperfect. There is another boring machine which bores at one operation a taper cork, but requires a separate handling to remove the cork from the block. The tapering machine alluded to previously has either a square of cork-wood or the round straight cork inserted in an adjustable lathe (which is a part of the machine) in which it revolves rapidly; it is then presented to the blade of a flat circular knife, from 24 to 30 inches diameter, which lies flat and revolves about five or six hundred times a minute. Two or more revolutions of the cork are made, which removes a thin shaving and gives the requisite tapering shape to the cork. This tapering machine is adapted to cut either a straight or taper cork, as it needs only a very slight alteration of the adjustable lathe to cut either style of cork. There are some minor details, but a five minutes' examination of the machines would convey more information than pages of written description. It is an exceedingly interesting mechanical operation, and those who have not seen it should embrace an early opportunity to do so.

In cutting the wood into corks, it is first steamed for a short time, then by a circular knife cut into strips suitable for either the length or breadth of the cork. If the boring machine is used, the smooth side of the strips is then introduced, and the corks are at once bored out as closely together as can be done. The corks need only sorting, to reject imperfect ones, when they are ready for sale. These corks are straight. If it be a taper cork, the straight ones are now introduced into the adjustable lathe of the tapering machine before alluded to, and a somewhat conical shaving is taken off, when the corks are sorted and put up for sale. It is asserted by those using this machine, that it is the most advantageous and economical. When the boring machine is dispensed with, the strips of cork-wood are cut into suitable squares by hand, and at once cut into either straight or taper corks by simply adjusting the lathe which holds the cork.

The corks, when offered for sale, are usually designated by numbers from one to twenty, and in addition are called straight or taper. The largest number of any one sold are those suitable for ale and soda-water bottles, while the vial corks of various sizes, except the two smallest, are in nearly equal demand. Of the other styles of corks, there are flat or specie corks of various sizes, enlarging by one-eighth of an inch.

In the manufacture of corks fully one-third of the wood is wasted. This arises from inequalities and imperfections in the wood, and the natural wastage in cutting circles out of any plane surface. This wastage has found some uses, among which the principal are in filling cushions, mattresses, the spaces between the roof and top ceiling of houses, as also the spaces in the sides of frame houses and buildings for storing of ice, while in the cork factories the coarser wastage is used for fuel.

Foreign hand-cut corks are now in a great measure being superseded by American machine-cut corks, as they are much more uniform in size and quality, and can compete successfully in price.

NEW BOOKS AND 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, Gilding on Glass, and Coach Painting and Varnishing, Tests for the Adulteration in Oils, Colors, etc., and a Statement of the Diseases to which Painters are peculiarly liable, with the Best and Simplest Remedies. Thirteenth Edition. Revised, with an Appendix, containing Colors and Coloring—Theoretical and Practical, 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, Industrial Publisher, No. 406 Walnut street. Price, by mail, free of postage, $1·50.

How a work of this kind, containing such a copious mass of information, can be made and sold for the price it is afforded is one of the mysteries of book-making we are unable to solve. It is, without exception, the best and cheapest work of the kind of which we have any knowledge. The chapter on the "Principles of Harmony and Contrast of Colors" is well worth the price of the book. Were it studied by painters in general, we should have less of those hideous combinations of color, in house and ornamental painting, of which we have so often complained in these columns.

A MANUAL OF ELECTRO-METALLURGY. Including the Application of the Art to Manufacturing Processes. By James Napier, F.C.S. Fourth American from the Fourth London Edition. Revised and Enlarged. Illustrated by numerous Engravings. Philadelphia: Henry Carey Baird, Industrial Publisher, 406 Walnut street. Price, by mail, free of postage, $2·00.

This work treats of electro-metallurgy in both a scientific and practi manner. It is, as its title imports, a complete manual upon the subject. It commences with a history of the art, brought up to date. This is followed by a description of the various galvanic batteries, with their peculiaritie and their applicability to electro-metallurgic operation. The miscellan eous applications of the process of coating with copper are next treated, after which follow in their order discussions of the various methods of bronzing, deposition of metals upon one another, electro-plating, electro-gilding, results of experiments on the deposition of other metals as coatings, theoretical observations, etc. The value of the book is enhanced by a copious index. So far as we can infer from an examination made with special reference to detect omissions of recent processes and discoveries, the work is brought entirely down to the present state of the art.

MODERN WORKSHOP PRACTICE. As Applied to Marine, Land, and Locomotive Engines, Floating Docks, Dredging Machinery, Bridges, Shipbuilding, Cranes, etc., etc. By John G. Winton, Engineer. Strahan & Co., Publishers, 56 Ludgate Hill, London.

This is one of Weale's Rudimentary Series, intended to treat in a popular style, and in a practical manner, the departments of mechanical engineering named in its title. These subjects are viewed almost entirely from an English standpoint, yet the book contains much valuable information to the American engineer. A valuable feature of the work is found in its tables, the use of which will save much time and labor in calculations of all kinds pertaining to proportions of boilers and engines, bridges, etc.

ELECTRO-METALLURGY PRATICALLY TREATED. By Alexander Watt, F.R.S.A., Lecturer on Electro-Metallurgy, etc., formerly one of the Editors of "The Chemist." New Edition. Strahan & Co., Publishers, 56 Ludgate Hill, London.

This work, besides treating in a plain and specific manner with the difficulties and the various modes of procedure connected with electro-metallurgy, gives much additional matter not contained in former editions, upon the production of a dead white surface on silver articles, whitening brass dials, coloring gold articles, reduction of solutions, etc, etc. This work will be found a great aid, not only to amateurs, but to the profession al electro-metallurgist.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

601.—MANUFACTURING YARNS AND FABRICS CONTAINING HORSEHAIR.—H. Hayward, Paterson, N. J. March 1, 1870.

409.—SUBMARINE TELEGRAPH CABLES.—James Story, Paris, Ky. February 11, 1870.

424.—GENERATING GAS.—A. I. Ambler, Washington, D. C. February 12, 1870.

