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Improved Stall Floor for Horses.

In the construction of stables, there has been a great need for some plan whereby the floors may be rendered impervious to the urine of animals, and at the same time admit of its being rapidly and thoroughly conducted away, so that its decomposition will not load the air with foul gases.

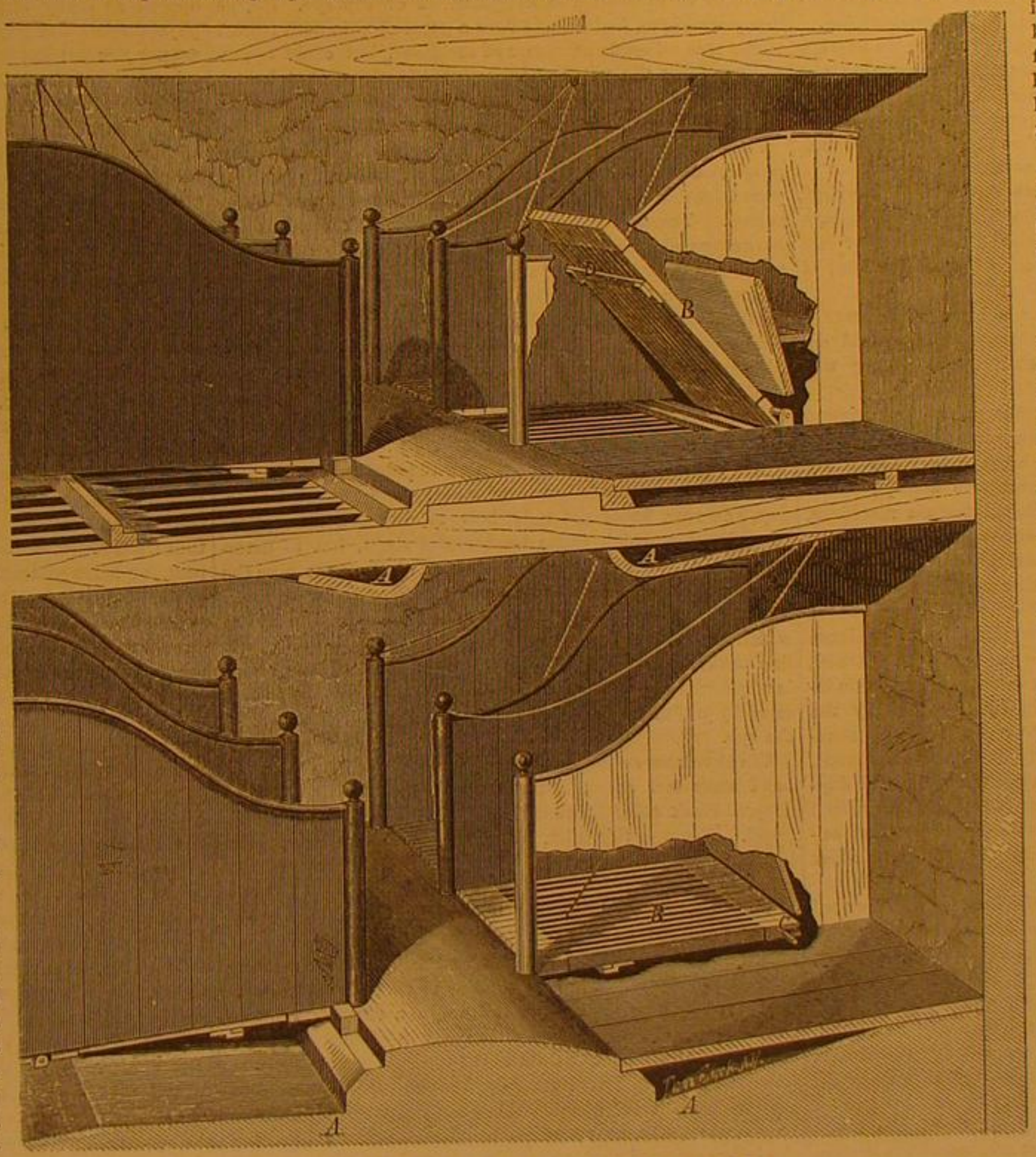
The construction adopted in the device herewith illustrated, seems to make provision for all the necessities of the case. The animals, instead of standing upon a continuous flooring, stand upon a wooden grating as shown at B, so constructed that any one of the bars may be taken out independently of the others, and so arranged that by means of a cord and pulley, the whole grating may be lifted, like a trap door hinged at one side, when it is desired to get access to the water-tight gutters A, underneath the grating.

This construction admits of tiers of stalls being placed on one floor above another, as shown in the engraving, without any inconvenience arising from dripping. The form of the gratings is shown at B. The ends of the bars are slotted, as shown at C, a rod passing through them all in common. This allows any one to be withdrawn when the opposite end of the grating is raised. This is a convenience in replacing such as become worn sooner than others, as will be the case in the middle of the grating.

The gutters A are made with a lining of cement on the lower story; but under the upper tier of stalls they are made of wood and lined with zinc. They thus conduct away the urine, and when it is necessary, they may be thoroughly washed out by the use of a hose.

The gratings are raised by means of cords and pulleys, acting upon a cross-bar D, which underlies the bars as shown.

Patented, June 8, 1869, by William M. Bleakley, Verplank, N. Y., whom address for State, county, or town rights.



BLEAKLEY'S IMPROVED HORSE STALL.

To Prevent Decay of Shingles.

The following is said to effectually prevent the decay of shingles:

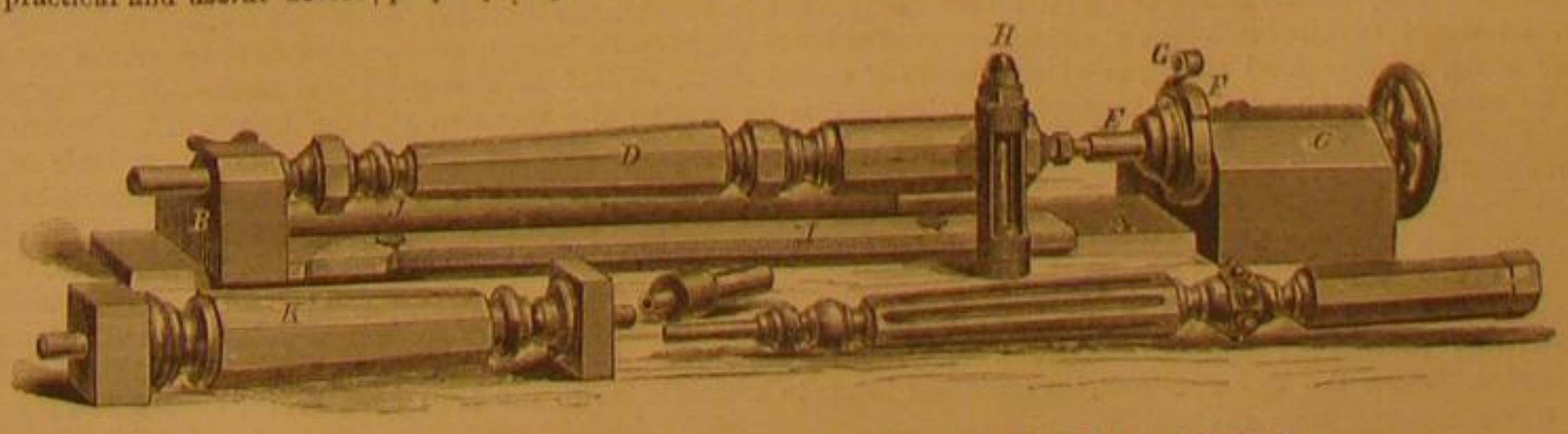
Take a potash kettle, or large tub, and put into it one barrel of lye of wood ashes, five pounds of white vitriol, five pounds of alum, and as much salt as will dissolve in the mixture. Make the liquor quite warm, and put as many shingles in it as can be conveniently wet at once. Stir them up with a fork, and when well soaked, take them out and put in more, renewing the liquor as necessary. Then lay the shingles in the usual manner. After they are laid, take the liquor that was left, put lime enough into it to make whitewash, and if any coloring is desirable, add ocher, Spanish brown, lampblack, etc., and apply to the roof with a brush or an old broom. This wash may be renewed from time to time. Salt and lye are excellent preservatives of wood. It is well known that leach tubs, troughs, and other articles used in the manufacture of potash, never rot. They become saturated with the alkali, turn yellowish inside, and remain impervious to the weather.

Improved Machine for Cutting Irregular Forms.

We illustrate herewith a very practical and useful device for cutting irregular and ornamental forms, such as table legs, balusters, etc., by which a great deal of work can be done in a short time and in a very exact manner.

The main features of the device are, the attachments for holding, adjusting, and feeding the pillars, balusters, etc., to be cut into irregular forms or plane sides, on a table past a rotary cutter. The invention may be said to consist of a bed, with centers, for holding the blank; one of the centers being adjustable longitudinally, and furnished with a dividing plate for adjusting the blank to the cutter, and a pattern for governing the action of the revolving cutter upon the blank. In the engraving, A is the bed upon which are placed the spindle or centering heads, B and C; B being adjustable vertically, and either having a spindle for holding the blank, or a hole for the turned end of the blank. The head, C, has an adjustable spindle, E, and is itself adjustable along the bed to receive different lengths of blanks. The spindle, E, carries a templet or dividing plate, F, with spacing notches, which dividing plate is removable to permit interchange of plates variously divided for various kinds of work. The notches of the dividing plate engage with a spring catch, G, which holds the plate in the desired position while the cutting is performed. H represents a rotary cutting tool rising through the table of the machine. A guide plate, I, or pattern adjustably attached to the bed, A, serves to direct the cutting. The operator takes hold of the baluster, at B, with his right hand, and with his left hand on a hand rail, J, pushes the machine from him, and at the same time against the mandrel; the machine is then pulled or drawn back, and lifting the spring catch, G, with the left hand, and turning the baluster with the right, one space, another side is presented to the cutting tool, thereby dressing the sides all alike, and making a thousand pieces exactly similar. After the required number have been shaped the straight bits are removed and properly shaped ones take their place, and the guide pattern is changed for one corresponding to the desired ornamental design. When this is effected, one man can do the work of twenty men, and with greater neatness and accuracy than can possibly be done by hand. At the same time the hands of the operator are perfectly safe from injury. For dressing stuff like the piece, K, with squares at both ends, the center pin, seen at the end of the piece, is inserted in the hole through the centering head, B. This machine is capable of dressing not only balusters and chair, table, desk, and counter legs, but can be used to dress hay-rake and grain-drill spokes; and stuff that has to be thrown away when finished by hand on account of knots and curls (the handsomest when finished), is dressed almost as readily as straight-grained wood. Any workman knows the disadvantages he labors under in dressing such work as seen in the engraving, on account of the turnings being larger than the neck of the baluster, most of it having to be done with a drawing-knife, chisel, or rasp. We are informed that one of these machines has been in use eight months, and has given perfect satisfaction. State rights, or machines, will be sold.

Patented, through the Scientific American Patent Agency, January 4, 1870, by Franklin Keagey, of Chambersburg, Pa., whom address for further information.



KEAGEY'S MACHINE FOR CUTTING IRREGULAR FORMS.

The Trial of the Pyx.

The trial of the Pyx is the formal testing of the coin of the realm of England, to insure its being of the requisite weight and fineness. The name is derived from the Pyx, or chest, in which the coins selected for the purpose are contained. The first trial of the Pyx took place in the ninth and tenth years of Edward I. And as the last observance of this ancient ceremony was held during the past week, a few brief notes may not be without interest.

The authority under which the trials were made varied considerably. First, the members of the King's Council, then the Barons of the Exchequer constituted the court, King James I. presiding at one trial. The court now consists of several members of the Privy Council, under the presidency of the Lord High Chancellor and a jury selected from the Hon. Company of Goldsmiths.

Last week the high officers of the Mint assembled at the Treasury, and in their presence the Lord Chancellor charged the jury to examine the coin of the late Master of the Mint, Thomas Graham, F.R.S., and to ascertain whether it was within the latitude of "remedy" allowed by law.

This remedy amounts to 12 grains on each troy pound of gold coin, or to 0·257 grain on each sovereign, and 24 grains on each pound troy of silver coin. Portions cut from standard test plates were handed to the jury, who adjourned to Goldsmiths' Hall. They then opened the Pyx-chest and tested the coin by weight; having done this, a certain number of gold coins were melted into an ingot, which was then assayed; the same process being adopted with the silver coin. In the present instance the Pyx represented a coinage of fourteen millions gold and one million of silver coin; the verdict of the jury being, that the coin, both as to weight and fineness, was within the remedy allowed by law. The details, however, were most favorable to the late illustrious Master, who has so lately passed away.

An adverse verdict would probably have been followed by no more serious penalty than the forfeiture of the Master's sureties, but it is interesting to note that in the reign of Henry I. the money was so debased as to call for the exemplary punishment of the "Meneyers," while in Anglo Saxon times the chief officer or Reeve would have been punished by the loss of his hand should he fail to clear himself of the charge of producing false coinage.—*Nature.*

INFERIOR taste prefers rounded periods to sense and force

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.

[Concluded from page 264.]

We have now two things to consider more closely: first, in which way the rays of light pass through the eye, and secondly, what becomes of them after their arrival at the retina.

The capsule of the eye has a beautiful transparent window, the cornea, for the entrance of the rays of light. Its anterior surface is the most important of the whole refractive apparatus. It was, therefore, considered of high scientific interest to determine its physical properties, above all, its curvature. At first, the method was very imperfect. Two hundred years ago, a French physician of great renown, S. L. Petit, endeavored to ascertain the curvature of the cornea by applying to frozen eyes taken from the cadaver, pieces of card board into which he had cut circular notches, fitting them upon the cornea as nearly as possible. This procedure could give only an approximate measurement.

In a similar way the curvature, thickness, and position of the crystalline lens, the second part of the refracting apparatus, was examined.

But the minute parts, with their delicate structure, appeared so infinitely beyond the scope of the imperfect methods of investigation, that a great many properties of the eye, requisite for discharge of its functions as an optical apparatus, had to be supplied by hypothesis, that is, imagination.

The less instructed a man, the more he is given to admiration and superstition. Is it astonishing, therefore, that the eye was supposed to be the most perfect optical apparatus, quite beyond the reach of our comprehension? God being the Creator, how can it be possible that there are short-comings and defects in one of His most wonderful works?

For a long time all investigators were convinced, *a priori*, that an analytical study of the eye could only reveal its perfection. This preconceived idea, however, was forced at last to give way to the unambiguous results of exact methods of inquiry.

As every new truth, overturning an old prejudice, carries with itself the remedy for the prejudice, so the optical defects of the eye were detected, and no religious feeling was wounded.

If, on earth, there be a power, it is the progress of science. Religion, the search of the human soul after the divine, pursues the sublimest object; but has always had too many egotistic exponents, who led the multitude astray; threw the noblest minds into prison; employed torture machines, and all the horrors of the Inquisition, only to gratify the sway of their own hierarchy. The history of science has no such horrors to record; all its conquests have been ennobling steps of civilization.

In our day, a scientist, arriving at a conclusion at variance with orthodox creed, can no longer be tortured or imprisoned, or burned as a heretic; but in most countries, this one included, he may incur persecution, not by law, but by the zealots of society. Germany at the present time, is the country where the greatest religious liberty exists. No scientist, by declaring openly his dissension on certain points of dogmatic Christianity, or orthodox Judaism, will loose a minimum of his social position. Therefore, pure and independent science now flourishes more in Germany than in any other country of the world.

The progress of our knowledge of the healthy and diseased eye, during the last decades, is nearly exclusively the work of German genius and labor. Holland, a sister country, having one prominent investigator.

The greatest name in natural science, of the present age, is that of Helmholtz, Professor in the University of Heidelberg. His discoveries and inventions count by the dozen. For the study of the eye, he is the originator of a new epoch. Relating to the point under consideration, I here show you an instrument devised by him, on the principle of the heliometer of astronomers, wherewith the curvature of the cornea can be determined on the living eye with wonderful accuracy, By his researches, and those of other observers, a great many irregularities of the eye have been detected, demonstrating beyond doubt its imperfections as an optical instrument. The curved surfaces of the cornea and crystalline lens are far from being perfect in form, they are, even in the best eye, unsymmetrical, the system is not central, not achromatic, nor aplanatic either; all of which are shortcomings a good optician now-a-days knows how to avoid. You say, be that as it may, the eye is nevertheless an admirable instrument, adequate to all the purposes of common life, and more is not needed. This seems, at first glance, very plausible, but we must consider that the purposes of life are suited to, and governed by the power of the organs of our body. And this power is limited. If we could fly, we would need no railroads; if our eyesight were more acute, another kind of writing would exist, and you may be sure, to cite an example, that the *N. Y. Herald* would be printed still worse. As it is, its type is just on the verge of visual acuteness, perhaps a little beyond it, to be read for any length of time without injuring the eyes, and therefore it deserves a premium from oculists.

The irregularities of the dioptric apparatus of the eye have one defect common to them all; they prevent the rays of light from being regularly refracted. Were the eye a perfect optical apparatus, all the rays emanating from one luminous point, would be united in one point again on the retina. But this does not take place even in the best constructed eye.

The most conspicuous imperfection of the normal eye is its want of symmetry. The meridians differ in curvature, and, therefore, in refractive power.

This is the cause that the pencil of refracted rays has a peculiar shape, being what mathematicians call a skew surface, for instance like a winding staircase. I have represented the peculiar shape of the way the rays of light take within the eye by a model of silk threads. It will interest you, furnishing a tangible illustration how far exact science, guided by mathematics, may penetrate the mysteries of nature.

At the first dawn of science, the investigator is overpowered by the discovery of a general law, which he then represents by a diagram. So it is with the eye. The law of refraction was found, and the eye called a living camera obscura of unimpeachable perfection and diagramatic regularity. Astronomers having found the general law of gravitation, immediately had a diagramatic system of the world built up. This undoubtedly was correct, but then came the perturbations in the orbits of the celestial bodies, which had to be accounted for, and they were accounted for by the progress of astronomical research. The same development took place in the science of the eye. There were disturbances of vision, unexplainable as long as the organ of sight was supposed to be perfect. The onward march of science found means to discover the causes of these disturbances and instruments to measure them to one-thousandth of an inch. Some years ago, while experimenting on these subjects, I told a certain mathematician, that we are now able, not only to recognize, but also to measure the irregularities of the eye. He, as many wise men, had always been a great skeptic with regard to the true scientific character of medicine, but could appreciate so fully the value of these investigations, that he exclaimed: "Then sir, you command all conditions to introduce astronomical accuracy into your researches."

Many persons who like to hear themselves, called practical people, but who in reality are only slow thinkers, do not like pure scientific questions, the noblest that can ever be discussed. These would-be practical persons ask what is the advantage of such obscure investigations? People had better devote their time, they say, to more useful pursuits than to scrutinizing the imperfections of nature. I answer these practical people, that the discovery of every truth, of what kind soever it may be, is the most useful fruit of human labor. This subject we have just been considering, proves this conclusively. You can easily imagine, that if all eyes have irregularities, some will have them exaggerated to such a degree as to diminish the power of sight. Such eyes are weak, and not capable of performing the duties our present state of civilization demands of them. The educated of today, however, know not only how to discover the optical irregularities which cause weakness of sight, but to determine their nature and degree with such nicety, as to give the practical optician directions, in what manner he has to grind a new kind of spectacles—I mean cylindrical—by the aid of which thousands of weak eyes are now enabled to do any fine work, as well and as long as perfect eyes. I think this is a splendid reward to the scientist who invented the instrument by which we are able to measure the irregularities of the eye.

We have now accompanied the rays of light into the eye, but I have not mentioned that wonderful opening of the deepest black color in the middle of the iris, I mean the pupil. Through this inlet, all the rays of light must pass before they reach the retina. How is it that this ray of light is so black?

This question, again seemingly impractical, was much discussed some 30 years ago in German Universities, and resulted in one of the most brilliant and beneficial discoveries of modern science. The first impulse to these investigations was given by a sad and criminal deed, in a country town of the kingdom of Saxony, by a clergyman in discord with one of his parishioners. One dark night the minister on his way home was attacked and severely beaten. Being convinced that the perpetrator was no other than the man with whom he was at enmity, he entered a complaint against him, but the judge objected that self-testimony and moral conviction although they might do very well in religious matters, could not be taken as evidence in courts of law. Whereupon the priest, who was well versed in legendary and scientific lore, replied: "During the affray I received a severe blow upon the eye which caused a brilliant light to flash out of it, so that I could recognize the features of the assailant, who was the man I accuse." The judge was so surprised by the novelty of this assertion and the positiveness with which it was uttered, that he declared himself incompetent, and appealed to the opinion of experts. The question was brought before the forum of the medical faculties of the Universities of Leipsic and Berlin, and was studied profoundly by the celebrated physiologist Johannes Müller. The result of his researches was a most valuable acquisition to science, the discovery of the so-called specific energies of the nerves of sense, according to which a nerve of special sense, excited in any way whatever, invariably answers by causing the sensation peculiar to it alone. The optic nerve, when pricked, burnt, cut, hit, electrified, etc., will invariably cause a sensation of light, but this light is subjective, due to an abnormal condition of the nerve, and not in the least capable of being perceived by another person, or illuminating the objects around the irritated eye. Any one can repeat on himself the truth of these statements. Therefore the complaint of the priest was dismissed, his assertions being in contradiction to the laws of nature.

This celebrated case was the starting point of scientific inquiries into the cause of the darkness of the pupil of the eye, and the peculiar condition under which the pupils of certain animals, and sometimes also of men, may become luminous. After a good deal of preparatory labor Prof. Helmholtz solved the problem and invented the ophthalmoscope, or eye-mirror, an instrument by which it is possible to look into the depth of a living eye and see its marvelous interior structure in all its details and brilliancy, as if it were a picture spread out before us. The optic nerve expanding into the retina, with its wonderfully ramifying net of arteries and veins, on which you can see the pulsation of the blood as well as you can feel it on the wrist; the choroid with its shades of pigmentation and intricate interlacing of blood vessels; nay, even the miniature images of outward objects can be seen portrayed on the retina, and their reversal, for centuries a topic of lively discussion, directly observed on the back-ground of the living eye.

This was a triumph of science so great and important in its results as the instrument itself is small, and of admirable simplicity. It was at once made practical by the combined efforts of many illustrious physicians who discovered with it a great number of diseases hitherto unknown, and which, as soon as they were recognized, became amenable to treatment. The little instrument proved not only a mirror for the eyes, but revealed many of the other evils which flesh is heir to. It did not only inaugurate a new epoch for the study of the organ of sight, which in the short interval of two decades has become the most cultivated, reliable, and beneficial of the various branches of medicine, but led to the study of other organs in the same way. Mirrors for the ear, the throat, and other parts of the body, opened so many fertile fields for the progressive labor of physiologists and physicians. There may be hardly any one among you but has been, or will be, benefited by the practical results of these investigations. Even the French, the proudest of all nations—the present company as representing the American, of course, excluded—recognized the value of the ophthalmoscope, by giving it the highest praise a Frenchman is capable of. A French reviewer naively said: "The ophthalmoscope is such an admirable German invention that it deserves to be a French one."