540.—MACHINERY FOR SPLITTING ROCKS.—John Robb, New York city. February 24, 1870.

544.—MACHINERY FOR MAKING NAILS.—D. Reed, R. M. Bassett, and T. S. Bassett, Birmingham, Conn. Feb. 24, 1870.

549.—STEAM BOILER AND ENGINES.—F. B. Blanchard, New York city. February 24, 1870.

550.—MANUFACTURE OF NEEDLES.—R. J. Roberts, New York city. Feb. 24, 1870.

551.—WINDMILLS.—Edward Savoral, New York city. February 24, 1870.

563.—MACHINERY FOR MANUFACTURING SCREWS.—J. A. Ayres, Hartford, Conn. February 25, 1870.

564.—MECHANISM FOR ACTUATING MACHINES.—C. H. Wilcox, New York city. February 25, 1870.

568.—MANUFACTURE OF HAIR CLOTH AND LIKE FABRICS AND LOOMS THEREFOR.—I. Lindsay, Pawtucket, R. I. February 25, 1870.

592.—SEWING MACHINES.—Charles Lennig, Philadelphia, Pa February 28, 1870.

636.—RAILWAY.—D. R. Pratt, Worcester, Mass. March 3, 1870.

676.—CARPET SWEEPER.—A. J. Hapgood, New York city. March 7, 1970.

605.—RAILWAY CARRIAGE WHEELS.—H. W. Moore, Jersey City, N. J., and F. Bloodgood, C. B. Wood, and F. Wood, New York city, March 1, 1870.

631.—FLUID METER.—J. F. de Navarro, New York city. March 3, 1870.

635.—JOURNAL LUBRICATOR.—W. A. Wood, Hoosick Falls, N. Y. March 3, 1870.

663.—DEVICE FOR HOLDING LETTERS, ETC.—F. T. Ferguson, Boston, Mass. March 5, 1870.

700.—ETCHING PLATES FOR PRINTING.—J. McLoughlin, Morrisania, N. Y., and E. McLoughlin, New York city. March 9, 1870.

709.—BURNING OIL FROM PETROLEUM.—J. A. Tatro, Hartford, Conn. March 10, 1870.

725.—TYPE-SETTING MACHINE.—J. T. E. Slingerland, New York city. March 11, 1870.

744.—WATER INDICATOR AND REGULATOR FOR BOILERS.—R. N. Pratt and R. Berryman, Philadelphia, Pa., and F. A. Pratt and S. Colt, Hartford, Conn. March 14, 1870.

Answers to Correspondents.

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

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

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

A. G. B., of Pa.—The effective horse power of steam engines is determined by the dynamometer. The absolute horse power, or indicated horse power, by multiplying the mean effective pressure in the cylinder, by the velocity of the piston in feet per minute, and dividing the product by 33 000. The nominal horse power of ordinary condensing engines is found by multiplying the square of the diameter of the cylinder in inches by the velocity of the piston in feet per minute, and dividing the product by 6,000. In the application of this rule, the speed of piston is fixed according to the length of stroke, that is, the speed for a 2 feet stroke is assumed to be 160 per minute, and speeds for other lengths of stroke to be to this speed as the cube roots of their lengths. Nominal horse power is only a conventional expression for the measure of the dimensions of an engine. It does not give any idea of the actual power of which the engine is capable. The Richards Steam Indicator is the best instrument for testing the power of steam engines.

S. H. W., of Conn.—It is evident that your logic is not able to draw any distinction between the statement that matter moves, and your own statement that it moves itself. You will doubtless admit that the earth moves constantly in its orbit. Because you make that admission, we shall not consider it legitimate to charge you with believing that *it moves itself*. You admit the existence of matter, which admission of course allows the existence of the essential properties of matter. What violence is done to just logical inference by supposing that matter was originally endowed with motion, as it was endowed with impenetrability? Such a supposition does not imply self-creation, or power to endow itself with motion, as you illogically assert.

O. S. M., of Va.—The protection afforded against the injurious effects of white lead in grinding would at best, we think, be so partial as not to render it of great practical value. The injury resulting from this substance has been much reduced by modern modes of manipulation. There is no other harmless white pigment known, that could be generally used as a substitute for lead and zinc white. Oxide of zinc, however, is now largely used as less injurious than white lead, and not turning black by the action of sulphureted hydrogen.

H. W. S., of Ohio.—According to Dalton's investigations, it appears that when different gases are mixed, they only act mechanically to retard each other in their occupation of a given space. Thus, if a gallon of oxygen be placed in a jar, a gallon of any other gas that will not chemically combine with it may be introduced into the same jar, and still a third gallon of some other gas, etc. The experiment could not be performed with air and oxygen, as air contains oxygen.

S. & S., of Ohio.—Much obliged for the club of subscribers you have obtained among the workmen in your establishment. Similar efforts on the part of heads of other establishments, would, without doubt, result in mutual benefit. Your first query is answered at length in an article on "Mean Effective Pressure," which will shortly appear. Friction is a variable quantity even in the best constructed engines. No two will agree in this particular.

M. C., of Mass.—Carbonic oxide gives out but a small proportion of heat in its combustion, compared to that produced by the burning of carbon. We do not think it could be applied to brazing, etc., with advantage, and never heard of its being specially prepared to be used as fuel. In ordinary coal stoves a certain amount is generated, which is consumed in those stoves known as gas-burners.

A. P., of N. Y.—The mixture named would not injure leather in any way. On the contrary, we think it would undoubtedly act to preserve it. The different materials have been used, but we do not think they have all been used in a similar combination. We judge the mixture is patentable. Sugar cannot be made in the way you propose.

E. G. S., of Minn.—Water inevitably hardens in a new cistern lined with water-lime cement. You may soften it by adding a little quick-lime in the form of milk of lime, see article on page 217, Vol. XXI., of the SCIENTIFIC AMERICAN.

W. M. L., of Pa., wishes a solution of the following problem. Given the length of belt, distance between the centers of two cone pulleys, and *ratio* of their diameters to determine the diameters.

C. B. F., of Brockport, N. Y., will find the information he desires in the Encyclopedia Britannica, Vol. XVI., page 54; also, by a visit to the Morris & Essex canal at Rockaway and other points.

J. M. E., of Pa.—What is generally understood by the term atmospheric engine, is one in which the piston is actuated by steam on one side and air on the other.

B. C., of N. H.—A gas, or mixture of gases, absorbs as much heat in expanding after compression, as it evolves when compressed.

A. F. H., of W. Va.—The metallic appearance of the mineral you send is due to the presence of iron pyrites.

Recent American and Foreign Patents.

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

SCROLL SAWING MACHINE.—Eliphalet A. Tripp, Newark, N. J.—This invention has for its object to furnish an improved scroll-sawing machine simple in construction, easily and conveniently operated, and effective in operation.

WASHING MACHINE.—James D. Royse and John Royse, Cane Valley, Ky.—This invention has for its object to furnish an improved washing machine simple in construction, strong, and durable, which will not rub the clothes and which will, at the same time, wash them quickly and thoroughly.

COTTON SEED AND CORN PLANTER.—Joshua B. Godwin, Williamston, N. C.—This invention has for its object to furnish a simple, convenient, effective, and accurate machine for planting cotton seed and corn, which shall be so constructed and arranged that it may be easily adjusted for work in either capacity.

TIN CAN.—John Joseph Burkert, New York city.—This invention has for its object so to construct the covers and fastenings of sheet-metal cans, that such covers, after having been cut open, shall not have become entirely useless.

MONEY SAFE.—Philipp Schreyer, New York city.—This invention relates to a new manner of constructing iron safes, and to a novel method of applying the same to articles of furniture. The invention consists in so constructing a safe of an outer and inner metal case, that the two cases are only connected by a bolt or bolts, passing through their bottoms, no other fastening being required. The invention consists, also, in constructing such safes so that they can be applied as supports or central standards to tables.

PICTURE NAIL.—John H. Squiers and Ezra J. Warner, Newark, N.J.—This invention relates to a new device for fastening the porcelain knobs to the ends of nails or screws, which are used for suspending pictures, and for other purposes. The invention consists in the application of wire-spring fastenings to the porcelain knobs or heads, the springs being so formed as to catch readily over the heads of the nails or screws, to which they are to secured.

MULTIPLE SPONGE.—Hamilton Erastus Smith, Newark, N. J.—The object of this invention is to make small sponges more useful, and to increase their value. At present, large sponges, such as are used for washing coaches, etc., are very expensive, the value increasing with the size, while small sponges are comparatively useless. This invention consists in uniting a suitable number of small pieces of sponge into one large sponge by means of fastening devices, which are entirely concealed. The entire sponge surface of this multiple sponge is, therefore, applicable to use.

COMBINED COUNTER AND SHOWCASE.—L. F. Vienot, New York city.—The object of this invention is to reduce the cost of counters and show cases by combining them, and thereby saving the expensive counter tops.

PHOTOGRAPHIC PRINTING APPARATUS.—J. H. Hamilton, Sioux City, Iowa.—This invention relates to improvements in apparatus for making mezzotint photographs, and consists in the employment of a large box containing several square tubes, and supported on pivots, in a frame mounted on casters, so that it may be adjusted in vertical and horizontal planes to cause the tubes to receive the rays of light from the sun in the lines of their axis at all times and so as to fall on the negative perpendicular to it, the negative with the printing frame being placed at the bottom of the tubes.

TUG FASTENING FOR WHIFFLETREES.—L. A. Johnson, Candor, N. Y.—This invention relates to improvements in fastenings for connecting the tugs to whiffletrees, and consists in the combination with the tug hooks projecting from the ends of the whiffletree, of slides preferably arranged in grooves in the rear sides of the whiffletrees to slide forward and back, and having bent up ends provided with holes coinciding with the ends of the hooks to receive the said ends when slided inward to prevent the escape of the tug, and strengthen the said hooks. The said slides are provided with spring stops, which hold them in the open position for the reception of the tugs, or in the closed position for retaining them.

SAW PITMAN HEAD.—L. Morrison and A. G. Harms, Allegheny City, Pa.—The object of this invention is to simplify and render more convenient the mechanism connected with a muley saw, having more especial reference to the pitman head, but applying also to the buckle of the saw; and it consists in the method of adjusting the rivet pin of the pitman head, and in the construction of the buckle of the saw.

COVERING FOR STEAM BOILERS, STEAM PIPES, ETC.—James E. Sharp, Eleazer Ainsworth, and F. A. Sabbaton, Troy, N. Y.—This invention relates to a new and useful improvement in the mode of protecting steam boilers, steam pipes, or other articles from the effects of cold air, preventing thereby the condensation of steam and loss of heat.

COLUMNAR MATTRESS.—H. E. Smith, New York city.—This invention has for its object to furnish an improved mattress, which shall be so constructed that the air may pass through it freely to keep it pure; and which shall at the same time, be very elastic and comfortable as a bed.

ROCK DRILL.—Samuel Lewis, Williamsburg, N. Y.—This invention has for its object to improve the construction of an improved drill, patented June 15, 1869, and numbered 91,332, so as to make it more convenient in use and more effective in operation, enabling the length of stroke to be regulated at will, and any one of the drills to be raised and detached without disturbing the operation of the other drills.

KNIFE SCOURER.—J. Q. Adams and S. R. Goodsill, Brooklyn, N. Y.—This invention relates to a new and convenient improvement for cleaning and scouring the blades of table knives. The invention consists in the use of a cylindrical box, which has a perforated bottom and is combined with an annular cork, secured against the bottom.

WOOD PULP MACHINE.—S. C. Taft, Mendon, Mass.—This invention relates to a new machine for reducing wood to a pulp, to prepare it for the manufacture of paper.

STEAM GENERATOR.—Michael Ritchey, Paterson, N. J.—This invention relates to a new steam generator, which is so constructed that the water, before it enters the steam boiler, will be thoroughly heated, and that, when the pumping ceases, a complete circulation may be kept up in the same.