It takes a certain time to render a great name popular, but the name of Helmholtz as a creator of new science, will live as long as the names of glorious Newton and Humboldt, and as that of a benefactor of mankind, it will be unsurpassed even by the blessed names of Dr. Jenner and the one over whose ashes this country is still weeping, George Peabody.

But let us continue, that we may see how waves of light are converted into nervous fluid and ultimately into thought. We followed them to their collection in the image upon the retina. This membrane has a very complicated structure, which again, has been investigated nearly exclusively by German anatomists. Of the many layers which compose the thin transparent retina, one, the outer, is distinguished by a peculiar arrangement and utmost subtilty of its elementary parts. These are called rods and cones, and each of them posseses an inner and outer portion. Three years ago these details were at the limit of the power of the strongest microscopes; but the invention of a new system of lenses, the immersion system, adds so much magnifying power, while preserving good illumination, to the former microscopes, that it is now possible to distinguish further details in the rods and cones. The surface of the minute staves is covered by infinitely fine nervous fibers, finer than have been observed anywhere else in the animal organization. The outer portion of the little staves consists of extremely delicate disks, cemented together by a glue, the refractive power of which differs from that of the disks. In, around, or between these disks—which, is not yet clearly made out—terminate the delicate nervous fibers which run over the surface of the inner portions of the little staves. Until within the past two years, nobody had definite ideas how the nerve fibers were acted upon by light.

Physiologists contented themselves with the knowledge that the outer layer of the retina contained the percipient elements. Now it is supposed, or rather on the way to be proved, that the waves of light enter the little staves and are repeatedly reflected in the little disks. A remarkable coincidence exists between the size of these disks and the length of the light waves. The latter vary between ·00003 to ·00008 mm., according to the different colors, and the thickness of the retinal little disks lies between the same limits. You all know that the different colors which compose the sunlight, are due to ether waves of different length, and may be isolated by means of a prism. If now a ray of light, the undulations of which are of a certain length, say ·00005 mm., meets on its way a substance composed of different layers, the thickness of which is equal to, or a simple multiple of the length of the light wave, the latter will not proceed in its course, but be repeatedly reflected from the two surfaces of the layer corresponding in thickness to the length of the light wave. Waves thus repeatedly reflected are called standing waves, and possess a much greater force than the simple passing or flowing waves. Standing waves are, therefore, fit to impart far greater commotions to the nerve fibers in or on the disk, than the flowing waves. It is evident that the latter will be converted into standing waves only in disks corresponding to their length. They will only excite the nerve-fiber of these disks, having passed the others without acting upon them. Suppose, for instance, the light wave of blue color, being ·00003 mm. in length, enters a little retinal staff, then it will pass undisturbed through the disks of other dimensions than ·00003 mm., but after having once penetrated this one, it will be repeatedly reflected. Thus special nervous fibers are excited, and the definition of natural philosophers, that color is nothing but the sensation of ether waves of a specific length is accounted for. Here the light wave ends; it does not die however, but is transmitted to the ether-zones enveloping the molecules of the optic nerve. Usually this transmission is called absorption of light.

Natural science has of late discovered a law of the greatest fundamental importance, the law of preservation and correlation of forces. This law shows that force can neither be created nor destroyed, it can only be transferred, and manifest itself under other phenomena. Light can be converted into electricity, and the nervous current is very much akin to the electric current. It moves the magnetic needle, and has many properties in common with the electric currents. They are, however, not identical, since the velocity of the nervous current, as Helmholtz was the first to show, is only 61 mt. in a second, while that of the electric current is not far from 300,000 miles in the same time.

Thus far we are able to accompany the light wave: it has united with the nervous fluid, and will thereby be transmitted to the central organ of the nervous system, the brain, where it is ultimately converted into thought.

But here, science in its present state, stands on the confines of an apparently unfathomable mystery, to penetrate which another mirror must be invented. I have, however, faith in the power of science, and am convinced that nothing is impenetrable to the eye of the human mind.

The history of civilization shows a slow work, and frequent disturbances by political convulsions. Europe, especially Germany, where scientific investigation is so generally appreciated and liberally encouraged, may be crushed with the downfall of the untenable forms of personal government; but this country, although still betraying many deficiencies of youth, is the bright star that will usher in an epoch of higher culture.

In regard to the last problem of our subject, the formation of thought out of visual impressions, centuries may pass, before a brain mirror will be invented. But so sure as science is ever progressive, so sure it is that another Helmholtz will will come to invent this mirror, and as the course of civilization and human progress is westward, let us hope that he will be—an American.

MAMMALIAN FOSSILS.---A FACETIOUS REVIEWER.

Mr. J. P. Lesley contributes to *Old and New*, a review of the recent work of Dr. Leidy on "Mammalian Fossils of North America," which is worth reading for its humor as well as the scientific information it contains. It is so seldom that scientific discourse is relieved by wit, that it is refreshing to meet occasionally with an essay which happily blends learning with fun.

Mr. Lesley says:

The long expected and truly magnificent work of Dr. Leidy, on the mammalian remains in the rocks of Nebraska and Dakotah, with a synopsis of all the mammalian fossils as yet discovered in North America, has at length appeared. It forms an entire volume of the quarto "Journal of the Academy of Natural Sciences" of Philadelphia, and is illustrated with plates excellently well done. These plates show the teeth, jaws, heads, and limb-bones of the American fossil mammals, either life size, or on a reduced scale. Dr. Hayden prefixes to the book a geological description of that remarkable part of the United States, where the greatest treasures of this sort have been preserved for our astonishment and study. Creatures lived there, strange enough to test the credulity of the most superstitious—hogs that chewed the cud, deer that had solid hoofs like horses, or horses with cloven hoofs like deer; tropical pachyderms feeding at the swampy margins of vast fresh-water lakes, from the shores of which arose ranges of the Rocky Mountains in 45° north latitude.

North America in pre-human times was provided with every kind of mammal excepting man—horse, deer, cow, sheep, elephant, rhinoceros; and the smaller kinds were not forgotten—except the hippopotamus. That would have been a little too absurd. The red Indian and the mastodon together?—that is all right. But the corn-planter and the river-horse of the Nile and Niger!—not if you please.

Such at least were our reflections, until a Friday night, a few weeks since, we were destined to hear Professor Cope inform the members of the American Philosophical Society, that he had just discovered an unmistakable hippopotamus' molar tooth in a bed of Miocene Tertiary marl in New Jersey, and that a learned friend of his had collected other teeth, from a similar position in the series of rocks in Maryland, which he identified generically with hippopotamus. But the two species were different: that of the New Jersey locality having been no larger then the common hog, and distinguished by certain tuberculous processes studding the crown of the tooth, from which feature Mr. Cope should construct its specific name.

We ask, what does all this raree show of Palæontology mean? Who gets up those strange and varied forms? Was there no trick of humor in these shapes? Are we to call them tentative inventions, of a busy, ever busy mind, never satisfied with the result, but ever changing the combination, ever reaching toward a higher pitch of success? Or do we see a slow eternal growth—form expanding into form—form budding out of form—as in some vast circumplanetal coral reef, filled by one family of life, fed by one gulf stream of vital force, energetic, but half conscious, and as improphetic for itself of its own culmination in man, as the British savage was of the appearance of his children, the Newton and the Faraday?

The books say that no mammal has ever been found in rocks older than the Tertiary. Some years ago—a good many years ago, in fact, for it was in those early days of the Philadelphia Academy, made brilliant with the presence of Wilson, and Nuttall, and Say, and McClure, and Bartram, and Ord, and the Abbé Da Serra, and the wild Rafinesque, and the enthusiastic Vanuxem—Dr. Bartram found in the cretaceous green sand marl of New Jersey, a vertebra, which he so labeled (libeled is the proper word here), and placed it in the Academy's museum. Some time afterward, Dr. Leidy pronouncing it the vertebra of some extinct whale, and the European palæontologists being startled at the thought of a cretaceous whale, Sir Charles Lyell wrote over to Mr. Conrad, to look up the spot and verify the rock. He did. The marl was not cretaceous—but Middle Tertiary. Europe fell back in its easy-chair and lit another cigar, with "Infernal American pretension," *sotto voce*.

But the cigar was hardly lighted, when it was flung again into the grate. Dr. Emmons had found a mammal in the—Europe sprang to its feet with a thundering "What?"—in the Trias of North Carolina. This was rather too bad. In the Old World—that land of precedent and vested privileges—they could find no precedent for suckling babies which went back or down, lower than the Tertiary. The American cretaceous pretense had been squelched. No one thought of the Oolite. It was folly to suggest Lias. Madness alone could dream of babies at the breast in the age of the Muschelkalk, Keuper, or Rodte-todt-liegende. Their very names were against it. One might as well go recklessly two steps deeper—Permian—Carboniferous, and dig extinct sucking-pigs out with anthracite coal.

But how vain are the assaults of prejudice against the gates of Truth! A fact envelops us like a nightmare—or the cool night air—however we may rage or rhyme. Emmons found two perfect little one-side jaw-bones, about an inch and a quarter long, and so smooth and perfect that a lens could detect no fracture anywhere, and he found them in that iron-ore bed which lies between the two layers or benches of the Deep River coal-bed, at Egypt, in North Carolina. This stratum of iron ore is only two feet thick; and each layer of coal, above it and below it, is about two feet thick. But the ore contains millions of teeth of reptiles and fishes belonging to extinct genera and types of Triassic age.

Dr. Leidy examined both the specimens found by Dr. Emmons, and received one as a gift for the Academy's museum. They were alike. They belonged to a little mammal no bigger than a field-mouse, but with elongated jaws; for it fed on the numerous insects of that period! Dr. Leidy has now explained to the Academy the most remarkable deduction to be drawn from these little waifs of a by-gone world. Until their discovery it was taken for granted that all jaws of mammals were provided with knuckles, knobs, or condyles, at the upper hinder end, articulating into a socket in some form of temporal bone, attached to the other bones of the skull. All other known mammal jaw-bones were single bones, armed with a condyle. Shall we say that this poor little old-fashioned Triassic mouse's jaw-bone wasn't worth a condyle? Or, more probably that condyles hadn't been invented then? Its little jaw ends, backward, in a broad, smooth, nearly straight edge, chisel-shaped. How it was attached thus to its poor little head, or whether it had an auxiliary bone with a condyle on that, to articulate into the head, are questions, like many others, waiting fortunate discoveries to be answered. Reptile jaws, instead of being simple, are made up of several pieces; first, the long bone for the insertion of the teeth, a splint bone laid along its base inside, a triangular bone at its back end, a large bone on top of that, and an articulating bone (in lieu of a condyle) capping that again. We see in our poor little mouse, a praiseworthy attempt to free itself from this horrid reptilian style of getting up (resembling the feminine coiffure of the day), without attaining to the dignity of wearing a condyle.

Probably the mouse was in the intellectual posture of that member of the London Royal Society, who, in 1776, when Paine patented the crank for the steam-engine, wrote a memoir to show that the crank was inapplicable to the steam-engine; and another and more distinguished British engineer followed his brother member's assertions, with a conclusive mathematical demonstration, to the same effect. It is soothing to believe that in Triassic, Liassic, and perhaps through Cretaceous ages, the dislocation of the jaw was a casualty unknown to mammals. All jaws as yet were many-hinged, ligamentous, and capaciously flexible. The bird-like kangaroos of the Connecticut River Valley—the enormous Hadrosaurs of New Jersey—could worry down gentry of half their own size. They had the cheek to do it.

[For the Scientific American.]

THE COCOA PALM.

BY J. CANTINI.

A brief sketch of one of the principal palm trees may be of interest to many of our readers, especially at this particular season of the year, when the leaves form such an important article of commerce, and an object of general adoration in the Christian world. In some places, especially in Catholic countries, the palm leaves are largely imported from the southern coast, and an extensive business is carried on, though only for a short time.

The inhabitant of the North, who has never visited the tropical countries, has but a faint idea of the actual beauty and grandeur of these plants, which, even in the South, amidst eternal verdure, are ever an object of admiration. From our earliest childhood we hear the word "palm" in connection with every thing that is beautiful and poetical. We speak of the "palmy days," when we think of times of happiness; and we say, "he has carried off the palm," when we allude to glory. It would be difficult to say how long the palm has been associated with religion and sentiment, as the word "palm" itself is an expression of comparatively modern times. The Romans called a tree which grows on the shores of the Mediterranean the "Fan Palm," probably on account of the resemblance of its leaves to the palm of the human hand (*palma*).

One of the loftiest of the palms is the cocoanut tree (*Cocoa nucifera*), which grows to a hight of from sixty to a hundred feet. According to some naturalists, it is a littoral plant, but Humboldt and Bonpland assert that they met with it inland (in Mexico), though of a growth somewhat inferior to those of the sea shore. The tree prefers a sandy, arid soil, and it is rare that much vegitation is found growing around it. The cocoa-palms adorn the otherwise desolate beach or the low islands. Gliding along the shore in a boat, the attention of the traveler is aroused by the doleful, wailing sound which the wind causes in waving to and fro the long leaves. There is something solemn and almost ghost-like in the appearance of an avenue of cocoanut trees, when seen by the peculiar moonlight of the tropics, especially when there is a strong breeze blowing. The leaf-crowned summit forms, everywhere, an object of truly intertropical scenery, and the palms well deserve the name given to them by Linnæus, "Kings of Vegetation."

Various, nay, "hundredfold," as the natives express themselves, are the uses of this plant, and its propagation may be considered as a never-failing source of progressive national prosperity, for it will furnish, with but little trouble, clothing, food, and habitation.

Almost every particle of this tropical production can be used. The trunk serves to build the huts; the rind or husk, which is fibrous, is used, everywhere, for matting, brushes, etc. The leaves, which measure some twenty feet in length, are, also, of great utility. The finest roofs are made of the plaited cocoanut leaves. Screens, baskets, hats, and many other domestic articles are made of them. The heart or young leaves, called "cabbage," is an excellent vegetable, which can be prepared in many different ways. The dried leaves are sometimes used as torches in dark nights, while the washer-women often burn the foliage for the sake of its alkaline ashes. In the East Indies, the leaves of the cocoa palm, like those of the Palmyra, serve the natives in lieu of paper, upon which they write with a stylus. It is not unusual that letters, written upon these leaves, neatly rolled up, and sealed with a little gum lac, pass through a postoffice.

The most important part of the tree is the nut, which grows in bunches of twelve or more in number. In some parts, the fruit can be gathered four and five times a year. The liquid or water, or, as it is generally and improperly termed, the "milk," is, in the young nuts, a most delicious draft, as it is always cool, more particularly early in the morning. It is slightly effervescent, and, if mixed with Madeira wine or brandy, it makes an excellent beverage, though many consider it unhealthy. The natives ascribe many inestimable properties to this liquid; amongst others, they pretend that, if used as a wash. "it clears the face of wrinkles and imparts to it the rosy tints of youth."

The milk is made of the kernel itself by grating it and pouring warm water over it, after which it is pressed, yielding a whitish liquid. This milk is almost indispensable in the tropics, and fully takes the place of animal milk. Bread and pastry, prepared with it, are most delicious, and retain an almost imperceptible taste of cocoanut. The albumen of the young nut is quite soft, and can be removed with a spoon, and might appropriately be termed "a vegetable blanc mange."

Another valuable and important article of commerce, obtained from this nut, is the oil. The natives all understand how to extract it from the kernel by a most simple process. They remove the kernel from the shell and boil it in water, after which they pound it in a mortar and then press it. The milk or liquid is then put over a slow fire. The oil or fat will soon float on the top and can easily be skimmed off. Two quarts of oil are usually obtained from fourteen fresh nuts. This oil, when fresh, is excellent for cooking purposes, and for frying fish and plantains; but, not being rectified, it soon turns rancid, thus giving a most disagreeable taste to the food prepared with it. The natives everywhere lavish it upon their persons, as a preventive against the sting of insects, or to give to their skin a glossy appearance. In cool weather, or even over night, it becomes quite hard, and requires melting before it can be used for burning. Cocoanut oil is, with the exception of the Cohune oil, the only article in use among the Indians of America to burn in lamps and torches.

The much-relished "toddy" is also obtained from the cocoa palm by tapping the trunk. This beverage is slightly stimulating, and, when fermentation has set in, it is intoxicating. During the state of fermentation, this liquid can be used as yeast, and the bread made with it is remarkably light and spongy.

These are the general uses which are made of this valuable plant; but the inhabitant of the tropics will discover many more, which are, however, of value only to those who live there and are able to make use of the numerous medicinal and other properties attributed to this tree.

HOW TO CLEAN PAINT.—There is a very simple method to clean paint that has become dirty, and, if our housewives should adopt it, it would save them a great deal of trouble Provide a plate with some of the best whiting to be had, and have ready some clean warm water and a piece of flannel, which dip into the water and squeeze nearly dry; then take as much whiting as will adhere to it, apply it to the painted surface, when a little rubbing will instantly remove any dirt or grease. After which wash the part well with clean water, rubbing it dry with a soft chamois. Paint thus cleaned looks as well as when first laid on, without any injury to the most delicate colors. It is far better than using soap, and does not require more than half the time and labor.

DUGDALE'S UNIVERSAL CLOTHES WASHER.

The operation of hand washing is not only one of severe labor, but it also entails—when performed in the ordinary way—injury and great discomfort to the hands, which need constantly to be plunged in an alkaline liquid which attacks and dissolves the cuticle, acting with the friction to often remove the skin entirely from the more exposed parts. The water employed cannot in the ordinary way be raised above that point which the hands can endure, and it will be obvious upon a moment's consideration that could the friction be aided by a higher temperature than that commonly employed, and the consequent greater solvent power of the suds, the work of the laundry would be much lessened.

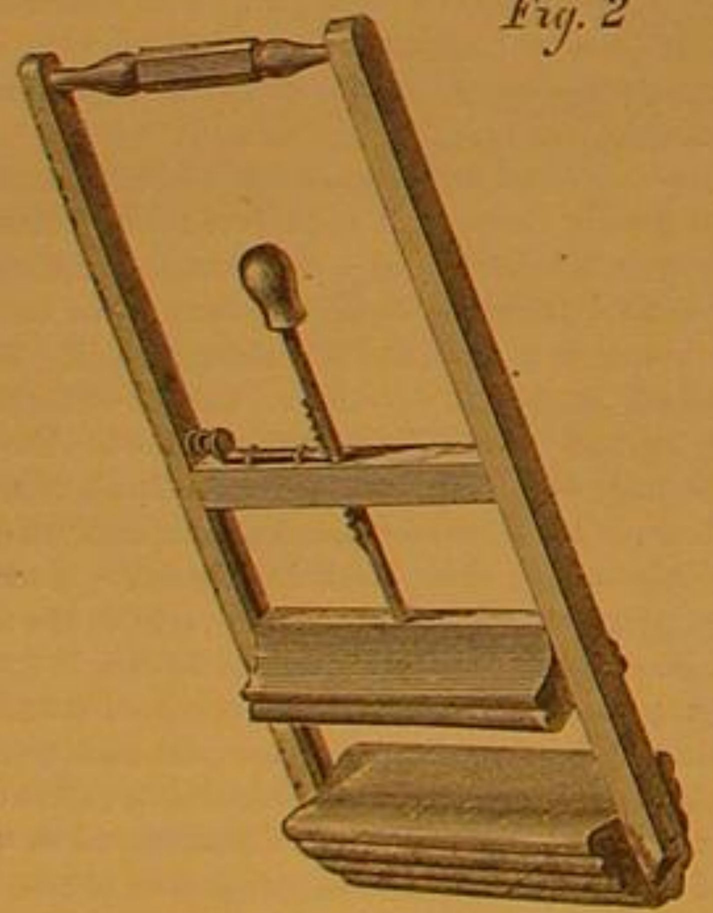
The accompanying engravings illustrate a device whereby

Fig. 1.

the hands are spared the discomfort and injury referred to, and the temperature of the suds may be maintained as high as is possible in an open tub.

The device is shown in detail in Fig. 2. It will be seen, it is simply a rubber, consisting of two parts in a suitable frame, which clasps the clothes when it is in use. The two parts when brought together present a rounded form, the exterior being fluted like a washboard, and the interior being made concave as shown, so that buttons, hooks, etc., may be clasped without damage.

Fig. 2



The upper part of that portion of the device which clasps the clothes, slides in grooves made in the side pieces of the frame, and is raised or opened by pressing back the bolt which locks it to its place, and pulling it upward by a knob or handle provided for that purpose.

The clothes are fastened in by pushing the knob down. Common tubs and zinc wash boards are used; the wash board is temporarily fastened in the tub, upon which the clothes are alternately drawn, and pressed down against the bottom of the tub; and they may be rubbed when required by applying one hand to the middle cross piece. This invention enables the operator to use suds hotter than the hands can bear, which dissolve the grease and dirt much more rapidly than suds at a lower temperature.

The device is very light, weighing only three pounds, and it is sold for introduction at a price within the reach of all.

Patented, January 18, 1870, by James K. Dugdale, of White Water, Indiana, who may be addressed for further information, and to whom orders for the universal clothes washer may be sent.

Artificial Ivory.—Tables for photography are made by mingling finely-pulverized sulphate of baryta or heavy spar with gelatin or albumen, compressing the product into sheets and drying it.

Improved Diamond-Pointed Steel Drill.

We have on various occasions called the attention of our readers to the great efficiency of opaque diamonds when applied to the cutting of hard materials. No existing substance can resist their action, and their durability when thus employed is very remarkable.

An annular drill used on the machine, which forms the subject of the present article, was recently employed in a tunnel of the Consolidated Bullion and Incas Silver Mining Company, Colorado, the tunnel having been at the time driven 600 feet into the mountain. This drill cut horizontally through 417½ feet of very hard quartz and feldspar rock; the expense for diamonds in drilling this distance being only thirty dollars.

This is only one of the daily accumulating proofs of the wonderful industrial value of the opaque diamonds, or—as they are more commonly called—carbons, and the great economy secured in their use for cutting and abrading the hardest materials.

We cannot, perhaps, place the defects of percussion drilling in a stronger light than by quoting from the report of the Commission to the Paris Universal Exposition.

The Commisson, after describing M. Sommeilier's machine—which has its solid steel drill attached direct to the engine piston, and conceding its manifest superiority over other percussion borers, proceed to say:

"Let us now inquire if this apparatus has answered the expectations of its author, and if this system of percussion will really render the service expected of it. We do not hesitate to express the opinion that it has not; and the following data will, we think, prove beyond a doubt that a percussion machine is not the one that should be employed in this kind of work.

"If we examine the staff employed in repairing the percussive tools, then used at the Mont Cenis tunnel, we remark that in 1863, for eight machines working there were sixty in the shops. At this time (1867), when the work is carried on both from the French and Italian sides, the number of engines working is sixteen, and the number of those in the workshops repairing is two hundred.

Fig. 1

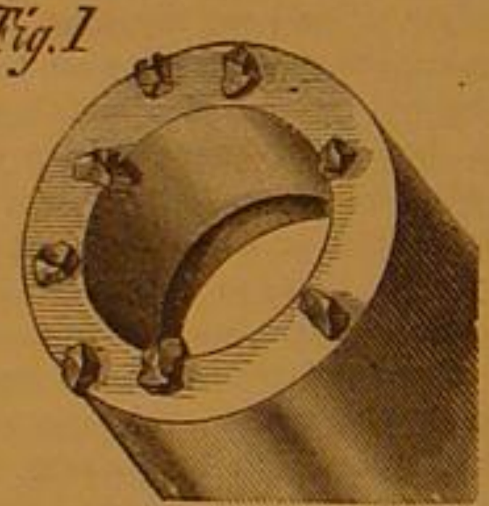
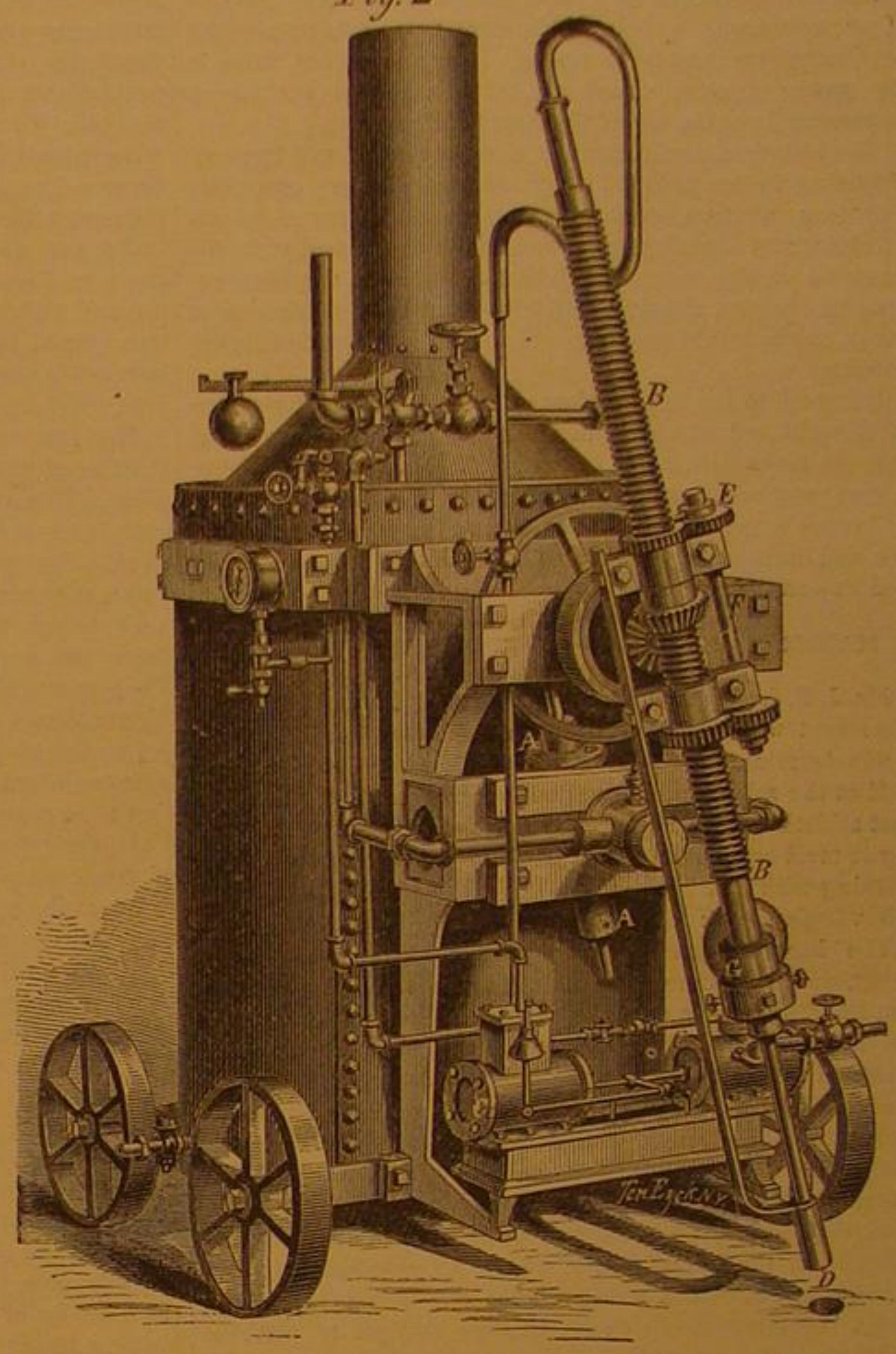


Fig. 2



LESCHOT'S DIAMOND-POINTED STEEL DRILL.

"Twenty-four men were constantly employed in repairing eight machines."

The Commission proceed to say, that, even admitting the possibility of constructing machines so that excessive repairing might be avoided, the percussion system is still liable to the objections that it makes an extravagant demand upon motive power, and that it cannot, on account of the great vibration be made to drill a circular hole to any great depth, which is a serious obstacle to the use of cartridges in blasting. They further express their conviction that the percussion system must eventually give place to the rotary system of drilling rocks, and warmly indorse the latter system as represented by the Leschot diamond annular drilling machine at the Exposition.

From the study of the imperfections of the system of percussion drilling, M. Leschot conceived the idea of setting diamonds in an annular cutter, the general form of which is shown in Fig. 1.

In the report of the Paris Exposition, before alluded to, the Commissioners make a comparison between the power required to penetate rock by means of this annular cutter, and that required by those drills which pulverize the rock to the full width of the hole, and pronounce the same to be in the proportion of 61 to 204.

This fundamental part of the device has, however, been improved upon since the introduction of the machine into this country. The diamonds are now securely fastened, and are set so as to give ample clearance, for the free descent of the drill, and the movement of the core through the tubular stem of the ring-cutter.

Great improvement has also been made in the various working parts of the apparatus. The original French machine only admitted the rotation of the drill at a speed of one fourth that now employed. The feed gear has also been greatly improved, so that the cut of the diamond tool may be, without delay, changed from the one hundredth part of an inch to the four hundredth part of an inch at each revolution of the drill; and this gear is now so constructed as to automatically adjust the feed to varying hardness of the rock through which the drill successively penetrates, giving slower feed when hard *strata* are encountered, and resuming its rapid feed when the hard *stratum* is penetrated.

The oscillating cylinder engine has been substituted for the fixed cylinder engines, and is specially constructed to adapt it to this purpose; securing superior speed, lightness steadiness, and durability.

A swivel head has also been added, by which the drill may be pointed in any direction; and the drilling may proceed at any possible angle with the vertical axis of the entire apparatus.

The hollow screw shaft is also an American improvement, which, added to the numerous other minor improvements, renders the machine, as we herewith present it, in the accompanying engravings, almost unrecognizable as the offspring of the original French machine.

The machines used in driving tunnels bore from three to five holes simultaneously, each in a different direction if desired.

Fig. 2 represents a "No. 1 Prospecting Drill," so called because of its general use in testing the character and value of mines and quarries. It consists of a small, upright boiler, to one side of which is firmly bolted the cast-iron frame which supports the engine and swivel drill-head, gears, and screw-shaft, as shown in the engraving. The engine—an oscillator of from five to seven-horse power—is shown at A. B is the screw-shaft with drill passing through it. This shaft is made of hydraulic pipe from five to seven feet in length, with a coarse thread cut on the outside. This thread runs the entire length of the shaft, which also carries a spline by which it is feathered to its upper sleeve-gear. This gear is double, and connects by its lower teeth with the beveled driving-gear, and by its upper teeth with the release-gear, E. This release-gear is feathered to the feed shaft, F, at the bottom of which is a frictional gear fitting the lower gear on the screw shaft, which has one or more teeth less than the frictional gear, whereby a differential feed is produced. This frictional gear is attached to bottom of feed shaft, F, by a friction nut; thus producing a combined differential and frictional feed which renders the drill perfectly sensitive to the character of the rock through which it is passing, and maintains a uniform pressure upon the same. The severe and sudden strain upon the cutting points, incidental to drilling through soft into, hard rock, with a positive feed, is thus avoided.

The drill proper (passing through the screw shaft, B), consists of a tubular boring bar, made of lap-weld pipe, with a steel bit or boring head, D, screwed on to one end. This bit is a steel thimble about four inches in length, having three rows of black diamonds in their natural rough state firmly bedded therein, so that the edges of those in one row project forward from its face, while the edges of those in the other two rows project from the outer and inner peripheries respectively.

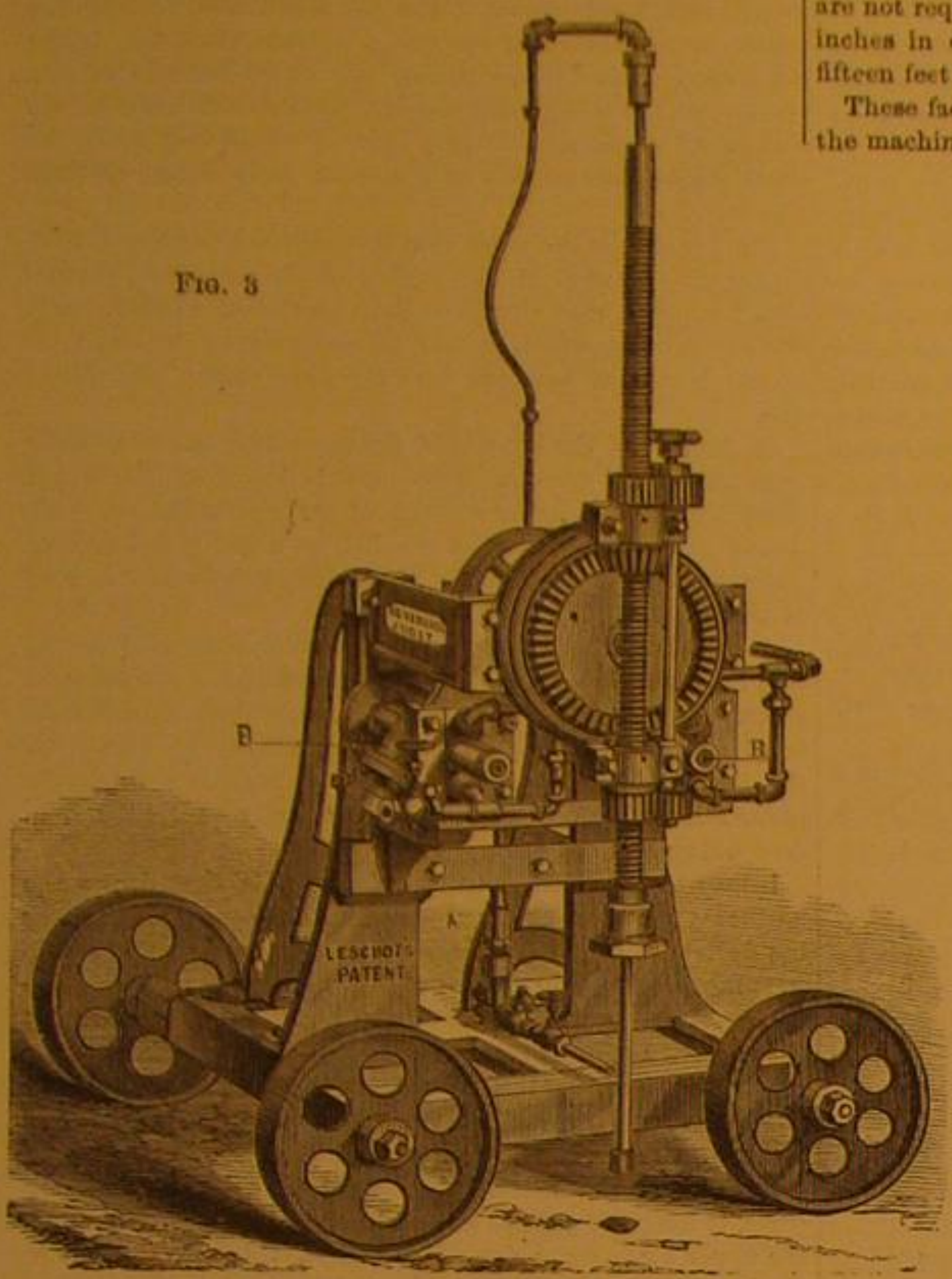
The diamonds of the first-mentioned row cut the path of the drill in its forward progress, while those upon the outer and inner periphery of the tool enlarge the cavity around the same, and admit the free ingress and egress of the water as hereafter described. As the drill passes into the rock, cutting an annular channel, that portion of stone encircled by this channel is of course undisturbed, and passes up into the drill in the form of a solid cylinder. This core is drawn out with the drill in sections of from 8 to 10 feet in length

The sides of the hollow bit are one fourth of an inch thick, and the diamonds of the inner row project about one eighth of an inch, so that the core or cylinder produced by a 2-inch drill (the ordinary size for testing) is one and a quarter inches in diameter.

Inside the bit, D, is placed a self-adjusting wedge which allows the core to pass up into the drill without hindrance, but which impinges upon and holds it fast when the action of the drill is reversed—thus breaking it off at the bottom and bringing it to the surface when the drill is withdrawn.

In order to withdraw the drill it is only necessary to throw out the release gear, E, by sliding it up the feed-shaft, F, to which it is feathered, when the drill runs up with the same motion of the engine which carried it down, but with a velocity sixty times greater; that is, the speed with which the drill leaves the rock, bringing the core with it, is to the speed with which it penetrates it as 60 to 1—the revolving velocity in both cases being the same.

FIG. 3



OPEN CUT OR QUARRY DRILL.

The drill rod may be extended to any desirable length by simply adding fresh pieces of pipe. Common gas pipe is found to serve admirably for this purpose, the successive lengths being quickly coupled together by an inside coupling four inches long, with a hole through the center of each to admit the water. The drill is held firmly in its place by the chuck, G, at bottom of screw shaft.

The small steam pump, C C, is connected by rubber hose with any convenient stream or reservoir of water, and also with the outer end of the drill pipe, by a similar hose having a swivel joint, as shown in the cut. Through this hose a ¼-inch stream of water is forced by the pump into the drill from which it escapes between the diamond teeth at the bottom of the bit, D, and passes rapidly out of the hole at the surface of the rock carrying away all the grit and borings as fast as produced. Where water is scarce or difficult of access, a spout is laid from the mouth of the hole to the tank or rerservoir and a strainer attached to the connecting hose, so that the same water may be used over and over again with but little loss.

This pattern rotates the drill from 300 to 360 revolutions per minute.

Figs. 3, 4, and 5 represent, respectively, drilling machines of various kinds, designed for particular uses, but identical in all essential points with the one described.

Fig. 3 is an open-cut or quarry drill, designed for blasting and gadding purposes. It is also extensively used for railroad grading, surface mining, well-boring, etc., where it is necessary to have the boiler at a distance from the drill, or to connect with a stationary boiler on the premises. This machine is adapted to rotate its drill from 900 to 1,000 revolutions per minute.

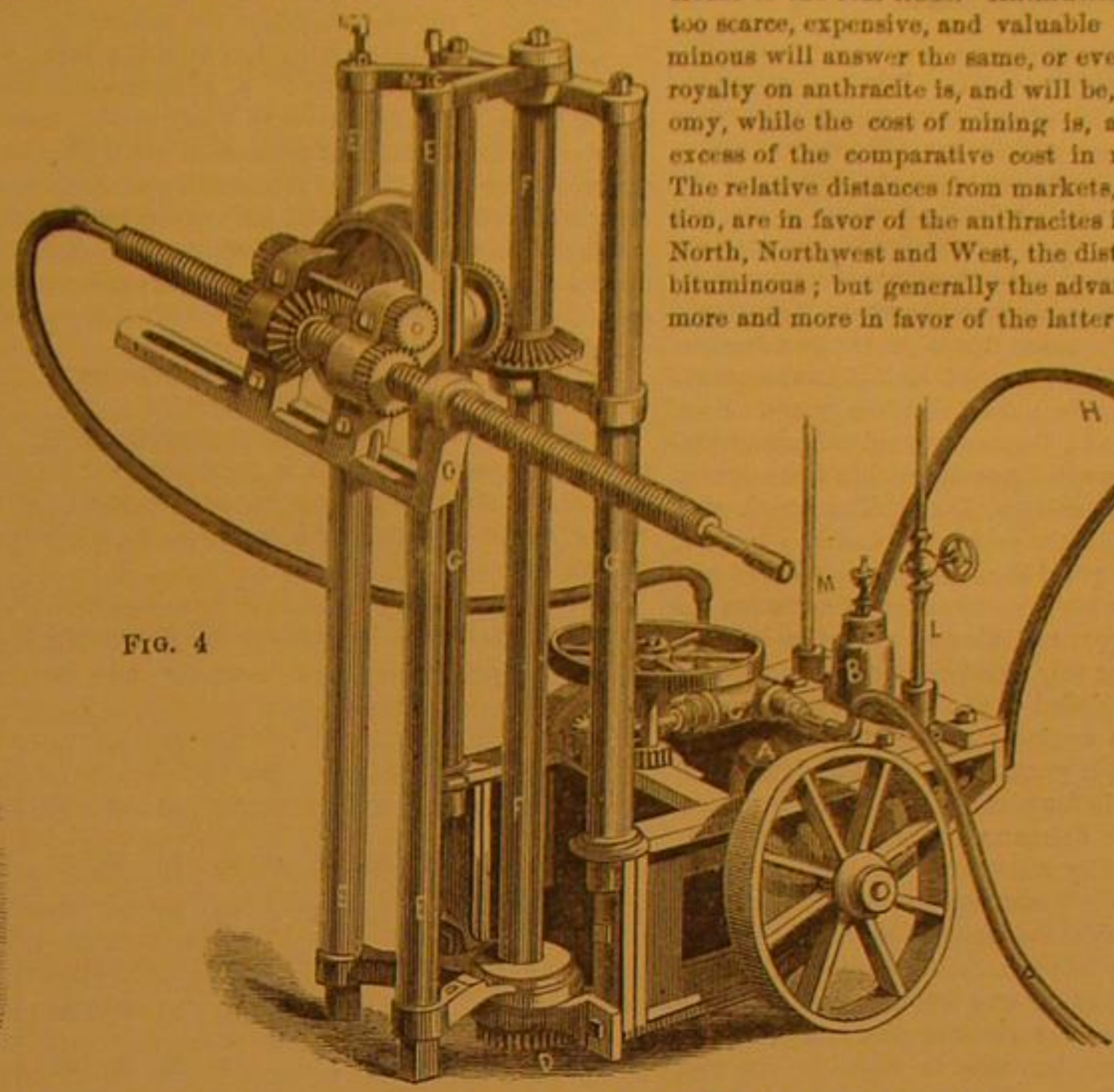
Fig. 4 represents a single-drill tunnel machine, constructed to work in tunnels of any hight, from four to sixteen feet; boring holes at any required angle, as near to the top or bottom of the heading as desired, and close to either side wall.

Fig. 5 exhibits the heaviest prospecting and well-boring machine. This machine bores holes from two to four inches in diameter, and to any depth within one thousand feet. We have personally witnessed the working of the drill, as herein described, and can say that nothing like its efficiency and rapidity of work, has been manifested by any other rock-drilling apparatus we have seen. A machine, like that shown in Fig. 2, cut through Hell Gate rock (very hard) at the rate of eight and one half inches in four and one half minutes, and through brown sandstone at the rate of thirteen inches in two and one fourth minutes in our presence, notwithstanding that its operation was retarded by the bad quality of the oil used for its lubrication, and want of sufficient steam to run at maximum speed.

In very hard trap-rock quartz or granite, eight feet per hour is found to be fair average rate of boring, where holes are not required to be over one hundred feet deep and two inches in diameter; while in sandstone, marble, slate, etc., fifteen feet per hour is easily bored.

These facts, together with the simplicity and solidity of the machinery, obviating the vexatious delays and expensive repairs incidental to percussion drilling, place these machines in the front rank of labor-saving inventions.

FIG. 4



SINGLE DRILL TUNNEL MACHINE.

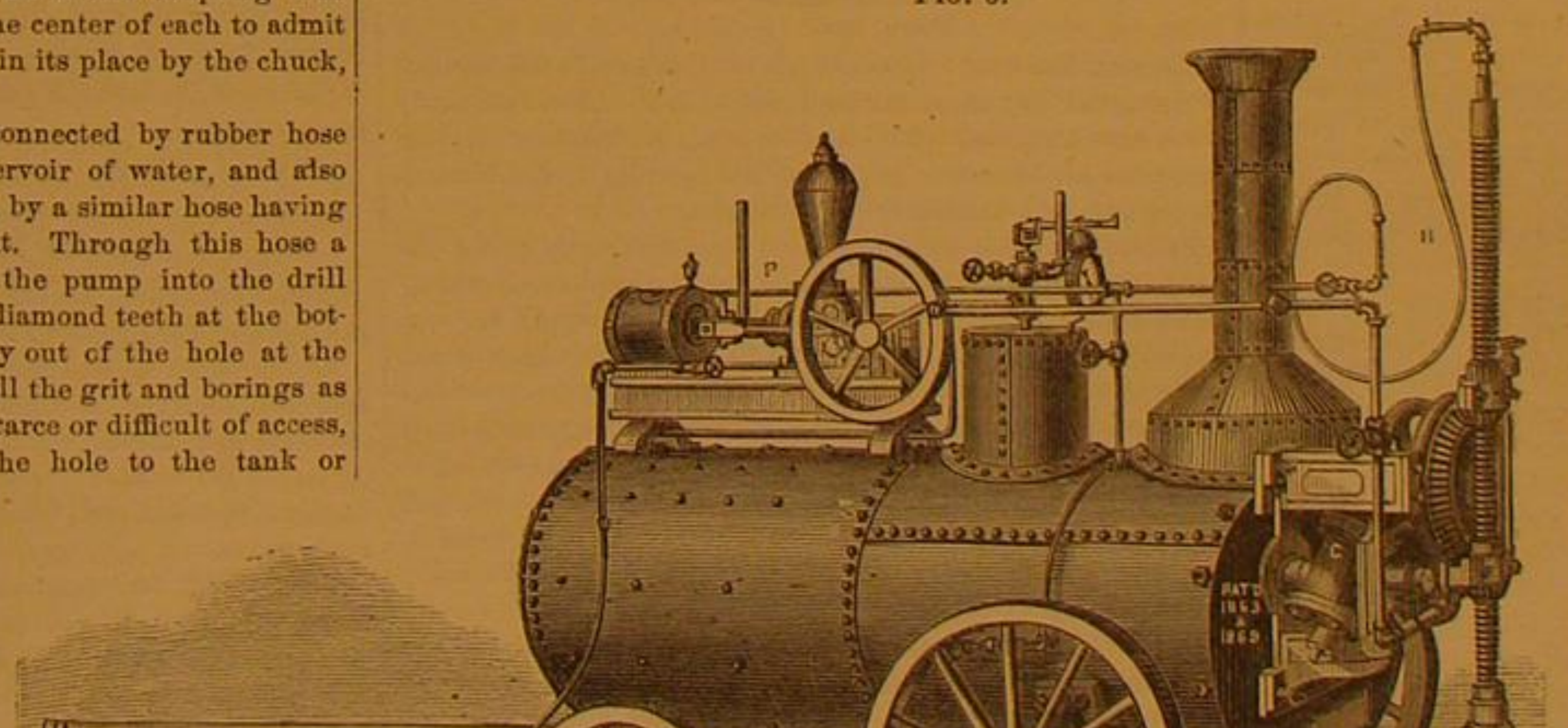
The first patent issued in America for this application of the diamond was granted to M. Leschot, July 14, 1863, and reissued to Messrs. A. J. Severance and W. T. Holt, Feb. 16, 1869, and October 26, 1869.