TONGUEING AND GROOVING MACHINE.—B. J. Barber, Ballston Spa, N. Y.—This invention relates to a new manner of arranging the cutters on the heads of tongueing and grooving machines, with a view to preventing the tearing of the wooden fiber, and the consequent cracking of the wood, which is frequently occasioned on the ordinary machines now in use.

EASY CHAIR.—William Charles Poppendieche, New York city.—This invention relates to a new adjustable easy chair, which can be so set and adjusted that its back and foot rest will be more or less inclined, and the arm rests extended, at the will of the person using it.

COMBINATION TOOL.—W. A. Sharp, Tama City, Iowa.—This invention comprises the combination in one tool, of a sliding hook, or gage, level plumb, compass, callipers, try square, bevel, foot rule, edging plane, rabbet plane, screw driver, tape measure, and marking gage.

COUNTERSINKS.—Asa Wheeler, Brattleboro, Vt.—This invention relates to countersinks, and in the mode of making them. The bit is formed in the shape of a hollow eccentric cone, with an angular slot at the line from the point to the base of the cone, where the sides of the parts with the greater and lesser radii meet. The base of the bit is united to the handle by a section representing about half, or a little more than half a cone, having its base connected to the inverted base of the bit.

MACHINE FOR STAMPING LACE PAPER.—Ambroise Giraudat, New York city.—This invention relates to a new machine for stamping lace paper either in long strips or circular pieces, and has for its object to do away with the ordinary tedious manual process, and to permit the employment upon the same piece of a number of hammers. Thereby the process of stamping will be greatly facilitated, and less labor required for the purpose.

HAND DRILLING MACHINE.—James E. Hunter, North Adams, Mass.—This invention relates to a new and useful improvement in hand drilling machines, whereby the same are adapted to all the various purposes for which hand drills are used; and it consists in so constructing and arranging the parts that the drill may be used as a ratchet drill, with an intermittent motion, or with a continuous crank motion, and so that the drill head may adjusted to drill holes at any angle.

STRAW CUTTER.—John S. Jones, Covington, Ind.—This invention has for is object to improve the construction of straw cutters, so as to make them more convenient and effective in use, enabling them to cut the straw or nay entirely off, and to feed the said straw or hay forward automatically.

SHOVEL HANDLE.—George C. Choate, Wyoming Station, Wyoming Territory.—This invention has for its object to furnish an improved shovel handle, which shall be so constructed and arranged that its end may be used as a tamping iron, or rammer, in leveling and raising railroad ties, in setting fence posts and telegraph poles, and for other purposes where a shovel and rammer are both required.

MOPS, MATS, WIPING CUSHIONS, ETC.—Hamilton Erastus Smith, Newark, N. J.—This invention has for its object to make sponge applicable to the rough usage which mops, mats, wiping pads, or cushions, or similar articles are subjected. The extreme porosity of the sponge makes the same particularly useful for the purposes of absorbing moisture the weakness, however, has thus far disqualified it for the rough usage, as thereby it would be too rapidly destroyed. The invention consists in strengthening the sponge by inclosing it in porous fabric, whereby it will become durable without losing its porous quality.

CLOTHES WRINGER.—Allen Magowan, Trenton, N. J.—This invention relates to improvements in clothes wringers, and consists in an improved arrangement of the pressure springs in connection with the sliding roller. Also in an improved arrangement of the support for the brackets holding the set screws by which the wringer is attached to the tube, or other support.

BELT SHIFTER.—W. E. Leighton, Pembroke, Ill.—This invention relates to improvements in belt-shifting apparatus, and consists in the application to the belt of a pair of clamping pulleys or rollers capable of clamping the belt between them, and of being turned obliquely to the line perpendicular to that of the belt either way, whereby the belt will be caused to move laterally, either to the right or left, as the said clamping pulleys are turned.

TYPE FOR PRINTING "TYPE RIBBON."—Henry Stephenson, William Thompson, and Wm. G. Blake, Sheffield, England.—This invention relates to a new and improved arrangement of type, whereby "type ribbon," so called, may be printed in various forms by type set up in forms the same as printing type. Th invention consists in a set of type of peculiar construction, which, when arranged together in a form, and with a thick and a thin brass or other metal rule, will represent the reverse of a design of "type ribbon," that is, a ribbon arranged in space and folded back and orth so as to present two or more rows of plain surfaces, with intervals between, one above another, with diagonal parts between the rows and terminating with waving ends, on which plane surfaces advertisements may be printed by ordinary printing type set up the forms with these improved type.

STREET CAR.—James A. Morrison, Brady's Bend, Pa.—This invention relates to improvements in street cars, and consists in an improved arrangement of means for applying hand-power for propelling them; also in an improved application of track-sweeping or clearing apparatus.

TUBE WELLS.—William R. Hamilton, Oakland, Pa.—This invention consists of semi-elliptic springs attached lengthwise, by means of sliding rings to the tubings of an artesian well, for the double purpose of steadying the tubing in the well, and sustaining, by their pressure against the sides of the oore, part of the weight of the tubing; and further in combining with the tubing, a pipe passing vertically downward for the purpose of conveying hot water to the bottom of the well in order to melt the thick oleaginous matter which always collects there and obstructs the lower orifices of the tubing.

MANUFACTURE OF ICE AND THE REFRIGERATION OF AIR AND SUBSTANCES.—D. L. Holden, New Orleans, La.—This invention relates to the manufacture of ice, and refrigeration of air by means of cold produced by the vaporization of chimogene, or other volatile hydrocarbon, in a vacuum, the vapor drawn off in the production of the vacuum being returned to the receptacle again in a liquified form.

SAW-FILING CLAMP.—Platt Merrill, Port Sanilac, Mich.—This invention elates to a new and useful device for holding saws in the process of filing them, whereby files as well as much time and annoyance is saved.