A second patent, covering the various mechanical devices employed in operating the tool, was granted to W. T. Holt and John North, June 22, 1869.

During the past two years—within which time the invention came into the hands of its present proprietors—all the above-mentioned improvements over the French machines have been made, and the drill successfully introduced into the principal Eastern, Middle, and Western States, and the Southern States of Maryland and Virginia.

For further information as to rights and machines, address Severance & Holt, 16 Wall street, New York.

FIG. 5.



HEAVY PROSPECTING AND WELL-BORING MACHINE.

The Future Supply of Bituminous to the Eastern Markets.

A brief glance at any geological map of the coal regions of Pennsylvania, which cover nearly one-third of the entire area of the State, will be sufficient to convince any one of the vast future importance of our bituminous coal-fields and the magnitude of their boundless resources; but only when compared with the insignificant areas of our anthracite coal-fields, can we appreciate the value of those immense deposits of the most available of fuels.

We possess, says the *Miners' Journal*, considerably less than 500 square miles of anthracite coal formation, and even this limited area has been ruinously encroached on and curtailed by wasteful and improvident mining. Yet those little basins now produce over 15,000,000 tuns of coal annually, or more than two-thirds of the entire coal production of the State.

We may live to see the time when the coal-fields of the State shall produce 50,000,000 tuns annually, since the yearly increase may reasonably be estimated at 2,500,000. Of course this cannot come from the anthracite mines. Our bituminous coal-fields must furnish the largest portion of the annual increase of the coal trade. Anthracite will, moreover, become too scarce, expensive, and valuable for use, when the bituminous will answer the same, or even a better purpose. The royalty on anthracite is, and will be, a large item of its economy, while the cost of mining is, and must be, greatly in excess of the comparative cost in mining bituminous coal. The relative distances from markets, or places of consumption, are in favor of the anthracites in the East, while in the North, Northwest and West, the distances are in favor of the bituminous; but generally the advantage will, in future, be more and more in favor of the latter and against the former, except in favored localities.

With 16,000 square miles of bituminous coal-fields, and less than 500 of anthracite, we must draw largely on the one to save the other in the future. Providentially, we find in bituminous coal the elements needed by science, pre-eminently, for the advancement of the industrial arts of the age.

A pure and rich bituminous fuel is adaptable to all the wants of society for the production of light, heat, and force. It may, or can take the place of anthracite in almost, if not every case, where fuel is required, but anthracite cannot so generally take the place of bituminous coal.

All coals undergo destructive distillation in their combustion, but anthracite, being mainly solid carbon, will only yield its gas, or ignite and burn, under a high temperature. But bituminous coal is readily converted into gas, ignites easily, and burns under a comparatively low temperature, and gas, however produced, will yield greater results in heat than can be obtained from any crude mineral fuel; while the gas is clean and pure, which can scarcely be said of our best coals in their raw state.

In the Siemen's and other similar processes, for the production of cheap gas as a fuel, from ordinary bituminous coal, and its application to the manufacturing arts, we must recognize a scientific improvement of great practical value, adaptable to an almost unlimited extent, and available, not only where intense heat and a pure fuel is required, but also in nearly all cases where coal is scarce and dear, and economy is a consideration.

We find in the statistics of the coal trade for the past year, that the production and consumption of bituminous coal is increasing in a greater ratio than the anthracite. This must continue in the future, until the bituminous column, which a few years ago was insignificant in amount, will lead the coal trade in Pennsylvania. It is now used in our rolling mills and forges, even in the midst of the anthracite mines. This seems like "carrying coals to Newcastle," but is nevertheless a fact; while for the production of illuminating gas, a rich bituminous is the only coal at present made use of.

Anthracite is a monopoly. It is limited and invaluable for certain important purposes, for use in the blast furnace, for domestic uses generally, and many other cases, where bituminous coal cannot come into competition in the Eastern markets; but the tendency of innovation is against the latter and in favor of the former. Bituminous coal may substitute anthracite in many cases, but anthracite will rarely replace bituminous in future.

Faraday's Titles.

Faraday had ninety-five titles and distinctions conferred upon him. One of them, namely, that of F. R. S., was sought for; all the rest were spontaneous expressions of respect and good-will from the societies named; but, after all, his best title was that of a true gentleman. All men spoke well of him. Although of humble birth, he never sought social distinctions; although born poor, he never coveted riches. In this respect he was very different from Sir Humphry Davy, who had vast ambition, and was eternally pining after rank. According to Sir Wm. Thomson, "Faraday had great kindness and unselfishness of disposition, clearness and singleness of purpose, brevity, simplicity, and discreetness—sympathy with his audience or his friend—perfect natural tact and good taste—thorough culture, and an indescribable quality of quickness and life."

Correspondence.

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

Do Locomotives Ever Die?

Messrs. Editors:—From what I have seen I am led to believe that locomotives are kept in use till they are killed. Their weak and corroded shells are unable to withstand the pressure put upon them, and they finally explode, killing and wounding the attendants. Then the responsible parties are wont to put on an innocent and mysterious cast of countenance, and ejaculate "What an unaccountable mystery are these steam boiler explosions!" About three years ago a locomotive boiler exploded on the Richmond and Petersburg railroad. It had been in use *only* about eighteen years. Soon after one on the Virginia and Tennessee road *only* about sixteen years old. Two years ago I saw one within five minutes after it exploded, in Chattanooga, Tenn. The break was along the edge of the lap in the center sheet of the bonnet, and on the bottom at this point the iron was only about one eighth of an inch thick, with deep blotches of corrosion up to the water line, but deeper and clearer near the bottom. This boiler had been in use *only* about sixteen years. I have since seen another that exploded on the Virginia and Tennessee road. In this case the engineer refused to go longer on the machine knowing that it was unsafe. He was discharged and a green engineer put in his place. The result was that, within an hour, he and his fireman and the engine were torn into fragments. It is hardly necessary for me to write that the superintendent of motive power was not tried for murder, and this scrap heap was *only* about eighteen years old. Within a few weeks an engine exploded on the Chesapeake and Ohio road; the first point of rupture was along the edge of the longitudinal seam of the center sheet at the bottom of the bonnet; the piece taken out increased in width to the top, along the first point of rupture. The iron was not over the eighth of an inch thick, with deep blotches and furrows of corrosion; the boiler had been in use nearly eighteen years; the stay bolts were badly worn; the fire-box in none too good a shape; and yet the boiler is being repaired by putting a new bonnet to the old fire-box.

I hope others of your many readers will communicate the facts bearing on this subject, with a view to ascertain at what age of continuous use locomotive boilers are dangerous by reason of corrosion. E. A. Dayton.

Richmond, Va.

Suggested Improvements in Sawing Lumber.

Messrs. Editors:—The lumber system of the United States presents one of those curious problems that can only be accounted for by the bounteous provisions of nature, which has given us enough to use with a large surplus to waste. At least 25 per cent of the stuff after being "squared" goes into sawdust and shavings, making a direct waste of one fourth the timber, to say nothing of the cost of reducing it to shavings and sawdust.

Let us look into this system, and see if there is not some reform demanded, and where the remedy lies. In most other countries lumber is brought to market in squared logs or heavy planks, and, after seasoning, or partial seasoning, is reduced to special dimensions by re-sawing. In England, planing mills and all wood-working establishments, saw their stuff to order—forest-cut stuff of all sizes or thin boards is not known. Here lumber is sawed green, reduced to boards and stuff of all imaginable sizes, in the forest, and then brought to market to be worked on planers without seasoning. Let us consider the two systems, and see if there is not some way of saving stuff and reducing the cost of working it.

Under our American system, as before stated, the lumber is sawed into boards and scantlings when green, in the forest mills. An ordinary lumber mill makes a kerf one fourth inch wide, which in manufacturing inch boards, turns *one fifth* of the squared stick into sawdust. Then again to compensate for irregular seasoning and warping of the stuff, the deviation of the saws, etc., at least another tenth is wasted, making a total of three tenths of the stuff. This extra thickness mentioned has, with the exception of the shrinkage, to be planed off when the stuff is worked—planed off from a surface covered with grit, dust, and dirt of transportation. Stuff that has been rafted in our western rivers after being sawed into boards, almost defy the planing and other lumber-dressing machines, until the "crust is off."

Another ev'l of our lumber system is the large amount that our yards have to keep on hand to make an assortment; few of them have the appliances for "cutting out" a bill of stuff. Rafters, studding, joists, beams, etc.—in fact everything but the thinnest boards—have to be searched for among the forest-cut stuff. If a customer wants a lot of special pieces, his only resource is to go to the log mill, and get it green.

The attention of the writer was called to the difference between our own and the English plans of preparing lumber, by the character of the machines used for planing. While the English tools for re-sawing are much heavier than ours, their planers we would call toys, in fact, there are not made at this time in England any planers that would work our American lumber; the width of the belts (which may be taken as an exponent of their capacity) is about one half our standard, and yet they do all that is required of them; the secret being that they *saw* their stuff, we *plane* ours. To compare the two plans on a basis of economy in either material or power, would be superfluous. Their deal frames, as they are called, have gang saws of from 14 to 16 gage, making a kerf of about one-sixteenth inch in width; and the cost of re-sawing planks into deals or boards on their machines, is amply compensated for by the saving in the amount of timber consumed, to say nothing of what is gained in planing or shaping it afterwards.

The want of efficient machines for re-cuttting, that could be set up in our planing mills, has been the great hindrance to re-sawing in this country. A reciprocating saw with a single blade (which is generally used) makes re-sawing expensive, while nothing but permanent earth foundations will prevent them from jarring the buildings. It is to be hoped that the band saw mill will take their place and fill this want, and that our forest mills will in time stop the manufacture of any kind of lumber but planks and squared beams from the green log.

Philadelphia, Pa. J. R.

A Magic Square.

Messrs. Editors:—The accompanying magic square is sent to you, not because it is formed on any new plan, but because it is different in some particulars from the more ordinary magic squares, and may be of interest to your readers.

The numbers used are 1 to 100. The whole square is a magic square, having the number 505 as the sum of its lines,

90	14	12	100	84		93	4	96	10		2
16	66	36	37	63		22	80	81	19		85
92	39	61	60	42		75	25	24	78		9
7	59	41	40	62		23	77	76	26		94
88	38	64	65	35		82	20	21	79		13
18	55	50	54	43		27	73	72	30		83
86	45	52	48	57		70	32	33	67		15
3	44	53	49	56		34	68	69	31		98
6	58	47	51	46		71	29	28	74		95
99	87	89	1	17		8	97	5	91		11

files, and diagonals. If the margin is disregarded, as indicated by the continuous line, the square will still be a magic square, having now 404 as the sum of its various lines. And if this square be divided into quarters, as indicated by the double lines, the four resulting squares will each be magic squares, having 202 as the sum of their lines.

Philadelphia, Pa. Pfeil.

Free Rail Joints.

Messrs. Editors:—I know not to what extent this method of laying railway track has been adopted, but I have certainly never seen a railway which had a more satisfactory appearance after an extended use, than that portion of the Nashua road which is constructed upon this plan.

No chair is used, and there is no sleeper directly under the rail joints; but in addition to the usual simple and strong four-bolted "fish joint," two broad faced sleepers are employed, close together, and so as to bring the ends of the abutting rails between them. This arrangement insures a free and open joint by allowing all dirt and clogging material to fall out, which of course leaves the opening free to its legitimate purpose, the expansion of the rails. The base of each rail is notched about midway for the reception of a spike to hold the track in its true longitudinal position, and to bring the expansion of the rail each way from its center.

One of the chief causes of the derangement of railway track is doubtless the clogging up of rail joints; rails will expand and contract, and whatever opposes such expansion and contraction sufficiently will throw the track out of line.

The mere action of sun and frost causes a variation of about three feet in the length of every mile of rail; hence the importance of this provision for the unobstructed play of the rails endwise.

If track is laid during very warm weather, one sixteenth of an inch at each joint is ample; but if laid in cold weather, three sixteenths of an inch is not too much to allow at each joint or for each rod of track. F. G. Woodward.

Australian Climate.

Messrs. Editors:—I should be glad if you could give some information on the following subject. Perhaps Capt. Maury will explain it to us.

I am unable to understand the cause of the dry climate of extra-tropical Australia in its summer season. It is long since I read Maury's excellent book, the "Physical Geography of the Sea," but I think it omits an explanation of this; and I have never seen one, that I am aware of. On the Bay of Bengal, the China Sea, and the Pacific, off the Philippines, the dry northeast monsoon, which is equivalent to the moisture-absorbing northeast trade, blows from October to March. This, by Maury's theory, should rise about the equator and then blow, as an upper current of air, toward the southeast, above the southeast trade of the southern tropics. Then, as in the case of the trade winds, descending about the latitude of thirty degrees south, it ought to give summer rain, say, from November to April, in the southern half of the Australian continent.

I notice, however, in maps of physical geography that the northeast monsoon does not cease at the equator, but blows into the southern hemisphere, still as a surface wind, of course changing its direction and blowing from northwest. It rises and becomes an upper current only on reaching the latitude of the northern limits of Australia. Then, it may be, having gone so far south before rising, it does not again descend from the upper atmosphere and become a surface wind, till, in its southward course, it has passed the usual latitude of this change, or, till it is almost beyond the southern limits of the Australian continent. In this case it would only make the ocean region southwards of Australia rainy during its summer months.

But I notice by the maps that the southern parts of Australia are not included in the region of the southeast trades; and, I suppose, may therefore have northwest winds in their warmer months, which should be supplied by the moist air of the northeast monsoon from the East Indian and China seas.

In the case of the hot winds the air would seem to come from the central deserts. This must be replaced, one would think, by this wet upper current of air descending on these desert parts. They may be too hot to allow of its raining there, but on the wind going to the southwestward, in rear of the hot wind, it might rain.

Are the hot winds of southeast Australia thus followed by rain? Perhaps even the south of Australia is too warm in summer to condense this moisture. Should these suppositions be correct, it must follow that, during all the dry season, in the southern half of Australia the upper regions of its atmosphere must contain plenty of moisture, only prevented from descending by local peculiarities.

It may be the heated surface of Australia that draws the northeast monsoon as a surface wind across the equator, as the deserts of central Asia are supposed to cause the southwest monsoon during the other half of the year. Could the surface of the country be covered with any vegetation to prevent the reflection of heat from the bare ground—especially in the north and west central deserts—the monsoon might rise about the equator and descend again, about thirty degrees south, as a rain giving wind to all the land south of that.

But might not merely planting forests in the southern parts, to keep the ground and air cool, induce the moisture of the upper air to come down? Even in this wet district of Ceylon there seems a very evident difficulty for rain to begin to fall again after the ground has got well dried and hot. Could not the rain be brought down by any means in the shape of thunder showers? In this country, though the rain is mainly, and clearly, distributed in accordance with Maury's theory, still a great deal falls in the shape of thunder showers in the valleys in rear of the hills. Hills often, at this time, get less rain than the low valleys; the thunder showers seeming, in great measure, to avoid the hills. The moisture for these thunder showers seems to come down daily from the higher regions of the air.

I fear I have made this too long, and must stop at once. I would say that the great rains of Australia in winter are as much a puzzle to me as its dryness in summer. I should be glad to see an explanation of both by an able hand. If my explanation, so far as it goes, be wrong, I should be glad to see it corrected. J. Taylor.

Island of Ceylon.

The Darien Canal.

The New York *Journal of Commerce* enumerates the advantages of the proposed Darien Canal as follows:

As compared to the route *via* Cape Horn to Calcutta, there would be a saving of 9,600 miles; to Canton, 11,900 miles; to Shanghai, 11,600 miles; to Valparaiso, 8,100 miles; to Callao, 10,000 miles; to San Francisco, 14,000 miles; to Wellington, New Zealand, 2,620 miles; to Melbourne, Australia, 2,830 miles.

The saving, in comparison to the Cape of Good Hope route, would be, to Calcutta, 4,100 miles; to Canton, 8,900 miles; to Shanghai, 9,600 miles; to Wellington, 5,260 miles; to Melbourne, 3,340 miles.

For the English trade to India, the Suez Canal would offer better inducements, but the time and expense of English vessels to China, Japan, and Australia, would undoubtedly be abridged by the Darien Canal; at all events, the canal may be expected to take a share of England's traffic which now comes and goes through the Suez Canal. All American vessels trading with Japan, China, and Australia, and, of course, those bound to and from the Pacific coast, will seek the American Isthmus Canal. It advantageous effect upon American commerce and national prosperity would be immense.

Improvements in Locomotion.—Sir Joseph Whitworth, at a recent dinner of the Foremen Engineers, deprecated the use of horse tramways as unsuited to the times. He further intimated his opinion that "mechanical engineers have a right to enter their protest, considering the many obstructions there have been for many years past to the employment of road locomotives." Sir Joseph thinks it quite possible to produce a small, light locomotive, which would work quietly and effectively for use on roads; but, as a preparatory condition, he recommends that the roads should be better made, and kept in a proper state of surface by the use of steam-rollers, steam-sweeping machines, and other appliances.

GENTLEMEN GLASS-MAKERS.

According to the testimony of several authors, the general opinion admitted even in the present day is that formerly the mere trade of a glass-maker carried nobility with it; in a word, that every common glass-maker was ennobled by the mere fact of the nature of his trade.

Since such a prerogative—however impolitic it must have been, by doing the most flagrant and unmerited injustice to other important branches of industry—has been, and is still admitted as an historical fact, let us examine for a moment, as briefly as possible, on what ground this nobility rests, if it ever existed, and what could have been the origin of the error.

The two principal offenders, in our opinion, are a poet and a celebrated potter; the first (François Maynard, French poet, born at Toulouse in 1582, and died 1646), by saying in his epigram against the poet Saint Amand, "Your nobility is puny, for you are not descended from a prince, Daphnis; *gentleman of glass*, should you fall to the ground, then farewell to your dignity;" and the second (Bernard Palissy, born in the diocese of Agen, about 1510, died in Paris, 1589), by employing this phrase in his immortal work, "Glass-making is a noble art, and those engaged in it are noble."

First, we undertake to establish that we are far from believing that a common glass-maker, more than any other manufacturer, ever merited or even ever obtained letters of nobility. Passing over these very rare exceptions, we are concerned here only with the corporation as a whole; in short, we shall endeavor to prove that, in France, the condition, the art even, if you like, of the glass-maker did never of necessity confer nobility on every one practicing it.

As regards the two authorities antagonistic to our opinion, we give the text of one of numerous decrees which were issued against the plebeians on all occasions when they attempted to lay claim to nobility.

Here is the text of a decree of the *Cour des Aides*, at Paris, in September, 1597.

". . . from the mere fact of working and trading in glass-ware, the glass-makers could not claim to have acquired nobility or right of exemption; nor, on the other hand, could the inhabitants of the locality assert that a nobleman was doing anything derogatory to his title by being a glass-maker."

From this enactment, repeated on each new attempt at usurpation, the natural consequence is, that the ordinary glass maker did not acquire nobility, and that the nobleman did not forfeit his by devoting himself to the glass trade. A still more recent proof is found in Article 2 of the privilege granted to Du Noyer, by Louis XIV., 1665, to found the manufactory at St. Gobain, "Du Noyer may take as co-partners, even nobles and ecclesiastics, without it being derogatory to their nobility."

In support of our assertions, let us further cite an article of a decree issued by the Venetian senate, which certainly of all past governments is that which has accorded the greatest number of prerogatives to glass-makers.

"The Senate decides that the marriage of a nobleman with the daughter of a glass-maker is contracted with the condition that the title of nobility be transmitted to their issue."

Nobility then is for the son of a noble; but as is seen, plebeian rank is still for the father-in-law.

The question of plebeians not having a right to nobility, as well as that of non-forfeiture for the noblemen being thus clearly settled, let us see what advantages accompanied the privileges generally conferred on noblemen, a favor of which we will shortly mention the cause.

These privileges are all mentioned in the letters patent of November 24, 1598, conferring on Balthasar de Belleville, applying equally to him and his brother nobles, the permission to establish a glass-house in Normandy, and declaring them exempt from all excise, subsidies, imposts, customs, taxes on land, barriers, highways, tolls, commissions, *bandage, robinage*, district, passage, and bridge and river dues.

In a word, the gentlemen glass-makers were then released from all existing imposts, which it is evident were rather numerous.

Was this favor—monopoly even, if you like—granted to nobility, prejudicial to plebeian glass-makers, as several writers have affirmed? We believe the contrary. While allowing even that the nobles profited by the labor of the plebeian, it is to the nobleman alone that the common glass-makers owed their establishment and afterwards their fortune.

In order to discover the origin of this association, we must go back to that remote period when the nobleman readily sold his castle in order to support the dignity of his escutcheon in a tournament; or even to those warlike times when every subject hastened to place at his king's service the vassals on his domain, both great and small, armed and equipped at his own expense. We shall then see many of them returning to these domains covered equally with glory and debt, that is, ruined.

This condition, sad for any one, was disastrous to the nobility, for it is known that the law formally excluded them, and that under pain of forfeiture of title, from commerce, by which alone they could have retrieved their fortune.

However ardently the kings of France might wish to abolish a law which pressed heavily on those alone who had sacrificed everything in the service of their country, this desire was paralyzed by the pride of the other nobles, who, still rich, compelled them to maintain in all its rigor a law in which, for fear of a subterfuge or oversight being found, all the trades then known were mentioned. At last this law shared the fate of everything not adapted to the times; and if it did not at once fall into disuse, a new importation, and consequently one not specified in the list of prohibited trades, glass-making, appeared, which allowed the kings, while still adhering to the ancient law, to profit by its silence relating to glass-making, and thus to open a resource as indispensable to the rising trade as to the re-establishment of the nobleman's fortune.

Such, in our opinion, is the real origin of the "gentlemen glass-makers," who, being nobles by birth, and no longer in dread of the law of forfeiture, in consideration of certain dues, delivered up their forests to the plebeian glass-makers. The latter, thanks to the nobles, found therein everything which they required, that is, space adapted to their trade, wood, without which they could not work, and still further, all the profits accruing from the exemptions, which being accorded to the lord alone, formed what in the present day would be known under the name of common capital.

From the preceding then, we conclude that, with some very rare exceptions, the title of "gentlemen glass-makers" was granted only to nobles who had the monopoly worked on their estate.—*Wonders of Glass-making.*

The Private Life of Galileo.