WASHING MACHINE.—Hamilton Erastus Smith, Newark, N. J.—The object of this invention is to provide a rotary machine for washing large quantities of clothes by the employment of a washing cylinder within which the clothes are contained.

CORN PLOW.—M. C. Buffington, La Harpe, Ill.—This invention consists of certain improvements in the construction and management of parts of corn plows.

CONTINUOUS SELF-FEEDING COTTON GIN.—Jules Alfred Chaufourier, New York city.—This invention relates to improvements in machinery for ginning cotton, by means of which a continuous and self-acting feed is obtained. The machine is of simple construction, and is arranged so as to prevent breakage of the fibers of cotton, and does not require and particular attention; one man may easily manage several machines at one time.

UNITED STATES SUPREME COURT.

The United States ex rel. A. O. Bourn vs. Charles Goodyear, Executor.—Appeal from the Circuit Court for the Southern District of New York.

This suit is commenced in the name of the United States for the purpose of setting aside the Goodyear patent on the ground of fraud in the procurement of its extension; and the question presented is, whether the alleged fraud in the procurement of the extension can be investigated and the patent canceled and declared void, in a proceeding instituted in the name of the United States, at the relation of one of its citizens directly for that purpose.

It has been decided in other branches of the Goodyear patent litigation that a patent or the extension of a patent cannot be attacked in any collateral proceedings, except in certain cases provided for by the act of 1836.

A demurrer was interposed below in this case, on the grounds of want of equity in the relation, want of jurisdiction of the subject matter, the Statute of Limitations, and the expiration of the term of the patent before commencement of suit.

The demurrer was sustained *pro forma* without argument, and an appeal taken to this Court.

The appellee insists, that as the appellant consented to the making of the decree appealed from, he is precluded from questioning it, or reviewing it by appeal. After presenting at length the points of the demurrer, it is submitted that the law makes the Commissioner of Patents the judge of the merits of the application for the extension. The relator concedes that the Commissioner is judge, except in cases of fraud, and contends that in such a case the Courts have jurisdiction to set aside the patent so obtained. It is urged that as the action is brought to declare void the patent, and not to review the action of the Commissioner, in any manner, the Statute of Limitations does not apply.

Injury in his business, suffered by the relator, it is submitted, sufficiently qualifies him as a party complainant in the suit. As to the expiration of the patent, it is alleged it has not expired in point of fact; but, if it had, the argument is, if the extension was fraudulent, it was void *ab initio*, and is as though it had not issued. All that can grow out of it, or come from it, is tainted with fraud.

The expiration of the term cannot prevent the patentee from recovering unpaid bounties and tariffs, or damages for infringement. Yet if the extension was obtained fraudulently, all these claims of the patentee are wholly unfounded, and his right to recover anything absolutely gone.

J. H. Parsons, A. Payne, and Caleb Cushing for appellant; E. W. Stoughton and Wm. E. Curtis for appellee.

James C. Stimpson vs. Charles T. Woodman.—Error to the Circuit Court for the District of Massachusetts.

This was an action to recover for the infringement of a patent to Woodman for an improvement in ornamenting leather. The description filed contained two distinct claims. One pertaining to raising the table so as to produce certain contact between the roller and the bed on which the skin rests when the pebbled impression is made. The other consists in combining a short metallic roller, having the required figure engraved upon its periphery with the propelling and operating machinery whereby the roller at the end of the radial arm is brought in contact with the table of a curvature corresponding to the arc described by the roller in its vibrations on which the leather is placed for pebbling, and is rolled over the leather with suitable pressure to produce the required impression.

The defense was, that long prior to Woodman's invention the pebbling roller was a well-known currier's tool, effectively used in hand devices and leather-finishing machines, interchangeably with other figuring tools; that Woodman's machine was fully anticipated by the machine of one Green, which had been used to operate not only non-rotating figured cylindrical tools, but a rotating cylindrical tool differing from the pebbling roller only in having a smooth instead of a figured surface; that the introduction of the pebbling roller into the Green machine was not a matter of invention, but of common knowledge and skill, and that the machine of Stimpson is substantially the same as the Green machine.

Under the charge of the Court the verdict was for Woodman, and the plaintiff in error brings the case here, contending that the introduction of an old mechanical device into an old machine, in the same mode, and for the same purpose that it had been previously introduced into an analogous machine, is not a patentable novelty; and that, viewed as a combination of old elements, it is no' new within the meaning of the patent law, and that viewed as a process or mode of operation, it is only what is known in law as a double use of the device on the one hand, and of the machine on the other, and therefore not the subject of a valid patent. It is contended, therefore, that the Court should have submitted to the jury the questions whether the pebbling roller itself was old, and had been used in prior machines; whether the other machinery, apart from the pebbling roller, was not old, and whether the mode of introducing the pebbling roller was not substantially the same as in prior machines, and was within the common knowledge and skill of mechanics; and it is claimed that had these questions been found in the affirmative, then under the rulings of the Court, as matter of law, the claim of the patent must have failed.

B. R. Curtis and George L. Roberts for the plaintiff in error; T. L. Wakefield, for the defendant.

Official List of Patents.

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FOR THE WEEK ENDING April 12, 1870.

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101,698.—KNIFE SCOURER.—J. Q. Adams and S. R. Goodsell, Brooklyn, N. Y.
101,699.—DOOR BELL.—Wm. Allport, New Britain, Conn.
101,700.—STREET SPRINKLER.—J. A. Bancroft, Worcester, Mass., assignor to L. F. Bancroft and Andrew B. Yetter, New York city.
101,701.—CUTTER HEAD FOR PLANING MACHINE.—B. J. Barber, Ballston Spa, N. Y.
101,702.—TRUCK FOR MOVING BUILDINGS.—Jesse Barlow, Van Meter, Iowa.
101,703.—INKING APPARATUS.—Henry Barth, Cincinnati, Ohio.
101,704.—FIRE KINDLER.—Charles Batcheller, Des Moines, Iowa.
101,705.—HAY LOADER.—J. M. Boorman, Scarborough, N. Y.
101,706.—CORN PLOW.—M. C. Buffington, La Harpe, Ill.
101,707.—TIN CAN.—J. J. Burkert, New York city.
101,708.—APPARATUS FOR SEALING PIPE JOINTS.—William Cassidy, New Bedford, Mass.
101,709.—SELF FEEDING COTTON GIN.—J. A. Chaufourier, Paris, France.
101,710.—ROTARY SPADER.—James Chenoweth, Shelbyville, Mo.
101,711.—SHOVEL HANDLE.—G. C. Choate, Wyoming Station, Wyoming Territory.
101,712.—CLOTHES DRYER.—J. V. Clark, Camden, N. J.
101,713.—FANNING MILL.—Barnard Cortrite, Norwalk, Ohio.
101,714.—WASHING MACHINE.—W. H. Cox, Knox county, Ill.
101,715.—SASH HOLDER.—T. H. Davis, St. Joseph, Mo. Antedated April 6, 1870.
101,716.—MOP HEAD.—Hezekiah Dodge, Albany, N. Y. Antedated April 4, 1870.
101,717.—EARTH CLOSET.—J. A. Drake and W. R. C. Clark, New Orleans, La.
101,718.—BASE BURNING STOVE FOR A STEAM HEATING BOILER.—W. B. Dunning, Geneva, N. Y.
101,719.—HARVESTER.—Rudolf Eickemeyer, Yonkers, N. Y.
101,720.—SULKY CULTIVATOR.—Frank Farnsworth, Frankfort, Ill.
101,721.—CORN HARVESTER.—Henry Flesher, Springfield, Ill.
101,722.—HAIR MEDICINE.—A. J. Fletcher, Red Bluff, Cal.
101,723.—LAMP.—S. W. Fowler, Brooklyn, N. Y.
101,724.—CAR SPRING.—Carlos French, Seymour, Conn.
101,725.—WATER WHEEL.—J. L. Frisbie, Hillsdale, Mich.
101,726.—SWIVEL FOR TEMPER SCREWS.—Thomas Graham, Samburg, Pa.
101,727.—WASHING MACHINE.—John A. Hall, Newburg, Canada.
101,728.—PHOTOGRAPHIC PRINTING APPARATUS.—James H. Hamilton, Sioux City, Iowa.
101,729.—DITCHING PLOW AND HEDGE GRADER.—Daniel Harmon, Coles County, Ill.
101,730.—CORK-CUTTING MACHINE.—E. F. Harrington, Boston, assignor to himself and John I. Munroe, Woburn, Mass.
101,731.—POTATO SEPARATOR.—Richard Haviland (assignor to himself and Charles Ware), North Branch, Md.
101,732.—MACHINE FOR COLORING PAPER HANGINGS.—John Heist (assignor to himself, C. Zink, and H. Spoehrer), New York city.
101,733.—HEATING STOVE.—M. C. Hull, New York city.
101,734.—PICKER FOR LOOMS.—Joshua Hunt and Albert Stockwell, Providence, R. I.
101,735.—APPARATUS FOR EXTRACTING MADDER.—James Hunter, Philadelphia, Pa.
101,736.—MACHINE FOR SEPARATING FLOUR FROM BRAN.—W. W. Huntley and Alpheus Babcock (assignor to W. W. Huntley and Frank Swift), Silver Creek, N. Y. Antedated February 22, 1870.
101,737.—MANUFACTURE OF GLASS.—C. H. Jenkins, Boston, Mass.
101,738.—TUG-FASTENING FOR WHIFFLETREE.—L. A. Johnson, Candor, N. Y.
101,739.—VIBRATING COLTER FOR PLOWS.—J. S. Johnston, Rockford, Ill. Antedated April 1, 1870.
101,740.—FAN ROCKING-CHAIR.—Geo. R. G. Jones, Memphis, Tenn.
101,741.—STRAW CUTTER.—J. S. Jones, Covington, Ind.
101,742.—TREMOLO ATTACHMENT FOR REED OR PIPE ORGANS.—Michael J. Kerigan, Boston, Mass.
101,743.—SPLINT FOR FRACTURED LIMBS.—George S. King, Washington, D. C.
101,744.—SINK APPARATUS FOR DRAINING CELLARS.—Adam Knacker, Meadville, Pa.
101,745.—BELT SHIFTER.—W. E. Leighton, Pembroke, Me.
101,746.—ROCK DRILL.—Samuel Lewis, Williamsburg, N. Y.
101,747.—STEAM ENGINE.—G. E. Long, Harrisburg, Pa.
101,748.—LAMP.—E. E. Lyon, Worcester, Mass.
101,749.—CLOTHES WRINGER.—Allan Magowan, Trenton, N. J.
101,750.—MACHINE FOR CORRUGATING SHEET METAL.—Wm. Mann, Newcastle, Pa.
101,751.—RAILWAY.—E. G. Markley, Sunbury, Pa.
101,752.—HORSE HAY RAKE.—R. W. McClelland, Springfield, Ill. Antedated April 4, 1870.
101,753.—RAILROAD CAR STOVE.—Samuel Meredith (assignor to himself, John Wood, and C. B. Dodd), West Philadelphia, Pa.
101,754.—SAW CLAMP.—Platt Merrill, Port Sanilac, Mich.
101,755.—RAILWAY CAR SEAT.—Ezra Miller, New York city.
101,756.—FEED-WATER REGULATOR AND LOW-WATER ALARM.—A. W. Morrell, Niles, Mich.