The account of the private life of Galileo, unlike many such accounts, does not give us much insight into the manners and customs and conditions of society at the time of which it treats, both because Galileo had so little real domestic life, and because the main correspondence which furnishes these private details took place between a nun (who of all persons can know least of the external world) and Galileo himself, and her letters to him have been preserved, while his answers to them have perished. Your great philosopher as a rule is exceedingly undomestic, and the proofs of this are so common that we need not quote a single example; the petty details of home weary them, and prevent the abstraction requisite for their labors: so the ancient Brahmins, who reasoned as profoundly as any light of Western civilization, lived in the solitudes of the forests of Ancient India; so Descartes withdrew himself from the world, and remained buried in the quiet of his country house while he produced his "Meditations."

Galileo also was by no means domestic. Of his three natural children, his son Vincenzio was a constant thorn in his side. He was a lazy fellow, who was always writing to his father for money, and who, Italian like, preferred to idle away his life in singing and lute-playing, to adopting any profession or attempting to get his own livelihood. We cannot find one good quality in Vincenzio Galileo; he was mean, selfish, inconsiderate, and unnatural in his behavior towards his father. One example of this is sufficient. He had quartered himself on his father, together with his wife and children, when the plague broke out in the neighborhood; whereupon Vincenzio deserted the old man, and went to a more healthy locality, leaving his father to take his chance with the other inhabitants of the district. Galileo's daughters Polissena and Virginia were placed in the Convent of St. Matthew, at Arcetri, in 1614, when the eldest was only thirteen years old; henceforth they became Sister Maria Celeste and Sister Arcangela. Of the latter we hear but little, but Sister Maria Celeste constantly corresponded with her father, and the greater number of her letters have been preserved, and are now in the Palatine Library at Florence. These letters contain some interesting details of convent life of the period, but of necessity they do not bear upon many of the doings of the outside world; their general tenor is the same throughout; they are full of her love for Heaven and for her "dear lord and father," as she was wont to call Galileo, and they almost invariably pass to an opposite extreme of matters exceedingly of the earth, earthy—the baking of cakes, the mending of linen, the getting up of his collars and so on. She tells her father all the minute details of her work, as: "I have been extremely busy at the dinner-napkins. They are near finished; but now I come to putting on the fringe, I find that of the sort I send as a pattern, a piece is wanting for two dinner-napkins: that will be four *braccia*." The last paragraph of this desultory letter begins, "These few cakes I send are some I made a few days ago, intending to give them to you when you come to bid us adieu;" and ends, "I thank Him for everything, and pray that He will give you the highest and best felicity;" and a postscript immediately follows this—"You can send us any collars that want getting up."

Galileo's villa was very near the convent, and a constant interchange of courtesy seems to have taken place; Galileo sent money and presents of meat and wine, while Sister Maria Celeste sent him plums, and baked pears, and candied fruits, and cakes, and mended his linen and kept his wardrobe in order. Her love for him amounted almost to worship, at least to veneration. When at length, worn out by watching in the convent infirmary, by ill health, and by the many privations inseparable from a convent life, she felt her end approaching, Galileo was in confinement at Siena, and she feared she should see him no more; but he was allowed to retire to his own house, and arrived at Arcetri in time to see his daughter before her death. Writing at this time (1634), Galileo says: "Here I lived on very quietly, frequenty paying visits to the neighboring convent, where I had two daughters who were nuns, and whom I loved dearly; but the eldest in particular, who was a woman of exquisite mind, singular goodness, and most heartily attached to me."

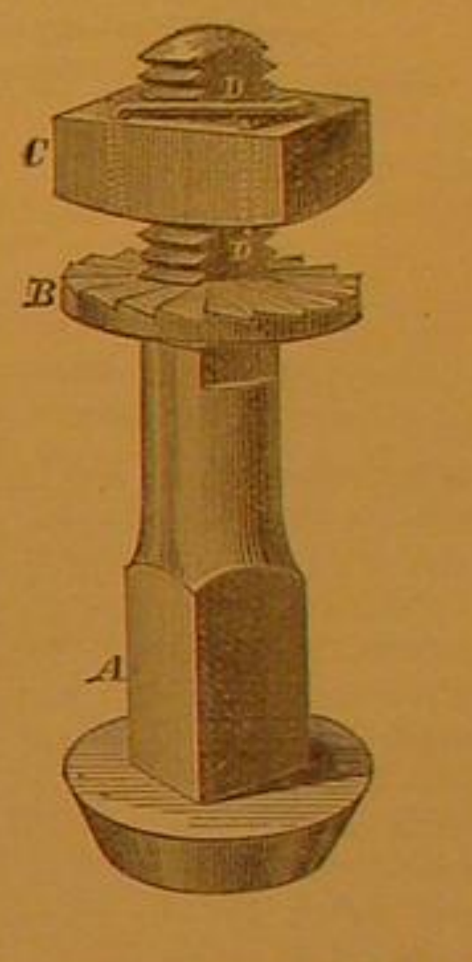
There is much in this "Private Life of Galileo" of great interest in connection with his scientific work, his books, his persecutions and trial by the Sacred College, and his condemnation; but we have preferred to keep strictly to his more private life, as the theme is so large, that if we once touched upon his scientific work and its results, we should require far more space than could be placed at our disposal here.

Galileo continued actively employed to within a few years of his death, in January, 1642. During his latter years he was a great sufferer. "I have been in my bed for five weeks," he writes to Diodati, in 1637, "oppressed with weakness and other infirmities, from which my age, seventy-four years, permits me not to hope release. Added to this, *proh dolor!* the sight of my right eye, that eye whose labors (I dare say it) have had such glorious results, is for ever lost. That of the left, which was and is imperfect, is rendered null by a continual weeping." Thus the poor old man complained, until finding that his blindness was incurable, and that his many ills were increasing, he ceased repining, and begged his friends to remember him in their prayers, till his unhappy checkered life was closed by death.—*Nature.*

LANGHORNE'S IMPROVED NUT-LOCK.

The well-recognized importance of locking nuts in all positions where they are liable to be shaken loose, has led to many ingenious devices for the purpose. The one herewith illustrated differs from many claimants to public favor, in that it may be locked and unlocked, as often as required, without injury to the device, other than the ordinary wear resulting from friction.

A is a bolt, differing only from common bolts in having one side of the portion over which the nut and washer pass, forged or filed flat. B is a ratchet washer, having its teeth formed on one side instead of on the edge, and turned toward the nut, C. The hole in the washer is made to fit to the flat portion of the bolt, to prevent turning. The nut, C, has attached to it a spring pawl, D, which is riveted at one end to the nut, and the other end plays freely through a small hole in the nut, as shown by the dotted lines.



When the nut is screwed home to the ratchet washer, the pawl, D, engages with the washer, and prevents the turning of the nut, until D is raised, by thrusting the point of a screwdriver, or some other suitable implement, under that part of the pawl which lies on the top of the nut.

For all situations where it is not convenient to permanently lock nuts, and where it is desirable to have a nut readily-removable, but which cannot shake by itself loose, this invention seems well adapted.

Patented, through the Scientific American Patent Agency, February 15, 1870, by Maurice Langhorne, of Washington, D. C., who may be addressed for the entire right or for State or county rights. Correspondence is solicited from those who have facilities for manufacturing cheaply. Temporary arrangements have been made to fill orders, which may be sent to the above address.

"Feathers" in Mahogany and other Woods.

We have been asked by a correspondent, says *The Builder*, for an explanation of the so-called "feathers" in the grain of mahogany, satin-wood, etc.: thinking others of our readers who have to do with woods may be interested in the subject, we offer the following explanation:

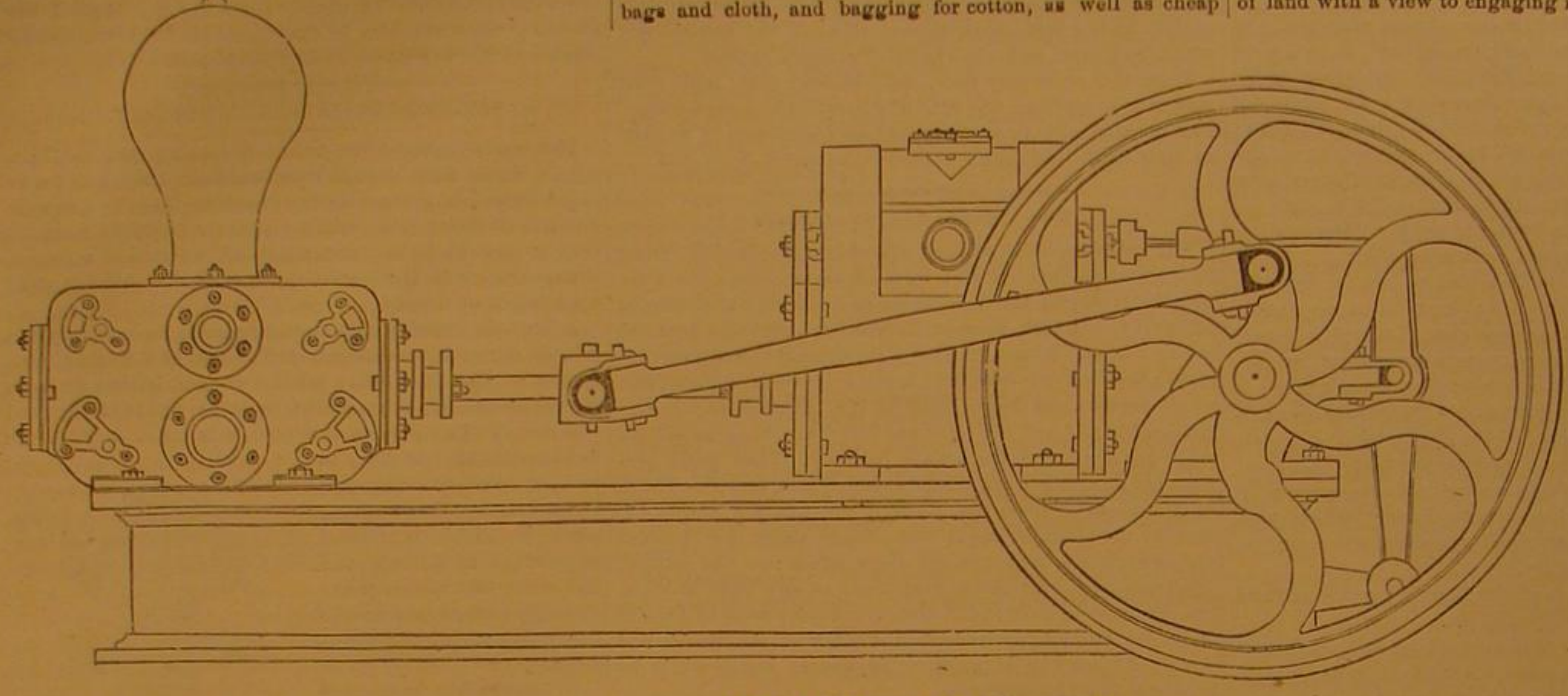
In the structure of all woods used in building, there is, firstly, a series of vessels of woody tissue surrounding the heart of the tree, having a vertical growth, and arranged in annual concentric circles; secondly, there are certain hard growths, called the "medullary rays," radiating from the heart, and consequently more or less horizontal; these vertical and horizontal growths are intimately but regularly plaited and intertwined together to give strength to the trunk, and thus far all is regularity. Now, where the branches burst through the stem, this regular arrangement is upset, and the above-mentioned woody vessels are disarranged, and pushed at different angles. When the tree is cut down and sawn horizontally across amongst these branches, these disrupted horizontal and vertical vessels (of different colors, be it remembered), are seen cut at every conceivable angle, and an ornamental "feather," more or less extensive, is the consequence. These feathers do not exist at the base of the tree, because there are no branches there to disturb the annual growths of the wood (minute feathers do indeed exist at the very heart, and these were caused by the growth of leaves and twigs when the tree was a seedling or little cutting). "Feathers" are not seen in deal because the fir is a straight-growing tree, without branches, in the portion of the trunk used in commerce. "Feathers" are seen most abundantly in "pollards," for the simple reason that after the top of the tree has been sawn off, an immense growth of branches is always induced, disturbing the tissues in every imaginable way: the action of the light on the "feathers" adds greatly to their beauty after the wood is polished.

PROF. J. W. PLYMPTON, Professor of Natural Philosophy, of the Cooper Union, was the recipient of a handsome testimonial of a silver pitcher and cup from the members of his classes, on Monday evening, April 18th, after an appropriate address by J. Pearson, on behalf of the classes, to which the Professor responded in a happy manner.

The Eclipse Steam Pump.

Two questions naturally suggest themselves to any one about to purchase an independent pumping engine, viz., whose is the best, and whose the cheapest?

The best and cheapest is evidently the one that will elevate to a given hight the greatest amount of fluid matter, for a series of years, at the least possible expense. The Lowey's patent double-acting pump herewith illustrated, is the invention of a practical hydraulic engineer, of great experience, and the pump in question is the result of his extensive practical knowledge and experience. By reference to the engravings, the reader will see that this pump is simple

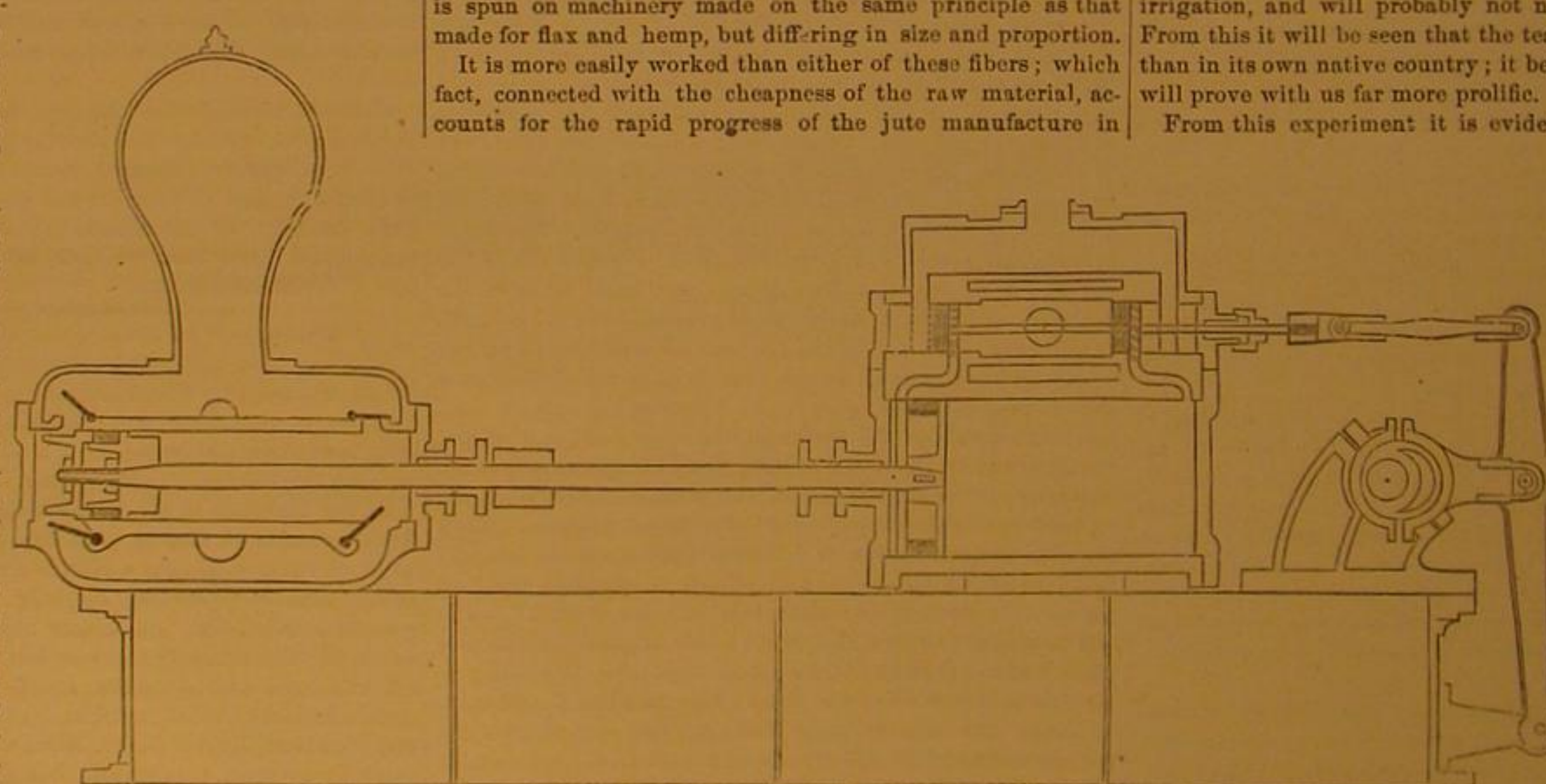


THE ECLIPSE STEAM PUMP.

in its construction; and the skillful will notice that the details are arranged to secure permanency, directness of action, ease of examination, and facility in making repairs.

Force and resistance being equal and correlative terms, it follows that if to raise 100,000 lbs. to a given hight, in a given time, it requires more than 100,000 lbs. force, the difference must be accounted for as frictional resistance, and with fluids this lost power is absorbed in friction against the walls of the pipes, according to their size, length, angles, size of openings, etc. The judicious application of the motive power, and the mechanical perfection of the working parts, act to reduce friction to its minimum. To reduce the loss of power to a minimum, has been the object sought in the construction of the Eclipse Steam Pump.

By referring to the engravings, it will be seen that the cylinder is mounted on a heavy cast iron horizontal bed, to which is likewise attached the steam cylinder and journal bearings. The work required of the pump governs the size of the steam cylinder, the pistons of which have a direct con nection, and are made to work with as little friction as possible, and are likewise arranged with special reference to being kept in unmistakable good order by unskilled attendance. The steam attachments are divested of all complication, requiring but one valve, which is so constructed as to prevent unnecessary waste of steam, and balanced so as to be worked with the same ease with, as without pressure.



THE ECLIPSE STEAM PUMP.

The valves of the pump are double, so that when by long and continuous use the first surface becomes defective, they can be turned (which is only the work of a moment), and are then as good and perfect as new valves, with but one wearing surface. All the valves and openings have the same area as the pipes, the size of which is determined by the most approved hydrostatic formula; and as the movement of the piston causes a positive and continuous flow, it would seem that this pump would lift the water as high as it is possible to be lifted by vacuum, and force it as far as it can be forced by any mechanical appliance. Hence its adaptability to the requirements of the trade, including that of stationary fire engines, seems to be such as will enable it to successfully compete with any of the numerous steam pumps in market.

For further information address Phillips and Cluley, proprietors, Monongahela Brass Works, 110 Water street, Pittsburgh, Pa.

The average depth of the Atlantic Ocean has been found to be twelve thousand feet.

The Jute Plant.

General Capron, the Commissioner of Agriculture, has imported, through the American Consul at Calcutta, a small quantity of the seed of the jute plant, with a view to introducing its culture into the extreme section of the Union south of the frost line. It is being distributed to planters in Texas and Florida, who will give it a fair trial. It is a fibrous plant, resembling coarse flax; of easy culture and rapid growth, with a comparatively large product. The crop when ripe is cut down to the roots, and after being steeped in water for a week or so the bark slips easily, and the silky fiber is detached, cleaned, assorted, and packed in bales of 300 pounds each. Its annual product in India is estimated at more than 300,000 tuns. It is the material of which gunny bags and cloth, and bagging for cotton, as well as cheap cordage, mats, and carpets, are made. Its great use, however, is for baling cotton. As it takes about six yards to wrap a bale of cotton, a crop of 3,000,000 bales would require, of course, 18,000,000 yards of bagging. The machinery for making it in India is very rude; in fact, no progress has been made in it for centuries. But jute factories of colossal size have been erected in Great Britain, some of which work up one thousand bales per week into bagging, sacking, sheeting, carpeting, duck, etc. In France some 10,000 tuns of the raw material are consumed annually; and in our Northern States its manufacture is steadily increasing. Jute is spun on machinery made on the same principle as that made for flax and hemp, but differing in size and proportion.

It is more easily worked than either of these fibers; which fact, connected with the cheapness of the raw material, accounts for the rapid progress of the jute manufacture in Great Britain, compared with linen or hemp. After being used up as bagging, etc., it finds its way to the paper mills for the manufacture of coarse papers.

The Commissioner is constantly engaged in introducing new plants for practical purposes, not only improved grains and grasses, but various hardy and exotic plants used in medicine, the arts, dyeing, and manufacturing, that cannot fail to succeed in many parts of the Union.

New Postage Stamps.

Third Assistant Postmaster General Terrell having completed his improvement of the postage stamps to take the place of those now in use, they are ready for issue. He says the gum is guaranteed to stick. The following is a description of the new stamps: One cent—Franklin, profile bust after Rubricht; color, ultramarine blue: two cents—Jackson, profile bust after Powers; color, velvet brown: three cents—Washington, profile bust after Houdon; color, milari green: six cents—Lincoln, profile bust after Volk; color, cochineal red: ten cents—Jefferson, profile bust after Power's statue; color, chocolate: twelve cents—Clay, profile bust after Hart; color, neutral tint purple: fifteen cents—Webster, profile bust after Clevenger; color, orange: twenty-four cents—Scott, profile bust after Coffee; color, pure purple: thirty cents—Hamilton, profile bust after Cerrachi; color, black: ninety cents—Commodore O. H. Perry, profile bust after Wolcott's statue; color, carmine.

Tea Growing in California.

It is unanimously admitted by those most competent to judge, that California is admirably adapted to the culture of the tea plant, the climate being especially favorable to the curing of the leaf. The opinion has even been expressed by highly intelligent Japanese now resident among us, that this State is, in every respect, better suited for growing this shrub than their native country. So confident are they of this, that a number of these people, who have already procured tracts of land with a view to engaging in the cultivation of several leading staples of Japan, will include tea in the number; satisfied that they can succeed in growing it, not only as an experiment, but render its culture commercially profitable. Over one year ago, Herr Schnell a German gentleman, who had spent many years in an official capacity in Japan, arrived in California, bringing with him a number of men, natives of that country, skilled in the raising of the tea plant and the manufacture of the leaf. These parties having since purchased an extensive tract of land in El Dorado County, will there engage in the tea culture; at first, on a limited, and, if results warrant, ultimately on a large scale, it being expected that many more of their countrymen will, from time to time, join them, or purchase separate tracts of land for the purpose of engaging in the same line of production.

Only in the item of labor will they be placed at any disadvantage, as compared with their own country. These colonists have already set out 140,000 tea plants, all of which are in a thrifty condition; and they contemplate having several chests of new tea, grown on this plantation, ready for exhibition at the approaching State Fair. These plants, set out last year, will be picked in June, and will probably afford another crop this fall. They have thus far required but little irrigation, and will probably not need any at all hereafter. From this it will be seen that the tea plant yields earlier here than in its own native country; it being probable, too, that it will prove with us far more prolific.

From this experiment it is evident that this shrub will thrive in almost any part of California, growing readily, as in China and Japan, on the slopes of the highest mountains. That it will pay to grow it here is also quite certain; first, because of the great abundance and cheapness of suitable land for its culture. Then we shall have it fresher, and more likely to be free from adulteration than the imported article. The duty of 25 cents per pound on all foreign teas, will also operate greatly in favor of the domestic grower; freights, exchanges, etc., making this protection equal to about 35 cents on the pound.

The purchaser of tea for export, in Japan, cannot make his purchase directly, even if supplied with Mexican dollars, the favorite foreign currency there, but must, under Government regulations, first convert his dollars into *kinsates*, or Government paper money, paying the banker, also a Government official, a certain discount on the same. These *kiasates* the tea merchant is obliged to accept in payment of his goods, at the peril of losing his head, a condition that, as may well be supposed, secures for them a ready circulation.—*Silk and Tea Culture, by T. A. Kendo.*

The Ottawa *Times*, a Canadian authority, boasting that the advantages of Great Britain for manufacturing are superior to those of the United States, says: "Without some protection, the United States could not manufacture for themselves at all. England would supply them with everything they want—ships, houses, planes, saws, and even door knobs—in iron;" and, it adds, what is also true, that "the internal taxation of the United States is counter-balancing even the high protective duties, making the cost of production in England, in spite of the present discriminating tariff, less than in the United States."

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Contents:

(Illustrated articles are marked with an asterisk.)

SAFETY VS. ECONOMY IN THE CONSTRUCTION OF STEAM BOILERS.

Two kinds of experiment are now and have been for some time in progress, having for their common object the improvement of steam boilers. These experiments are conducted by two sets of inventors, and have each done much to educate the steam consuming public. The first has for its aim the increase of the factor of safety to its highest point; the other aims at the increase of economy in the production of steam.

It is, perhaps, a little singular that those who aim at greatest safety, as well as those who aim at maximum economy, should have for the most part adopted tubular construction, with the distinction that the greater economy party use the tubes as flues through which to transmit the gases of combustion, and thus enlarge the heating surface; while the safety party put water in the tubes, and apply the heat out side, thereby securing great heating surface, while accumulated rupturing power is reduced.

Neither of these systems has proved altogether satisfactory. Unequal contraction and expansion have been a cause of manifold evils in the economy tubular system; and such boilers are confessedly not as safe as desirable. The safety tubular system, though safe, is uneconomical.

Notwithstanding this, the number of boilers constructed so as to make safety the principal point secured, are multiplying in the market, and are finding ready sale in many instances. There is without doubt a mean between these extremes, a mean that gives both maximum economy with maximum safety, so far as these can be simultaneously attained, and we believe we have seen boilers in which this mean is attained; but it is not our purpose to commend any particular boiler, however much it might serve us in illustrating our views upon this subject.

Most of those boilers in which the attainment of maximum safety is made the paramount object, are subject to the great defect of foaming, or priming, as it is called, so that the amount of water passed through them by the action of heat is no index of their true evaporative power. And as the economy of a boiler is entirely dependent upon its evaporative power, or the amount of water it can truly convert into steam per given weight of coal consumed, it may well be doubted whether the factor of safety is not too dearly purchased in this class of boilers.

Some recent experiments, to which we may refer more particularly at a future time, seem to show that in the ordinary mode of estimating the quality of steam by the hand, and its appearance when discharged into the air, very great errors in judgment are committed; and it is probable that many boilers claimed to evaporate from 12 to 13 lbs. of water per lb. of coal consumed, do not really do more than half that. It is further probable, that absolute normal steam from working boilers is much more rarely delivered to steam engines than is at present supposed.

The experiments referred to have also rendered it almost certain that the proportion of priming within certain limits is exactly as the rate at which the steam is delivered—all other things being equal—and that there is a limit to rapid delivery beyond which almost any boiler will prime, more or less, no matter how well it is constructed; and still another limit, below which no boiler will prime, no matter what its form may be. And further, these experiments indicate that boilers deemed safe when delivering wet steam may be unsafe when this delivery is so reduced as to force them to deliver dry steam; although, of course, no boiler composed of small pipes, or their equivalent, can produce such havoc by explosion, as one in which the water and steam are massed, and disruptive pressure accumulated upon an outside shell.

THE STUDY OF IMPRACTICABILITIES.

In this utilitarian age there are to be found many who are impatient of all that seems impracticable. They chafe at all propositions and attempts that do not clearly bear the stamp of practical skill and finished attainments. He who in his quiet workshop is studying for a solution to perhaps some impossible mechanical problem, and the one who timidly suggests some plan having in it elements of failure, plainly discoverable to the experienced and skillful, are as much the subjects of derision to this class of men, as those who dogmatically insist that wrong is right, and persistently parade their ignorance before the world.

The history of all improvement will show that failure has done as much to elevate the world as success. Even in the financial world, men need the instruction drawn from their failures to finally succeed. Few indeed march steadily on to wealth from the beginning of their career.

As in business, so in art and science. The artist perfects himself by the study of his faults. The scientist makes repeated failures ere he succeeds in originating some great and instructive experimental discovery. Scarcely an approach to perfection in mechanical construction exists that has not advanced by the gradual elimination of defects.

What is an improvement but the removal of impracticable elements. Who shall deny then the educating power of impracticabilities?

There is occasionally a correspondent who criticises the course of the SCIENTIFIC AMERICAN, because in its publication and illustration of new inventions, it does not deny its columns to such occasional ones as are faulty. If our views, as above given are correct, we should by making such a denial be narrowing the educational influence of our paper. We wish it distinctly understood that, while in our editorial statements we aim at scientific accuracy, and in our selections from foreign and home sources of miscellaneous contents, choose only such as we deem of general value, we do not wish to adapt our paper to skilled engineers and technical experts alone. We occupy a broader field, and believe we are doing far more good by acting as the general organ for the expression of the inventive talent of our country, learned as well as unlearned.

It is not enough that an invention has in it elements of impracticability to exclude it from our columns. Its publication proclaims a mechanical want, shows how it has been attempted to supply the want, and may suggest even by its impracticabilities how a practicable device may be constructed.

Probably no one of the readers of this journal has been called upon to study more critically and attentively the various devices illustrated and described in it, than the present writer of the descriptions which accompany the engravings. He certainly has not found that study devoid of interest, or of mental profit, albeit he has met with some of little practical merit. Judging from his own experience he now avows his belief that, of all the departments of this widely circulated and popular journal, none is of greater general value than that of the illustrated mechanical descriptions.

NEW MECHANICAL MOVEMENTS.

On page 193, current volume, we published some problems in new mechanical movements, which seem to have attracted considerable attention. We have received many so-called solutions, which, upon examination, have proved incorrect, but the incorrectness of which could scarcely be pointed out without giving a clue to the correct solutions.

We have also received diagrams of supposed new mechanical movements not called for by the problems proposed. Some of these show evidence of having never got further than the paper upon which they are drawn; and we would here remark, that it is well to scrutinize with very great care, any movement not experimentally demonstrated to be correct, before making any statements as to what it will do.

For instance, a gentleman from Massachusetts sends us a diagram of a movement by which it is claimed rotary motion can be converted into reciprocating motion, and *vice versa*. The device is neither new, nor will it do what is claimed for it. It is simply a slotted crosshead with straight slot inclined at an angle of forty-five degrees to the line of direction in which it reciprocates. In the slot slides a block through the center of which plays a crank wrist.

The device will convert a rotary into a reciprocating motion, but will not perform the converse movement. It has only the functions of the slotted crosshead placed at right angles with the line of direction in which the reciprocation takes place.

Problem second, in the article above referred to, has received but two original solutions, which we give below; we think one of these is a very ingenious one. Others have been proffered but they are old. One of these is the method described by Fairbairn. The problem was enunciated as follows: "Required to produce a variable rotary motion in a shaft driven directly by a belt from a pulley having a uniform constant rotary motion, without the use of anything but the one belt and the two pulleys; no cone pulleys or their equivalent to be allowed. All the motions to be continuous and in the same direction."

Fairbairn's method, above alluded to, is to make the driven pulley eccentric to its shaft, and use a belt long enough to accommodate itself to the eccentricity with a friction pulley to take up the slack. This does not conform to the conditions of our problem, which admits nothing but a belt between the two pulleys.

Mr. A. K. Smith, of Nebraska, Ohio, sends a solution new to us, but he says not new to himself, as he saw it many years since. The method described by him is to make the driven pulley eccentric and use an elastic belt. This is a proper solution of the problem.

R. B., a modest young machinist, of Buffalo, N. Y., shows that the elastic belt need not be used. With proper proportions an ordinary leather belt may have slack enough to compensate for the eccentricity of the driven pulley. This is also a correct solution.

Mr. L. A., of Brooklyn, N. Y., who does not seek celebrity, and therefore does not wish his name published in full, gives the most ingenious solution of any received. He accomplishes the required result by the use of two ordinary pulleys with shafts in their geometrical centers, but connected by a belt, one half of which is elastic and the other half inelastic. Whenever the elastic half of the belt is put on the stretch, it will yield so that the opposite side of the belt will be slack, the slack increasing as the elastic side receives more and more of the tension. When the inelastic half of the belt transmits the motion there will be no slack on the opposite side. The belt, therefore, alternately shortens and lengthens while transmitting the motion, thus rendering the speed of the driven pulley variable, as required. It is obvious that the greater the resistance which the driven shaft has to overcome, the greater will be the variation in the speed.

The inventor of this movement has employed it to produce some very life-like automatic movements in toy figures.

We hope to receive original solutions to the other problems in due time.

METALLIC HYDROGEN.

At a recent meeting of the Lyceum of Natural History, in New York, a paper was read by Dr. Loew, assistant in the College of New York, on the preparation of hydrogen amalgam, that deserves the attention of scientific men everywhere.

The researches of Graham, which we published at the time, went to show that hydrogen could be alloyed with palladium, and that it was also contained in meteoric iron. He condensed the hydrogen in the palladium, and came nearer proving its metallic character than any other person had done. Schoenbein, in his search for ozone, found a method for making the peroxide of hydrogen, that was simpler than any hitherto known, and which brought him to the very threshold of discovering hydrogenium. Schoenbein's experiment was this: An amalgam of zinc and mercury is violently agitated in water; the water is then filtered, and on being examined with iodide of starch and protosulphate of iron will be found to contain peroxide of hydrogen or oxygenated water. The experiment is a very beautiful one, and is now repeated in the class room. Dr. Loew has carried the investigation further, and has, instead of oxidizing the hydrogen, succeeded in combining it with the mercury. He takes an amalgam composed of not more than three or four per cent of zinc, and shakes it with a solution of the bichloride of platinum; the liquid becomes black, and a dark powder settles to the bottom. The contents of the flask are then thrown into water and hydrochloric acid added to dissolve the excess of zinc. The amalgam of hydrogen and mercury at once forms in a brilliant voluminous mass, resembling in every way the well known ammonium amalgam. It is soft and spongy and rapidly decomposes, but without any smell of ammonia. The hydrogen escapes, and soon nothing but pure mercury is left in the dish. The experiment appears to show conclusively that an amalgam of hydrogen and mercury can be formed, and that hydrogen is really a metal. It would also throw some doubt upon the existence of the amalgam of ammonium and mercury, and offer an explanation of that compound on the basis of its being the same amalgam of hydrogen and mercury that is prepared in the way now pointed out by Dr. Loew. The smell of escaping ammonia must be traced to some other source than the existence of that radical in combination with mercury.

The question may arise, What practical value can be derived from this discovery? We may not be able to appreciate its importance at this early stage, but heretofore it is easy to perceive that the possession of metallic hydrogen will enable us to make a vast number of compounds artificially, and will give us an explanation of many phenomena that are now obscure. If Professor Graham had not published his researches, the experiment exhibited by Dr. Loew would have attracted the attention of the world; as it is, it is likely to excite much interest both in this country and in Europe.

USES OF FLUOR SPAR.

We are sometimes asked to give the applications of Fluor Spar, and as we cannot answer these questions separately, we we propose, for the benefit of all of our readers, to devote some space to an account of the properties and uses of this valuable mineral.

Its name indicates two things—first, that it easily melts or flows; secondly, that as a spar it is frequently found associated with ores in our mines, for the Germans gave the name spar to the minerals which occur with metals, as, for example, calc spar, feldspar, iron spar, manganese spar. When worked up into ornamental objects, it is known as Derbyshire spar, from one of the localities where fancy articles are made. It is sometimes found in beds, but generally in veins, and often occurs as the gangue of metallic ores.

There are many applications of fluor spar, some of which we purpose to give in this article.

ALUM FROM FELDSPAR.

The manufacture of alum and other compounds of potash from feldspar has long been regarded as a desirable thing; this result can be obtained for alum by fusing the feldspar with fluor spar and treating the mass with sulphuric acid. In this way the silica is expelled in combination with the fluorine as hydro-fluosilicic acid, and the sulphuric acid unites with the alumina and potash of the feldspar to produce alum, while the lime of the fluor spar being insoluble can be collected on filters, or removed by decantation, in the form of gypsum. Other potash salts can be produced from the alum.

HYDRO-FLUOSILICIC ACID.

Gay-Lussac observed many years ago, that when fluor spar and silica were fused together, some of the fluorine combines with the silicon in the form of fluoride of silicon, and escapes with the gaseous products of combustion. Many attempts were made to save this gas, but without success, until Tessie du Motay constructed a furnace by which, it is claimed, that 68 per cent of the fluoride is economized. Plans of the furnace were shown at the Paris Exhibition of 1867, together with a large suite of salts prepared by means of the hydro-fluosilicic acid. Among these salts we recall pure caustic potash, carbonate of potash, silico fluoride of potassium, silico fluoride of sodium, silico fluoride of barium, and caustic soda. As many of our ores contain fluor spar, and as, in the process of smelting, the fluorine is expelled, it is well worth while to save the incidental product of fluoride of silicon by conducting it into water and converting it into hydro-fluosilicic acid. This latter acid has many applications in the arts, and if we could obtain it cheaply and in abundance, it would prove of great value. It has been recommended for the decomposition of bones and guanos; for the manufacture of artificial stones; for fixing colors in paintings with soluble glass; for the preparation of pure tartaric acid, by removing the potash from tartars; to remove lime and potash from the juice of beet-root; and in some of the operations in the manufacture of pins.

HYDROFLUORIC ACID.

For etching on glass, fluoric acid has long been employed, and for this purpose it can be readily prepared by pouring sulphuric acid upon pulverized fluor spar. The operation must be conducted at a gentle heat, in a leaden or platinum retort. When required pure, the latter metal is indispensable. It is, also, sometimes customary to pass the gas through ammonia or potash to produce the fluorides of ammonium or potassium, also to be used for etching glass or for the resolution of minerals.

It is proper to state in this connection, that great precautions must be observed in handling hydrofluoric acid. The preparation of the gas is attended with great danger, as it attacks violently the organs of respiration. A drop of the acid on the skin produces fearful ulcers, and on the tongue, instant death. In a concentrated state it must be preserved in platinum bottles, and in a dilute form, can be kept in gutta-percha bottles.

FLUOR SPAR AS A FLUX.

It has been observed that lime alone occasions a loss of 5 or 6 per cent of iron, in blast furnaces, and that a small addition of fluor spar remedies this evil, as it keeps the slag more uniformly liquid, so that the iron is not caught in it, but falls rapidly through it, and the slag can, by blowing out the furnace, be more easily removed than when other flux is used. The fluor spar also prevents the formation of graphite and removes phosphorus. The proper proportion is about 50 lbs. to 100 lbs. pig iron, or 40 lbs. to 100 lbs. spiegel iron. A larger quantity might prove injurious to the walls of the furnace. In small crucible operations, fluor spar can be recommended as a valuable flux, and in blow-pipe analysis it has a similar application. [See page 229, Vol. XIX., letter of S. D. Poole, Lynn, Mass.]

PREPARATION OF ALUMINUM AND MAGNESIUM.

Metallic aluminum has been made by fusing the double chloride of aluminum and sodium with a proper proportion of metallic sodium, but the actual operation is attended with some practical difficulties, which are said to be removed by the addition of fluor spar. The mixture usually taken is composed of 100 parts double chloride of aluminum and sodium, 50 parts fluor spar, and 20 parts sodium. These substances are intimately mixed and introduced upon the hearth of a furnace previously heated to redness. The doors of the furnace are closed while a strong heat is brought to bear, and by occasional stirring the metallic aluminum will flow down to the front of the inclined hearth. By permitting the more fluid portion of the flux to run away, some fluoride of aluminum can be saved as an incidental product. Magnesium can be prepared in a similar manner by fusing 600 parts chloride of magnesium, 480 parts fluor spar, and 230 parts sodium, in a suitable crucible. The sodium must be freed from naphtha and cut into small pieces so as to be intimately mixed with the chloride and fluor spar, it is then projected into a crucible previously heated to redness, and the cover held down during the first stormy reaction by an iron weight. The magnesium will be found scattered through the slag in small bright pellets, from which it can be separated by crushing and washing.

HYDRAULIC CEMENT.

It is not an easy thing to graduate the heat in the preparation of hydraulic cement so as to prevent the formation of hard slag. By mixing fluor spar with the limestone, a greater range of heat is found to be admissible, and a second burning can be obviated and the properties of the cement are said to be improved.

An excellent cement can also be made by fusing feldspar, lime, and fluor spar together, and separating the potash by dissolving in water. This has the additional merit of securing a most valuable incidental product in the potash.

ANTOZONITE.

A variety of fluor spar has been discovered in Germany, which, on the application of heat, gives off an odor that forcibly recalls chlorine, and, twenty years ago, was supposed to contain that gas. Schoenbein considers the odor to be due to a modified form of oxygen which he calls antozone, and he names this variety of the fluor spar antozonite. A French chemist, also, takes the ground that fluor spar contains oxygen. If either of these theories could be proved by experiment, other and important uses would be opened up to this mineral.

SEPARATING GOLD AND SILVER.

The Stevens flux, for treating mineral ores, is essentially fluor spar, obtained in the treatment of cryolite for soda, and there is, consequently, nothing particularly new about it. According to experiments conducted by Dr. Chandler, of the School of Mines, Columbia College, the amount of fluor spar required in the working of gold quartz is very large, often one hundred per cent, so that the economy of the process must depend upon the cost of the fluor spar at the mines. It is doubtful if fluor spar can be economically employed on a large scale in treating gold quartz. In the working of titaniferous iron ores it now has considerable employment, and may add to the value of that class of ores.

The above are some of the uses to which fluor spar can be applied, from which it will be apparent that it is a valuable mineral, worthy of the attention of metallurgists and manufacturers everywhere.

THE INCREASED USE OF COLD-ROLLED SHAFTING.

The use of cold-rolled shafting is, so far as we can learn, steadily increasing, and its application to purposes where exactitude of diameter, superior strength and rigidity, as well as the highest perfection of finish is required, has now become very extensive.

For our own part we have certainly never seen anything in the way of shafting, superior in point of elegance of finish to this product of cold-rolling.

This beautiful finish, however, is not gained at a sacrifice of strength as might be supposed by those unacquainted with the process, as the following table of results obtained in experiments performed by Major William Wade, of the United States Department, will show.

We may also state that similar tests were made by John P. Whipple, Chief Engineer, U. S. N., and William Fairbairn, Esq., Manchester, England, with like results.

The table is a summary of the average results obtained from numerous experiments made with bar iron, rolled while hot, in the usual manner, compared with the results obtained from the same kinds of iron, rolled and polished while cold, by Lauth's patent process, as manufactured by Jones & Laughlins, of Pittsburgh, Pa., whose advertisement will be found in another column.

	Iron rolled while		Ratio of increase by cold rolling.	Average rate per cent of increase.
	Hot.	Cold.		
TRANSVERSE—Bars supported at both ends, load applied in the middle, distance between the supports 30 inches. Weight, which gives a permanent set of one tenth of an inch, viz.: 1½ in. square bars.	3,100	10,700	3,451	162½
Round bars, 2 in. dia.	5,200	11,100	2,134	
Round bars, 2½ "	6,800	15,600	2,294	
TORSION—Weight which gives a permanent set of one deg., applied at 25 in. from center of bars. Round bars, 1½ in. diameter, and nine in. between the clamps	750	1,725	2,300	130
COMPRESSION—Weight which gives a depression, and a permanent set of one hundredth of an inch, to columns 1½ inch long and ¾ in. in diameter	13,000	34,000	2,615	161½
Weight which bends, and gives a permanent set, to columns 8 in. long and ¾ in. diameter; viz.: Puddled iron	21,000	31,000	1,476	64
Charcoal bloom iron	20,500	37,000	1,804	
TENSION—Weight per square inch, which caused rods ¾ in. dia. to stretch and take a permanent set, viz.: Puddled iron	37,250	68,427	1,837	95
Charcoal bloom iron	42,439	87,286	2,059	
Weight, per square in., at which the same rods broke, viz.: Puddled iron	55,760	83,156	1,491	72
Charcoal bloom iron	50,927	99,293	1,950	
HARDNESS—Weight required to produce equal indentations	5,000	7,500	1,500	50

NOTE.—Indentations made by equal weights, in the center, and near the edges of the fresh cut ends of the bars, were equal; showing that the iron was as hard in the center of the bars as elsewhere.

SCIENTIFIC INTELLIGENCE.

SEPARATION OF ANIMAL AND VEGETABLE FIBER.

M. Shervord has invented an ingenious method for the separation of animal fiber from vegetable. The process does not alter the structure or color of the animal fiber, and permits the use of cotton and linen fiber separated from it for numerous purposes. It is sufficient to suspend the goods in an atmosphere of nitrogen or carbonic acid, and to cause the vapors of perfectly dry sulphuric, phosphoric, or hydrochloric acid to enter the room. These fumes disintegrate the vegetable fiber and leave intact the animal—the two fibers can thus be separated and appropriated to their respective uses.

CLEANING ENGRAVINGS.

It very often happens that fine steel engravings get stained with moisture on the wall, or specked with mildew, and it becomes an important question how to bleach them. One of the best methods is to moisten them carefully and suspend them in a large vessel partially filled with ozone. The ozone bleaches them perfectly without attacking the fiber of the paper.

For the evolution of ozone the simplest way would be to clean pieces of phosphorus and place them, half covered with water, in the bottom of the jar in which the pictures are suspended. On a large scale, a Ruhmkorff coil and constant discharge of electricity would be preferable. It is somewhat surprising that this method of cleaning fibers has not been more generally applied.

INFLUENCE OF FORESTS UPON RAIN.

The London *Athenæum* contains another example of the influence of forests upon the quantity of rain. In several districts of Australia there is a perfect rage for cutting down timber, and where this devastation has been carried out, the quantity of water that falls in a year has greatly diminished; from 37 inches in 1863 it has decreased to 17 inches in 1868. In 1869, from January to July, comprising two of the wet months, there only fell 11 inches of rain.

In Victoria the want of water is becoming a serious question, and the Government has been compelled to appoint an inspector of forests intrusted with the duty of preserving the trees already existing, and to establish nurseries for young sprouts wherever admissible. By a judicious planting and preservation of forests it is anticipated that a decided improvement can be effected in the climate of the country.

The residents of New England, who permit the mountains to be stripped of their trees for the production of charcoal, would do well to consider at what a cost to the water power of the States, to the fertility of the farms, to the climate of the country, and to the health of the community, all this momentary gain is attained. While other governments are planting trees at great expense, they are cutting them down to obtain a few chaldrons of charcoal.

MORIN'S EXPERIMENTS UPON THE PUNCHING OF METALS.