101,757.—TRACK CLEARER FOR STREET CARS.—J. A. Morrison, Brady's Bend, Pa.
101,758.—TABLE FOR CHANGING GAGE OF RAILWAY CAR TRUCKS.—G. F. Morse, Portland, Me.
101,759.—GRAIN DRYER.—I. Y. Munn, Chicago, Ill.
101,760.—CIRCULAR SAW MILL.—Peter Neeb, Buffalo, N. Y. Antedated April 5, 1870.
101,761.—TANK FOR STORING OIL.—Person Noyes, Lowell, Mass.
101,762.—BOILER FEEDER.—S. J. Parker, Williamsport, Pa.
101,763.—MACHINE FOR BURRING AND CLEANING WOOL, ETC.—Ziba Parkhurst, Milford, Mass.
101,764.—EASY CHAIR.—W. C. Poppendieche, New York city.
101,765.—GATE.—Fitch Raymond, Cleveland, Ohio.
101,766.—PLOW FEEDER.—Joseph Richardson, Ballston Spa, N. Y.
101,767.—STEAM GENERATOR.—Michael Ritchey, Patterson, N. J.
101,768.—WASHING MACHINE.—J. D. Royse, and John Royse, Cane Valley, Ky.
101,769.—STREET LAMP.—W. G. Schmidlin and J. W. Driscoll, New York city.
101,770.—MONEY SAFE.—Philipp Schreyer, New York city.
101,771.—REGULATING DEVICE FOR GAS BURNERS.—Henry Schultz), assignor to himself and Henry C. Bentley), Milwaukee, Wis.
101,772.—STORE AND HOUSEHOLD GRAPPLE.—John Seltzer, Philadelphia, Pa. Antedated March 28, 1870.
101,773.—IMPLEMENT.—W. A. Sharp, Tama City, Iowa. Antedated April 7, 1870.
101,774.—TUBULAR WELL.—J. Shaw, Bridgeport, Conn. Antedated April 4, 1870.
101,775.—ROOFING TILE.—George Shove, Yarmouth Port, Mass.
101,776.—MULTIPLE SPONGE.—Hamilton E. Smith, Newark, N. J.
101,777.—MOP, MAT, AND WIPING CUSHION.—H. E. Smith, Newark, N. J.
101,778.—WASHING MACHINE.—H. E. Smith (assignor to Mrs. Mary Jane Smith), Newark, N. J.
101,779.—MECHANISM FOR OPERATING THE FEEDING WHEEL IN SEWING MACHINES.—Friedrich Spoehr, Philadelphia, Pa.
101,780.—APPARATUS FOR MOVING THE CARS.—E. Springer, Davis, Ill.
101,781.—PICTURE NAIL.—J. H. Squier and E. J. Warner, Newark, N. J.
101,782.—VENEER CUTTER.—William Steele, Sistersville, W. Va.
101,783.—MANUFACTURE OF SUGAR AND ALCOHOL FROM LICHENS.—Sten Stenberg, Stockholm, Sweden.
101,784.—MILK CAN.—A. Sunderland, Madison, Ohio.
101,785.—WOOD PULP MACHINE.—Stephen C. Taft, Mendon, Mass.
101,786.—PAPER FOR CHECKS, DRAFTS, NOTES, ETC.—G. F. Thomae, Jr., Brooklyn, N. Y.
101,787.—DUST ARRESTER FOR RAILROAD CARS.—W. M. K. Thornton, Rolla, Mo.
101,788.—SCROLL-SAWING MACHINE.—E. A. Tripp, Newark, N. J.
101,789.—FRUIT AND EXTENSION LADDER.—Melzer Tuell (assignor to himself, Lewis D. Young, and B. F. Fenner), Penn Yan, N. Y. Antedated April 9, 1870.
101,790.—COUNTER AND SHOW CASE.—L. F. Vienot, New York city.
101,791.—RAILWAY CAR BRAKE.—Edward P. Vining, Grand Rapids, Mich.
101,792.—PISTON PACKING.—Ellery A. Walker, Hyannis Mass.
101,793.—COAL DIGGING APPARATUS.—William Ward Pittsburgh, Pa.
101,794.—SHIRT BOSOM AND WRISTBAND COMBINED.—E. H N. Warner, New York city.
101,795.—GRATE BARS FOR STEAM GENERATORS.—Marshall D. Wellman, Allegheny county, Pa.
101,796.—COUNTERSINK.—Asa Wheeler (assignor to Geo. B. Wheeler), Brattleborough, Vt.
101,797.—DISH STAND.—H. C. Wilcox, West Meriden, Conn., assignor to Woods, Sherwood & Co., Lowell, Mass.
101,798.—SLATE FRAME.—W. A. Wilde, Malden, Mass.
101,799.—STOVEPIPE SHELF.—Joseph W. Wilder, Leominster Mass.
101,800.—MACHINE FOR TWISTING AND CURLING HAIR.—P Wisdom, Brooklyn, and J. H. Wilcox, New York city.
101,801.—Chas. B. Withington.—Suspended.
101,802.—ROCKER FOR CHAIRS.—Wilhelmina J. Zakrzewska Berlin, Prussia.
101,803.—PADLOCK.—A. M. Adams, Washington, D. C.
101,804.—WOODEN BOX.—Olif Abell, Wolcott, Vt.
101,805.—WOODEN BOX.—Olif Abell, Wolcott, Vt.
101,806.—APPARATUS FOR LIGHTING AND EXTINGUISHING GAS.—A. N. Allen and R. H. Dewey, Pittsfield, Mass.
101,807.—OIL CUP.—A. C. Ancona, Evansville, Ind.
101,808.—ATTACHING KNOB TO SPINDLES.—M. Andrew, Melbourne, Colony of Victoria.
101,809.—CORN HUSKER.—L. Augustus Aspinwall, Albany, N. Y.
101,810.—CHURN.—Mahlon B. Atkinson, Georgetown, D. C.
101,811.—CLOTH-STRETCHING MACHINE.—Solomon H. Austin, Providence, assignor to W. J. Austin, Smithfield, R. I.
101,812.—APPARATUS FOR TANNING BY INFILTRATION.—J. G. Baker, Wilmington, Del.
101,813.—STAND FOR TEA AND COFFEEPOTS.—J. H. Bigelow Worcester, Mass.
101,814.—AUTOMATIC RELIEF VALVE.—A. M. Black, Providence, R. I.
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101,966.—Beer Faucet.—Felix Manz, Allegheny City, Pa.

REISSUES.

3,910.—Railroad Car Ventilator.—H. D. Carroll, Robert Hitchcock, and J. H. Hare, Springfield, Mass., assignees of Robert Hitchcock.—Patent No. 67,877, dated August 20, 1867.
3,911.—Machine for Making Needles.—C. O. Crosby, of New Haven, Conn.—Patent No. 51,150, dated November 28, 1865.
3,912.—Straw Cutter.—Warren Gale, of Peekskill, N. Y., and B. B. Belcher, of Chicopee Falls, Mass., assignees of Warren Gale.—Patent No. 31,001, dated December 18, 1860; reissue 1,977, dated May 30, 1865; reissue 2,127, dated December 19, 1865
3,913.—Seeding Machine.—F. H. Manny, of Rockville Ill., assignee of Wm. Workman.—Patent No. 28,934, dated June 26, 1860.
3,914.—Trace Holder—J. B. North & Co., of New Haven, Conn., assignees of Stephen Stout.—Patent No. 78,154, dated May 19, 1868.
3,915.—Sash Fastener.—The Judd Manufacturing Company, New Haven, Conn., assignees of Morton Judd.—Patent No. 39,032, dated June 30, 1863.
3,916.—Felting Machine.—J. T. Warring, of Yonkers, N.Y., assignee of Rudolph Eickemeyer.—Patent No. 87,763, dated March 16, 1869.
3,917.—Street Sprinkler.—L. F. Bancroft, of Worcester, Mass., and A. B. Yetter, of New York city, assignees of L. F. Bancroft.—Patent No. 53,557, dated April 3, 1866.
3,918.—Wrench.—Loring Coes, of Worcester, Mass., assignee of G. C. Taff.—Patent No. 88,230, dated March 23, 1869.
3,919.—Railway Car Wheel.—Gustavus Natorp, of New York city.—Patent No. 83,722, dated November 23, 1868.
3,920.—Converting Iron into Steel.—The Barron's Patent Steel Manufacturing Company of New York city, assignees of Thomas J. Barron.—Patent No. 60,823, dated January 1, 1867.

DESIGNS

3,963.—Adjustable Counting-House Calendar.—S. S. Coe, Cleveland, Ohio.
3,964.—Knitted Fabric.—Thomas Dolan, Philadelphia, Pa.
3,965 and 3,966.—Stocking Fabric.—Thomas Dolan, Philadelphia, Pa.
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3,971.—Blotting Pad.—James S. Bryant, Hartford, Conn.
3,972.—Ornamenting Glass Ware.—Stephen Hipkins, Jr., (assignor to the Belmont Glass Works), Bellaire, Ohio.

EXTENSIONS.

Method of Cooling and Ventilating Rooms.—Azel S. Lyman, New York city.—Patent No. 14,510, dated March 25, 1856.
Shirt Collar.—Polly Hunt, Jersey City, N. J., and Geo. W. Hunt, Newburgh, N. Y., administrators of Walter Hunt, deceased.—Patent No. 4,376, dated July 25, 1854; reissue No. 1,828, dated November 29, 1864.
Head and Tail Blocks for Saw Mills.—E. H. Stearns, Erie, Pa.—Patent No. 14,700, dated April 15, 1856.
Pressure Bells.—M. L. Barton and C. A. Buell, Chatham, Conn., administrators of Jason Barton, deceased.—Patent No. 14,593, dated April 8, 1856; reissue No. 1,798, dated October 25, 1864.
Culinary Boilers.—Edward Whitely, Cambridge, Mass.—Patent No. 14,632, dated April 8, 1856; reissue No. 9,038, dated July 28, 1868.

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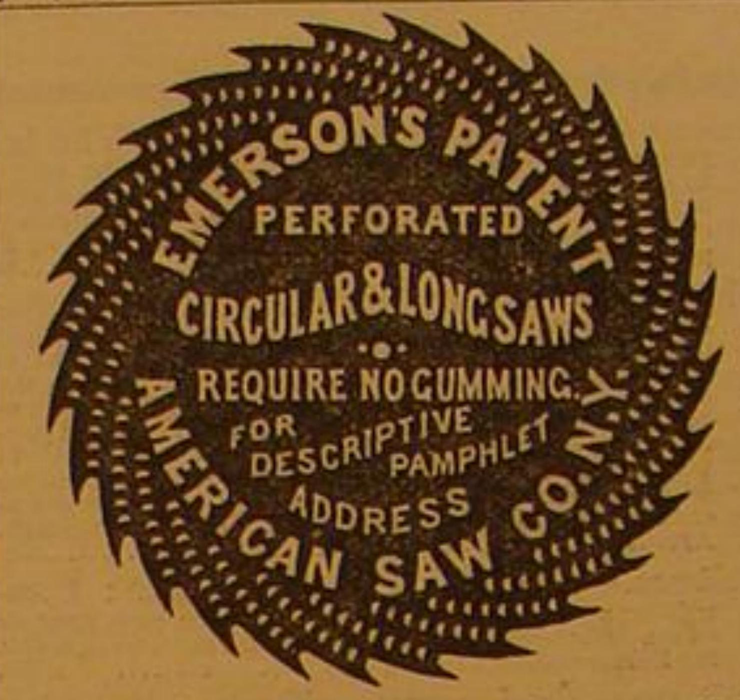

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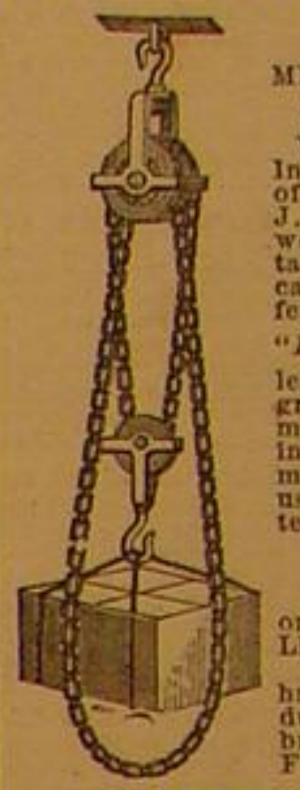

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