General Morin, one of the ablest of French engineers, and who has given to the world one of the best treatises on mechanics extant, has been extending his investigations to the determination of the power expended in the punching of metals and plastic substances.

The results of a large number of experiments are given by him in a paper read before a recent session of the Academy of Sciences, Paris, which demonstrate that the same elements of resistance enter into the operation of punching as in that of shearing. In short, a punch and die may be considered as a shears with circular blades. The coefficient of pressure in punching, per any given area of section, will be exactly that for shearing the same area of section, without reference to the thickness of the material.

The measure of force, necessary to effect the various punchings easily gives the value of the resistance to shearing, in case of the ordinary metals. This resistance (per square meter) is determined to be, for

	Kil.
Lead	1,820,000
Block tin	2,090,000
Alloy of lead and tin	3,390,000
Zinc	9,000,000
Copper	18,930,000
Iron	37,570,000

It is difficult to give these figures in exact denominations of English measures and weights. A square meter is 1·196 square yards, nearly; and a kilogramme is, approximately, 2·205 lbs. avoirdupois.

THE GREAT UNION DEPOT ON FOURTH AVENUE, NEW YORK.

The contract for this enormous structure has been finally awarded to the Architectural Iron Works at the foot of Fourteenth street, New York. The depot is intended to accommodate the trains of the Harlem, Hudson River, and New York Central Railroads. For the latter a branch road will be built to connect with the Harlem, the trains being switched off in the neighborhood of Spuyten Duyvil. The car house will have accommodations for twelve single trains, while, if it be necessary, double or even treble that number can be accommodated.

Photographs of the plans and drawings were sent to Europe for bids, but it was found that American founderymen could more than compete with any bids received abroad.

The foundation of this immense structure, to be the largest of the kind on this continent, is well under way—in fact, nearly completed. The contract calls for the completion of the entire structure within eight months from its date. If not completed within the time specified, the contractor is to forfeit and have deducted from the contract price $500 a day for every day over; and if completed within the time specified, the contracter is to receive, in addition to the contract price, the sum of $200 for each day the work is so completed and accepted by the engineer.

The weight of iron to be used will be over 8,000,000 pounds. It will require 100,000 square feet of glass in the roof alone, and 90,000 square feet of galvanized corrugated iron to cover the roof. The roof over the car-house will extend over an area limited south and west by the office buildings, east by the Fourth avenue, and north by a line 30 feet 6 inches south of Forty-fifth street. The entire length of the roof will be 652 feet, and it will be 199 feet 2 inches in width between the walls, and supported by 32 arched trusses, placed 20 feet four inches apart. These great arches will be set upon the foundation, whose upper face is 2 feet below the surface of the ground, rising to an elevation of 94 feet from the springing line to the extrados of the arch.

The car-house is to be lighted through three skylights extending over the entire length of the roof—one on the center, double pitched, and two single ones on each side of the center. There will be seven courses of ventilators running the entire length of the roof, faced up with stationary sheet iron slats.

On the south end, the segmental portion of the arch above the brick wall will be faced with cast iron trimmings and plate glass.

The north end will be closed with a beautiful cast iron front highly ornamented. The east side, along the Fourth avenue, will be finished with cast iron pilasters acting as casings set in front of each truss. These pilasters are to have bases and caps, supporting a main cornice along the front, and crowned by a cast iron balustrade; a line of balconies will run along the west side and across the south end, connecting with the offices in the second story. The trusses are placed in heavy cast iron shoes, sixty-four in number. To permit free expansion and contraction of the trusses, without interference with the side walls crossed by them, there will be placed cast iron boxes or casings perforated by a series of cores, and fitted together by means of bars and angles in such a manner as to insulate entirely the mason work from the trusses.

The rafters will consist of five-inch deck beams secured to the top chord by double angle iron studs, 3½ by 3½ inches, and stiffened by diagonal braces of same size, riveted together and fastened on the chord by means of bent lap plates one half inch thich, and riveted to the former.

The doors and windows will have cast iron trimmings, all ornamented, the windows to be glazed with rough half inch glass. The whole of the north front will be of cast iron, the width to be 203 feet 10 inches, and raised 112 feet 6 inches in extreme hight. The windows and doors of the first story will have rolling shutters.

The ends of the structure will be occupied for offices on the first floor, while the ground floor will be set apart for ticket offices, passengers' rooms, baggage lockers, restaurants, news-stands, etc.

Pennsylvania iron, of the best welded quality, will be used for plates, flat or square bars. Round bars and rods for braces to be of Ulster iron: rivets and bolts, of charcoal iron. Sheet iron, best welded and refined Pennsylvania. Cast iron, mixed in the following proportions, viz.: American pig No. 1, and Scotch pig No. 1, 5 per cent of each for shoes, casings, lintels, box, angle, studs, and braces. American pig No. 1, 10 per cent, and Scotch pig No. 1, 15 per cent, for columns and pilasters. American pig, No. 1, 15 per cent, and Scotch pig No. 1, 20 per cent, for hanging cornices, friezes, and flat pannelings. American pig No. 1, 30 per cent, and Scotch pig No 1, 30 per cent, for small moldings and ornamented work. All rolled and welded iron to be subject to a strain of 30,000 pounds per sectional inch.

BILL TO AMEND THE PATENT LAWS NOW PENDING BEFORE CONGRESS.

We have now before us the completed bill pending before Congress to amend the patent laws, to which reference was made in No. 8 of the current volume. It amounts substantially to a codification of our entire present patent system, and we feel bound to confess, that in many respects the bill is a great improvement upon the old law, reflecting credit upon the Committee, of which Hon. T. A. Jenckes is chairman.

The bill came up for discussion in the House on the 15th inst., but went over under the rules, and before the discussion was concluded. The provisions of the bill embrace patents, designs, trade-marks, and copyrights, and are too voluminous to print in our columns.

We regret to notice, however, that the provisions relating to appeals from the Commissioner to the Supreme Court of the District, have been stricken out. We trust that the House will insist upon its restoration.

In explaining the various features of the bill, Mr. Jenckes says:

"In the law with regard to patents, which appears as chapter two of the bill, there are four principal propositions of amendment. One is the requirement of a fee to be paid at the expiration of seven years from the date of the patent, and another at the end of the twelfth year as a condition of keeping the patent alive. Such a provision is found in the patent laws of almost all other countries. The proposition had met the commendation of the Commissioner and of persons doing business at the Office. Its adoption will increase the revenues of the Office, and will weed out those worthless patents which are sometimes taken hold of by speculators near the expiration of their terms for the purpose of harassing the public with igenious reissues. One great annoyance and evil will be removed and positive good obtained in its place.

"Another source of difficulty, and which was becoming a great one, arose from the fact that there is a large number of what are called rejected applications in the Patent Office. During the past year there were over five thousand of final rejections, and the year before nearly as many, and since the constitution of the Office there are perhaps twenty thousand remaining in the Office; most of these rejections have been acquiesced in and the claims abandoned. But some of these have been rejected improperly, and contain descriptions of valuable inventions. In course of time it has been discovered in many cases the rejection was wrong and that the examiner had made a mistake, and the applicant has again made application for his patent, and pressed it, and it has sometimes been allowed and sometimes rejected. If allowed, he would go and try its validity in the courts. If refused, the further difficulty arose on the provision in the existing law for the revision of the decisions of the Commissioner.

"As the law now stands an appeal may be taken to one of the judges of the Supreme Court of the District of Columbia, or remedy be had in a suit in equity in that or any other circuit court. This led to a conflict in the jurisdiction exercised by the Commissioner and that exercised by a single judge in this District court, and exposed behind it a further and greater cause of difficulty. That is, the law as it now stands, contains no provision absolute in itself, clearly and distinctly defining what should constitute the abandonment of an invention to the public. We heard the solicitors at great length on the question, and the conclusion the committee arrived at is expressed in two short provisions of the proposed bill. The substance of them I will state. Each and every party whose application has been refused is allowed two years to renew that application before the Commissioner, but this provision is not allowed to revive any application for an invention which has been, as a matter of fact, abandoned to the public. In other words, it says a mere lapse of time in the prosecution of an application of a patent shall not be conclusive evidence of abandonment; that the right to a patent for a first and original invention is a vested right, and can only be lost by the inventor in not proceeding in accordance with the provisions of law, or in his forfeiting that right in accordance with those provisions; and to those in this condition, not cut off by any positive existing statute of limitation a new statute of limitation is proposed, defining the time within which such new application shall be made. Thus all the rights are preserved and the mode of prosecuting them is pointed out. The field of controversy concerning these old applications, whether abandoned or not, is fully and satisfactorily provided for."

"The Committee also propose to amend and enlarge the provisions as to relief between interference patents, and to provide relief in cases where a patent has been improperly obtained or improperly reissued, or where the validity of a patent is contested by persons using the things patented.

"There is now no means provided by which a person thus injured or threatened to be injured by a suit can turn around on his prosecutor and test his right to the patent. We propose to give that remedy, so that a single suit can determine the question and avoid the extended litigation and expense now attending controversies upon patents. Heretofore it has sometimes happened that persons have obtained reissues of old patents, and then gone around the country threatening suits against persons; sometimes commencing a suit in a court, and if not liking the temper of the judge, or from some untoward circumstance connected with the trial, abandoning it and commencing another somewhere else, with the hope of obtaining a decision in their favor. And when they have succeeded in obtaining a single decision they will go around again and levy a tax upon all who do not feel able to go to the expense of contesting the validity of the patent.

"That has been a great burden and a great wrong, which has many times been sought to be amended. But the difficulty has been to do it without injuriously affecting rights conferred and established. The committee propose to do it by recommending that where any party has been sued for the infringement of a patent, and he thinks the patent is invalid for any reason or should not be enforced against him for any cause, he may commence a suit against the owners of the patent who have sued him, in order to test the validity of that patent, and the final decision in that case shall be conclusive upon the right of all parties claiming the right to use the thing claimed to be patented.

"I know one case where after a defendant had succeeded in a suit upon a patent, the patentee turned around and brought upwards of a hundred suits all over the United States upon that very patent, subjecting each of the parties sued to as much expense as the one who had defeated him, in the hope of obtaining a reversal of the former decision. That is an evil to be prevented; and we think we have provided a remedy which will reach the case, so that the expense of one suit shall be all that is required to test the validity of any patent or the right of any party under it.

"The committee have recommended also certain provisions which are entirely new concerning trade-marks. These have not heretofore been the subject of any national law. It is a subject embraced within the common law jurisdiction of all the courts of the country, and also within the general equity jurisdiction of all the State courts. This bill does not propose to interfere at all with the local and State jurisdictions. A person, standing upon his common law rights, may still go into the State courts and defend a trade-mark, exactly as he may do now; but if he chooses to register his claim at the Patent Office, pay his fee, and take his certificate of registration, it will protect him throughout the United States, in the same way as a patent for a design or a copy-right is protected.

"Concerning trade-marks, we are at present in an anomalous condition, which perhaps is not understood by the House generally. By certain treaties or conventions with Belgium, France, and Russia, we have agreed to recognize the validity of the trade-marks of those countries upon their being registered in the Patent Office of the United States, and to give them the same effect throughout the United States that they have in the country where they originated; and trade-marks recognized by the law of this country have the same effect throughout those European countries as the trade-marks secured by the citizens or subjects of those countries.

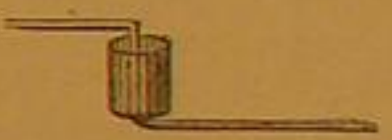
"A *fac similie* of the trade-mark is to be sent to the Patent Office. The kind of business, as well as the kind of goods, to be protected, is to be described briefly and correctly. A fee of $25 is to be paid into the Treasury of the United States. A certificate of such registration, with a *fac simile* of what is filed in the office, is to be delivered, under the seal of the Patent Office, to the person causing such registration. It is to be in effect for thirty years from the date of registration, and if it be copied by a person not having a right to do it, or if it be copied by a person in such a manner that the imitation is calculated to deceive the public, then the party may have his remedy in any court of the United States for the injury done him."

ELECTRIC FORCES.

There is no fact connected with the electric agencies, by which distant communication is secured, more suggestive than the minuteness of the power by which it is sustained. To project a ball at a distant ship with certainty of aim, to blast the sunken rock that impedes navigation, to impel the giant ship that splits the storm with its defiant bow, forces are presented to the eye which bear some natural comparison with the work accomplished. But when a message has to be sent thousands of miles beneath the ever fretting sea, from one continent to another, force seems ignored. We look in vain for any machine hissing with a vigor such as the mind deems necessary to eject the electric current from America to Europe quick as the sunlight comes to the earth. There is even an absence of the usual forces for communication upon the land, where nitric and sulphuric acids, zinc and mercury, are busy in numerous cells brewing the electric fire. The power employed bears more truthful comparison with the action of the brain wherein human thought is evolved. The thought may be one which shall change the destinies of a nation; it may be the sweetest idyl that ever warbled from angelic lips; but both come from within the dome of a brow notable only for its repose.

The battery which operates the Atlantic cable is composed of five cells, although for some time it used only one. Each cell is composed of a glass tumbler, a small disk of sheet copper, and a similar one of zinc, a few pellets of sulphate of copper and moist sawdust filling the tumbler. This is all. It has no smell. A spoonful of water upon the sawdust now and then is all it needs for support. It seems insignificant and powerless, yet does its work efficiently and well. The French cable uses only seven such cells, although twice as long as the other.

We have before us, as we write, a battery which was used to transmit a message by the Atlantic cable—the minutest, we presume, ever employed. It has a fascination to us inexpressible. It is composed of a simple gun cap soldered to a piece of copper wire, and a narrow strip of zinc. These, with a drop of water from the ocean, were all the forces that were needed to send a message from continent to continent. Here is a sketch of its actual size:

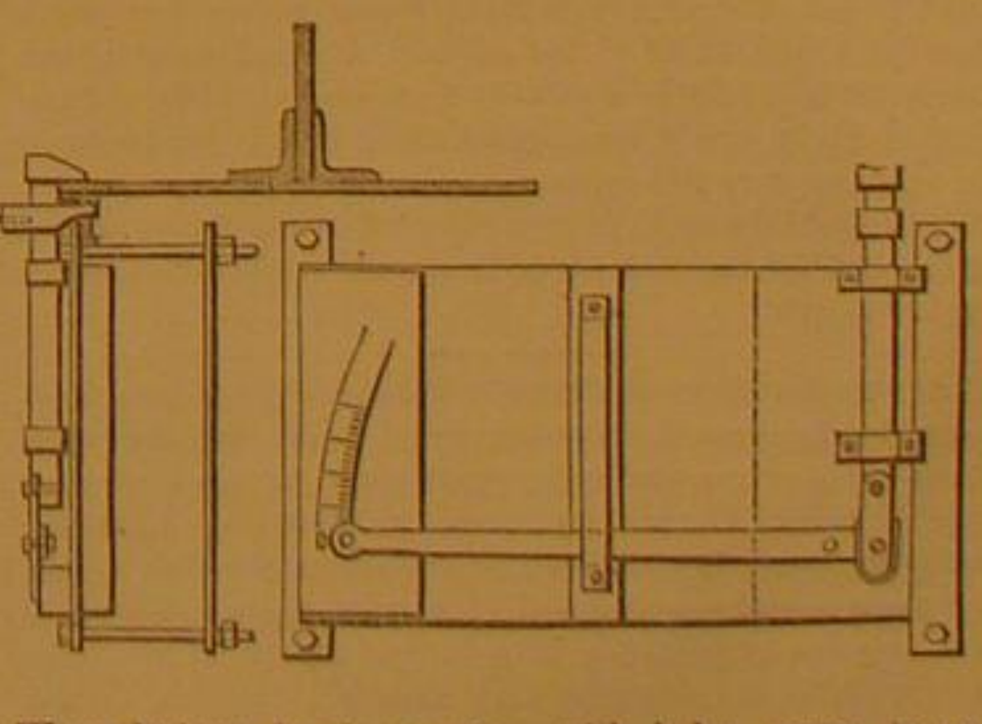


Had the ocean drop been a tear, it would have generated the same current which thus thrilled between two worlds and made them one. Were we disposed to moralize on the salt of this tiny battery and its mysterious agency, we might be excused did we regard it as typifying the power of sorrow which touches the universal heart and makes it throb. It is the alembic of the world's deepest and most omnipotent emotions, and yet may find its rise in the stopping of a single pulse, in the quenching of a single life.

This tiny battery has in it, indeed, a vast moral. We despise the lesser forces of our lives, and measure our influence by an unwise disparagement. From these, however, when true and pure, come the sunlight of the efflorescence of the earth. Let us hold our light high and honored, however small may be its flame. It may reach the radius of another light, and help the dawning of a brighter day—not to ourselves alone, but to thousands who never knew us. A single kind word has ere now planted a seed that has burst its blossoms upon the "infinite meadows of heaven."—*Journal of the Telegraph.*

INSTRUMENT FOR MEASURING THE DEFLECTION OF GIRDERS.

The accompanying engraving represents an instrument which has been used by the Western Railway Company, of France, in testing the bridges of the new Dieppe line *via* Pontoise and Gisors.



Wrought-iron bands together with bolts, serve to secure a plank, carrying the whole apparatus to a rigid structure independent of the girder. A clutch is then screwed on to the flange of the girder. A lever works on a pivot, and the shorter end—one tenth of the longer arm—is attached to a clutch bar. The other end carries a pencil which traces the deflection on a card. By means of the unequal division of the lever it is manifest that a small deflection will produce a comparatively large movement of the pencil. In point of fact, a deflection of 1-10,000th of a meter can be detected with this instrument.

BREAD POWDERS, EXTENSION.—The patent of Professor Horsford for pulverulent phosphoric acid, to be used in making bread, has been extended for seven years from April 22, 1870.

The Amended Patent Laws.

The bill to amend the patent laws, to which reference is made in another column, passed the House on the 21st inst. As the seventieth section caused much comment in the House, on motion of Mr. Cleveland of New Jersey, it was stricken out. The section is as follows:

On all patents hereafter granted there shall be paid the following additional fees, namely: At or before the expiration of the term of seven years from the date of the patent the sum of $25, and at or before the expiration of the term of twelve years from the date of the patent the further sum of $50, and in default of the payment of either of the sums aforesaid, within the periods aforesaid, the said patent shall be forfeited, and the invention so patented become public property.

In the course of Mr. Cleveland's remarks, and as a reason for his moving to strike out the section, he said it was proposed by section seventy to increase the revenues of the department at the present rate of patent issues, after seven years, nearly $400,000, and after twelve years of more than $500,000 more, making, after twelve years, an increase in the revenue of more than $900,000 as a tax upon the inventors of the country because they are inventors.

Prevention of Boiler Incrustation.

A very simple mode of preventing boiler incrustation is in general use at the Darmstadt Gasworks. The engine has worked day and night since 1854 almost without interruption, and the formation of calcareous deposits has been entirely prevented by the use of crude pyroligneous acid, combined with tar; it is either introduced into the boiler or mixed with the feed water. Since this mixture has been in use they have never had a stoppage through incrustation, and have never had to use a hammer to remove scale. Each year, during the summer, when less gas is required, the boiler is opened, and perhaps a couple of handfuls of loose sediment taken from the bottom. The quantity employed is very small—just enough to redden litmus paper; consequently the iron is not attacked, as indeed is apparent from the fact that the boiler has been but twice under repair.

The Pneumatic Railway.

The use of the zircon or oxygen lights on the passenger car of the Broadway Pneumatic Underground Railway, in this city, has been discontinued, and common gas substituted. The gas is compressed in cylinders, and is made to pass through a soda-water bottle containing benzine; the brilliancy of the light is thus greatly improved owing to the carbon which the gas takes up in passing through the liquid.

The Pneumatic Railway continues to be an attraction. It is visited daily by large numbers of persons.

Editorial Summary.

A Speaking Automaton.—A German genius has invented a speaking machine, which is now on exhibition in Leipsic, and is a masterpiece of inventive art. It is in imitation of all the parts of the human organs of speech, executed in india-rubber and wood. A keyboard played like that of a piano, puts the parts in motion, while by a pedal and bellows the required air is sent through the wind pipe. The keyboard has only fourteen keys, representing the sounds of a, o, u, i, e, j, r, w, f, s, b, g, d, sh; other sounds of the alphabet are produced by the same movement, and the admission of more or less air. The sounds of m and l are produced by closing the lips and pressing the tongue against the roof of the mouth, etc. The French nasal sounds are produced by a separate contrivance. The laughing, it is said, sounds truly diabolical, and the crowing of a rooster very comical.

Pearls in the Gulf of California.—The revenue returns for 1869 show that the catch of pearls and shell for the past year on the Gulf coast of the territory granted to the "Lower California Company" amounted to the large sum of $78,000. This, of course, is the valuation of the pearls given by the divers and speculators, and is consequently very much below the actual value of the catch. A pearl is sold frequently for $20, which, resold at Panama, at $200, brings $1,000 in Paris, and in many cases much greater profits have been made on very fine gems.

Not one-half the catch is ever reported to the Government, and the yield of the Gulf for 1869 may be safely estimated at $300,000 in gold.

Electric Telegraph without Wires.—It has long been known that telegraphic messages could be transmitted without the use of wires, and many years since signals were sent across the Bristol Channel by the use of the water as the conducting medium; but in that case the water through which the signals passed was inclosed in a tube, so that it was, in truth, only the substitution of a wire of water, if the term can be used, for the metallic wire usually employed. Prof. Loomis now proposes to go further; he claims to have discovered a mode of transmitting messages by electrical air currents; and is seeking an opportunity for making experiments on the summit of Mont Blanc.

An Extensive Foundery.—An iron foundery has been recently erected by the Messrs. Howard at Bedford, England, of remarkable size. There are 35,000 square feet on the ground floor. There are four cupolas, or furnaces, capable of melting 300 tuns per week, and which are expected to be very shortly in full work. The internal and general arrangements were planned by Mr. James Howard, M.P., the erection being under the direction of Mr. Usher, architect, Bedford.

Promising experiments in coating iron with sulphur, as a protection from corrosion, have been recently instituted.

Wear of Locomotive Driving Wheels.—In reply to a recent correspondent's observations upon the greater wear of the tires on the front driving wheels of locomotives, two causes have been suggested by a number of correspondents. The first is, that these wheels carry greater weight, and the second that the cutting of the sand employed is greater upon them than on the others, as the sand is sprinkled directly before them. It is thought that these causes are ample to account for the fact observed.

Business and Personal.

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

Facts for the Ladies.

For ten years past we have been using, in our establishment, Wheeler & Wilson's Sewing Machines, and, also, sewing machines of other manufacturers; and, after so many years, we have arrived at the conclusion that Wheeler & Wilson's Sewing Machines are greatly superior to all others.

All the parts of their mechanism are so strong that the expense for repairs is merely a trifle. Besides, they can execute a larger variety of sewing than all other machines. The simplicity of their mechanism makes the repairs easy; they do not tire the operator, and make very little noise in running. In a word, they cannot fail to be of great value to persons in want of sewing machines.

SISTER DOROTHEE,
Congregation of Notre Dame, Montreal.

Answers to Correspondents.

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

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

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

H. McG., of N. Y.—To find the horse power a belt of given width, moving at a given speed will transmit, divide the number of square inches of the belt in contact with the smaller pulley by two. Multiply the quotient thus found by the velocity of the belt per minute in feet, and divide the product by 36,000. The quotient will be the required horse power. To find the proper width of belt to transmit a given horse power, multiply 36,000 by the number of horse power, divide the product by the velocity of the belt per minute in feet; divide the quotient by the number of feet in length of contact of the belt with the smaller pulley, and divide this last quotient by 6. The result is the width of the belt in inches.

G. H., of N. Y.—The genuine Babbitt metal is composed of 4 parts copper, 12 parts best Banca tin, 8 parts metallic antimony, and 12 parts more tin to be added when the first-named ingredients are in a state of fusion. First melt the copper and add 5 lbs. of the tin. Then reduce the heat to a dull red; then add the rest of the first proportion of tin, and the other ingredients in the order and quantities mentioned, waiting for each to melt before adding another. Keep the surface of the metal covered with powdered charcoal to prevent oxidation.

J. N. C., of Ill.—A burning mirror of great power might be made of wood covered with burnished tin foil, but it would of course be liable to shrink, warp, etc., from the effect of weather. If the concavity be a portion of a sphere, not more than about eight degrees of arc should be used. The following rule would be accurate enough. Multiply the diameter of the mirror by 50, and take one sixth of the product for the radius of the concavity.

H. D., of Ohio.—The boiling point of water varies according to the hight above the sea level. Altitudes may be thus ascertained. A difference in hight of 543 feet makes a difference of one degree in the boiling point. The higher the elevation, the lower the temperature at which liquids boil, and *vice versa*.

V. C., of Wis.—The explosive used in the toy torpedoes is fulminate of mercury. A very small portion of this substance is twisted up in strong tissue paper with bits of sand, or broken glass. We consider them as dangerous playthings.

S. B. H., of R. I.—You will find full directions for finishing inlaid woodwork in Watson's "Manuel of the Hand Lathe," published by Henry Carey Baird, 406 Walnut street, Philadelphia.

T. O. H., of Mo.—The presence of all the air that will remain in an annealing oven cannot affect the process of annealing. We don't believe in your vacuum theory.

T. E. H., of Mass.—You can use the ordinary lacquer, employed for protecting fine brass work, upon gilt. This will be better than soluble glass.

J. B., of ——.—Chloride of sodium is common salt. Your proposed application of it to scaling castings will not do.

Recent American and Foreign Patents.

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

Folding Chair.—George McAleer, Worcester, Mass.—This invention has for its object to improve the construction of folding chairs with flexible seats, so as to make them better adapted to support the back of the person sitting in them, than the folding chairs constructed in the ordinary manner.

Refrigerator.—Anthony B. Sweetland, Fitchburg, Mass.—This invention relates to a new and useful improvement in refrigerators, for keeping food (or articles designed for food) at a low temperature, and consequently from decay.

Combination Boot Jack.—Samuel Kennedy, Rochester, Pa.—The object of this invention is to combine in a small space, a boot jack, blacking brush, and blacking box, so that the necessary apparatus for removing the boot from the foot, and blacking it, may be always together and more portable than they usually are.

Lathe Spindle.—James E. Boutelle, Fishersville, N. H.—This invention relates to a new and useful improvement in lathe spindles, for wood turning, whereby heating of the center is prevented, while it is made self-lubricating.

Power Loom for the Fabrication of Plain Velvet Stuffs.—Pierre François Ramel and Jean Drogat, Lyons, France.—This invention relates to a new power loom for the fabrication of plain velvet stuffs, which is capable of weaving two pieces at the same time, and which is worked by hand or steam power, and able to weave every quality of velvet.

Saw Mill.—Charles Taylor, McKeesport, Pa.—This invention relates to improvements in circular saw mills, and consists in an improved arrangement of two carriages, one on each side of the saws, for operation by the same feed shaft, and the one on the side receiving the lumber being arranged for disconnecting with the driving shaft when not required for use.

Stove.—J. L. Pfau, Jr., Quincy, Ill.—This invention relates to improvements in stoves and furnaces for burning coal, and more particularly cylindrical stoves, and consists in an air and gas mixing apparatus, arranged for resting on the top of the fire brick above the fire, and receiving the air through the side of the stove, heating it, and finally delivering it to the gas arising from the fire below, in a distributed way, calculated to facilitate the burning of the same and the smoke, more effectually than when the cold air is admitted directly to the gas, in the common arrangements.

Heat Radiator.—Thomas Scantlin, Evansville, Ind.—This invention relates to a new heat radiator, which is constructed with the object of securing more extended radiating surfaces, and unobstructed draft. The invention consists chiefly in a novel arrangement of pipes and drum for obtaining the desired circulation of smoke, and also in a novel means for letting air into the stove.

Thread Guide for Bobbin Winders of Sewing Machines.—Thomas Shanks, Baltimore, Md.—This invention has for its object to lay thread evenly on the bobbins of sewing machines when the same are removed from the shuttles for the purpose of being filled.

Animal Trap.—John O. Kopas and George W. Bauer, Washington, D. C. —This invention consists of four or more wooden or iron plates projecting from a common shaft hung in a box, each plate being provided with a bait-holder, so connected with a latch on the next plate in front that, when the animal stands on that one of the plates which is held by its latch in a horizontal position, and pulls at the bait suspended from the nearest vertical plate, such pulling loosens the latch of the horizontal plate and leaves it free to sink beneath the animal's weight, and precipitate the latter into the box, which operation also resets the trap and closes the orifice by which the animal entered.

Hay and Cotton Press.—B. R. Brown and James Toone, Jr., Jackson, Tenn.—This invention consists of a device for holding the platen of a cotton or hay press down to its work when operating upon the loose material.

Road Scraper.—James C. Evans, Delaware, Ohio.—This invention relates to divers improvements in revolving or self-dumping scrapers, all tending to increase the efficiency of the machine.

Corn Planter.—James M. Kiracofe, Mount Solon, Va.—This invention has for its object to furnish an improved corn planter, which shall be so constructed and arranged as to drop the corn accurately and regularly, and cover it, and drop the fertilizer at the same time with the corn.

Handle Seat for Plows.—Edward Wiard, Louisville, Ky.—This invention has for its object to furnish an improved seat for securing the handle to the mold board of plows, which shall be so constructed as to hold the handle firmly and securely.

Combined Rule and Calculator.—Nels Ockerlund, New York city.—This invention has for its object to furnish a simple and convenient instrument, which, while serving all the purposes of an ordinary rule, may be used for measuring angles, adding, subtracting, finding the fourth term of a proportion, etc., etc.; while, at the same time, being compact and easily manipulated.

Stump-Sawing Machine.—A. and H. Goodman, Williamsburgh, Mo.—This invention relates to improvements in machines for sawing stumps close to the ground, and consists in the application of a vibrating sawing frame upon a frame hinged to the side of a truck frame, and provided with small rollers for rolling together with the truck towards the stump, as motion is imparted to the saw frame by connecting rods working from a line shaft on the truck, and operated by a horse-power apparatus also mounted on the truck, to be worked by a sweep attached to the driving wheel on the top of the truck, and arranged to work over the saw frame and stump, or in case of sawing high stumps or trees, the drive wheel may be provided with short levers and handed around. The said power is also provided with a set of feeding gears for working the driving wheels of the truck, and arranged for being geared or ungeared with the power as required.

Cooking Utensil.—J. A. Morrison, Brady's Bend, Pa.—The object of this invention is to furnish cheap, ready, and convenient means for toasting bread, broiling or frying meat, or warming vegetables, and it consists in combining with a metallic frame or stand two curved reflectors, one above other, with their convex sides near and facing each other, and with a toasting or broiling grate between them, supported by the frame, the concave side of the upper reflector being uppermost and forming a pan for frying.

Measuring Boards.—I. J. W. Adams, Salisbury, Md.—This invention relates to a new and useful improvement in the mode of measuring boards and planks, and is especially adapted to measuring flooring as it is delivered from the planing machine, whereby accuracy of measurement is secured and time saved.

Looms for Fancy Weaving.—Albert R. Field, Centra Falls, R. I.—This invention relates to new and important improvements in looms for weaving fancy goods, and it consists mainly in the mechanism for raising and lowering the harness of the loom, but embraces in combination with such mechanism other and improved mechanical appliances for producing the necessary motions for properly operating the harness, changing their positions, and thereby changing the figure or face of the goods woven.

Pump Spout.—J. H. Gleim, Tipton, Mo.—The object of this invention is to provide convenient means for returning water to a well or cistern as it is pumped up, and in so doing the inventor has three objects in view: first to *save water*, which in some sections of the country at certain seasons of the year is a matter of great importance; secondly to obtain *cool water*, after thus pumping and returning the water, without waste; and thirdly, pumping and returning the water for the purpose of agitating and thereby aerating the water in the well.

Expansion Joint for Pipes.—J. E. Jones, Tidioute, Pa.—The object of this invention is to produce a suitable joint for connecting the ends of pipes, the said joint allowing free expansion and contraction of the pipes, during the changes of temperature.

Hose Coupling.—Charles Powell, Birmingham, England.—This invention relates to improvements in coupling joints for hose or other pipe, and consists in providing longitudinal brackets or projections, on the end of one section with notches fronting the center, and a rotating collar on the other section behind the flange, with spiral flanges for wedging in the said notches, when the joints are placed together and the said collar is turned on its section, clamping the flange between it and the flange or end of the other section firmly together. The flange of the section on which the collar turns has radial notches engaging the projections of the other section to prevent it from being turned with the revolving wedging collar, by the frictional contact. The revolving wedging collar may have lugs for the attachment of a spanner for turning it, or a lever may be permanently attached to it.

Gun Wiper.—Herman Greve, Sparta, Wis.—This invention relates to a new gun wiper for small arms, and consists in an expanding and contracting cylindrical piece of vulcanized India-rubber, or other suitable substance, made hollow for the most part of its length, having a screw plug arranged in the hollow and permanently connected at the bottom, and provided with spiral grooves on the exterior, which is dropped into the barrel, and expanded by a rod with a tubular end, having screw threads fitted for the screw plug, and screwed down therein to expand the wiper against the wall of the barrel, and to turn it to scrape the foul matter adhering to the inner wall of the barrel into the groves of the wiper so that it may be drawn out when the wiper is withdrawn.

Gate.—S. Henry, Chenoa, Ill.—This invention relates to improvements in gates for fences, and consists in a combination with gates composed of longitudinal bars pivoted to the posts and to the vertical end bars, so that a slight downward movement of the end vertical bars next the posts and attached to the horizontal bars near the pivots and the posts, will open the gates by swinging them upon the said pivots of hinged platforms on each side of the gate connected at their ends with these vertical bars, so that the weight of the person or animal advancing will open the gate.

Dovetailing Machine.—James R. Van Epps, Albany, N. Y.—This invention relates to new and useful improvements in machines for cutting dovetails for putting together boxes, drawers, flasks for founderies, and for all similar work.

Window-blind Hinges.—A. C. Cornell, St. Louis, Mo.—This invention relates to improvements in hinges, to be used for opening, closing, and locking the blinds by turning a shaft projecting through the window frame to the interior of the building.

Drill.—Alexander Thompson, Burlington, Vt.—This invention has for its object to so improve the device for holding rotary drills that the feed of the drill can be varied at will, and that, also, the drill and holder may be used in narrow places, where they otherwise could not be inserted.

Shifting Rail for Carriage Seats.—Caspar Disser, West Union, O.—This invention relates to a new device for securing the rail to a carriage or buggy seat, and for facilitating the removal of the same; and it consists in the application of swiveled fastening buttons and hook-shaped back fastenings, by which the rail is securely locked, and which facilitates the ready removal of the same

Belt Replacer.—William C. Bridges, Michigan City, Ind.—This invention relates to a new apparatus for adjusting belts on their pulleys, facilitating their removal from and application to, such pulleys, and it consists in the application of a curved semi-annular belt-receiver to a suspended lever, in such manner as to conveniently receive the belt from the pulley and reapply it to the same.

Egg-packing Case.—George Ruston, Freeport, Ill.—This invention relates to improvements in egg-packing cases, and consists in providing small cells within a box by means of narrow strips of strong paper extending across the box one way, and perforated at suitable distances for the reception of short tenoned pieces, dividing the spaces between the long strips, into compartments, one for each egg

Cartridge Cases.—O. Schevenell, Marion, Ala.—This invention relates to a new and useful improvement in cartridges for shot guns, more especially, but which may be used in rifles and guns of larger caliber, and it consists in making the cartridge case of staves of wood, or other suitable material, with common gun wads at the ends of the staves the whole being cemented or stuck together so that the shot will be retained therein and kept in place, while the case, or joints of the case will be broken in ramming down the cartridge.

Bark Mill.—J. G. Curtis, Emporium, Pa.—This invention relates to improvements in bark mills, and consists in an arrangement with a pair of metal cylinders, with notched teeth formed on them, in circular rows, with plain grooves between them, one having coarse and the other finer teeth, and the one with the coarser teeth being arranged in a suitable case above the other, of strong iron plates, with projections corresponding to the grooves in the rollers, and notches corresponding to the teeth, fitted in the sides of the case, for adjustment, to or from the rollers, and for action in connection with the toothed rollers for grinding the bark fed into the case at the top, to be first acted on by the coarse or breaking roller, in connection with which, at the point of receiving the bark, there is a strong iron block, permanently attached to the case, and having projections and grooves acting in conjunction with the roller, for breaking the bark into coarse pieces before passing to the lower breaking plates.

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101,967.—Apparatus for Measuring Boards.—I. J. W. Adams, Salisbury, Md.
101,968.—Spider Furnace for Burning Bagasse.—John Amick, Assumption parish, La.
101,969.—Manufacture of Steel from Cast or Pig Iron.—H. M. Baker, Washington, D. C.
101,970.—Roofing Material.—M. G. Balfour (assignor to himself and B. Boorman), Mauston, Wis.
101,971.—Hay Derrick.—Alden Barnes, Bloomington, Ill.
101,972.—Ventilator.—Orlando Barr, Beloit, Wis.
101,973.—Steam Generator.—J. F. Belleville, Paris, France. Patented in England, June 15, 1866.
101,974.—Water-proof Compound for Boots and Shoes.—M. H. Boettger, Sacramento City, Cal.
101,975.—Lathe Spindle.—James E. Boutelle, Fishersville, N. H.
101,976.—Cultivator.—Jacob Bower, Dayton, Ohio.
101,977.—Stop-cock for Steam and Liquids.—Joseph Breeden, Birmingham, England. Patented in England, Dec. 21, 1868.
101,978.—Belt Replacer.—William C. Bridges, Michigan City, Ind.
101,979.—Cloth-measuring Apparatus.—T. M. Brintnall, Medina, Ohio.
101,980.—Shifting Rail for Buggies.—Ira Bronson, Lockport, N. Y.
101,981.—Turning Chisel.—R. P. Buttles and Salmon Sweet, Mansfield, Pa.
101,982.—Sawset.—E. Y. Clark, New York city.
101,983.—Shutter Worker.—A. C. Cornell, St. Louis, Mo. Antedated April 14, 1870.
101,984.—Bark Mill.—J. G. Curtis, Emporium, Pa.
101,985.—Camera Stand.—William W. Dames, San Jose, Cal.
101,986.—Shifting Rail for Carriage Seats.—Caspar Disser, West Union, Ohio. Antedated April 1, 1870.
101,987.—Slate Washer.—Samuel G. Dugdale, Richmond, Ind.
101,988.—Hemmer for Sewing Machines.—John V. D. Eldredge, Detroit, Mich.
101,989.—Loom.—A. R. Field, Central Falls, R. I.
101,990.—Wheat Drill.—John F. Fisher, Greencastle, Pa. assignor to himself and Daniel Breed, Washington, D. C. Antedated April 7, 1870.
101,991.—Axle for Wheat Drills.—John F. Fisher, Greencastle, Pa., assignor to himself and Daniel Breed, Washington, D. C. Antedated April 7, 1870.
101,992.—Boiler Feeder.—Lucus Foote, Fairfield, Ohio.
101,993.—Velocipede.—Frederick J. Forsyth, Bay City, Mich.
101,994.—Manufacture of Elastic Rolls.—J. B. Forsyth, Boston, Mass.
101,995.—Pump Spout.—J. H. Gleim, Tipton, Mo.
101,996.—Turbine Water Wheel.—D. W. Glendinning, Detroit, Mich.
101,997.—Gun Wiper.—Herman Greve, Sparta, Wis.
101,998.—Farm Gate.—Michael Gunshenan, New York city.
101,999.—Clothes Dryer.—Joseph C. Haines, West Philadelphia, Pa.
102,000.—Singletree.—Andrew J. Hanna, New Garden township, Pa.
102,001.—Sheet-metal Bending Machine.—C. C. Hare, Kansas City, Mo. Antedated April 8, 1870.
102,002.—Sink and Washstand.—Christer L. Hedell, Galesburg, Ill.
102,003.—Gate.—Samuel Henry, Chenoa, Ill.
102,004.—Corn Planter.—Christopher Hippensteel, Lee's Cross Roads, Pa.
102,005.—Steam Condenser.—John Houpt, Springtown, Pa.
102,006.—Bolt Cutter.—H. L. Howard, Mendon, Mich.
102,007.—Whip.—Liverus Hull, Charlestown, assignor to American Whip Co., Westfield, Mass.
102,008.—Wagon Tire Tightener.—A. B. Hurd, Watkins, N. Y.
102,009.—Wagon Brake.—Reuben Hurd, Morrison, Ill.
102,010.—Expansion Joint for Pipes.—J. Evans Jones, Tidioute, Pa.
102,011.—Dovetailing Machine.—Dedrick Jordan, Charlestown, Mass., and Joseph Dill, Grand Rapids, Mich.
102,012.—Closet and Bed.—Wm. Kelly, Bath, Me.
102,013.—Printers' Furniture.—A. N. Kellogg and J. J Schock, Chicago, Ill.
102,014.—Bootjack and Brush.—Samuel Kennedy, Rochester, Pa.
102,015.—Sweep Horse-power.—Richard J. M. King, Ypsilanti, Mich.
102,016.—Bell.—Joseph Kintz (assignor to himself and P. Clark), West Meriden, Conn.
102,017.—Corn Planter.—James M. Kiracofe, Mount Solon Va.
102,018.—Apparatus for Removing Oils, Grease, Gums, and the like, from Cotton and Woolen Waste, and Recovering the Same.—J. W. Krepps, Chicago, Ill.
103,019.—Dental Apparatus for Casting Plates for Artificial Teeth.—J. A. Loomis, Carthage, Ill., and C. F. Moll, San Francisco, Cal.
102,020.—Smoke Stack.—Hector Mackinnon, Cleveland, Ohio
102,021.—Cherry Stoner.—Jonah Merchant, Farmington Ill.
102,022.—Folding Chair.—George McAleer, Worcester Mass.
102,023.—Combined Hay Rack and Wagon Box.—F. G. McClellan, Attica, Ohio.
102,024.—Fruit Jar.—Robert McCully, Philadelphia, Pa Antedated April 2, 1870.
102,025.—Axles and their Boxing.—Rob Roy McGregor Covington, Tenn.
102,026.—Bolt Cutter.—Wm. Mendham, Philadelphia, Pa. Antedated April 4, 1870.
102,027.—Sheet-metal Grooving Machine.—D. H. Metcalf and Daniel Squier, Battle Creek, assignors to themselves and Martin Metcalf, Grand Rapids, Mich.
102,028.—Agricultural Steamer.—Henry W. Millar, Utica N. Y.
102,029.—Door Spring.—Abel Mishler, New York city.
102,030.—Method of Treating Tracing Paper.—Julius Moog, Karlsruhe, Germany, assignor to Emil Heusner, Newark, N. J.
102,031.—Cooking Utensil.—J. A. Morrison (assignor to himself and A. J. Elliott), Brady's Bend, Pa.
102,032.—Windmill.—W. D. Nichols, Chicago, Ill.
102,033.—Apparatus for Redistilling and Rectifying Spirits.—Alonzo Noteman, Toledo, Ohio.
102,034.—Rule and Calculator.—Nels Ockerlund, New York city.
102,035.—Alarm and other Bell.—Thomas Pemberton and Geo. A. Pemberton, Birmingham, Eng. Patented in England, May 4, 1868.
102,036.—Attachment for Heating Stoves.—J. L. Pfau, Jr., Quincy, Ill.
102,037.—Steam Trap.—L. H. Plum, Cincinnati, Ohio.
102,038.—Hose Coupling.—Charles Powell, Birmingham, England.
102,039.—Loom.—Pierre F. Ramel and Jean Drogat, Lyons, France.
102,040.—Harness Buckle.—George Reyer, Indianapolis, Ind.
101,041.—Cooling Ale and Beer.—Michael Reynolds, New York city. Antedated April 7, 1870.
102,042.—Chimney.—Francis Richardson, Hebron, Ill.
102,043.—Railway Rail Splice.—George P. Rose, Elmira, N. Y.
102,044.—Stovepipe Thimble.—P. H. Rose and M. B. Hudson, Canandaigua, N. Y.
102,045.—Cultivator.—H. S. Ross, Millville, Ohio.
102,046.—Washing Machine and Boiler.—John Russell and T. T. McGrath, Fentonville, Mich.
102,047.—Egg Packing.—George Ruston, Freeport, Ill.
102,048.—Shoemakers' Edge Plane.—J. H. Sanford (assignor to Chandler Sprague), North Bridgewater, Mass.
102,049.—Dredging Apparatus.—C. A. Scanlan, Charleston, S. C.
102,050.—Funnel Can Filler.—Thos. Scantlin, Evansville, Ind.
102,051.—Cartridge Case.—Oswald Schevenell, Marion, Ala.
102,052.—Horse-collar Cap.—John Sellors, Bellevue, Mich.
102,053.—Heating Drum.—Charles W. Servoss, Chicago, Ill.
102,054.—Eyeletting Machine.—Elijah Shaw, Milwaukee, Wis.
101,055.—Butter Worker.—W. S. Shoemaker, Towsonton, Md., and E. H. Shoemaker, Columbus, Ohio.
101,056.—Water Wheel Regulator.—J. P. Sibley and A. Walsh, Bennington, Vt.
102,057.—Rotary Pump.—Anthony Sluthour, Cleveland, Ohio.
102,058.—Wrench.—O. J. Smith, Wauwatosa, Wis.
102,059.—Clothes Dryer.—Lewis A. Stave, Oconomowoc, Wis.
102,060.—Turbine Water Wheel.—Gilbert Stover, Crystal, Mich.
102,061.—Roofing Compound.—Wm. M. Stuart, St. Clair, Mich., assignor to himself, A. O. Whitcomb, W. S. Holmes, and R. H. Holmes.
102,062.—Blower.—Benjamin F. Sturtevant, West Roxbury, Mass.
102,063.—Fan Blower.—Benj. F. Sturtevant, West Roxbury, Mass.
102,064.—Refrigerator.—A. B. Sweetland (assignor to himself and James Daley), Fitchburg, Mass.
102,065.—Saw Mill.—Charles Taylor, McKeesport, Pa.
102,066.—Drill.—Alexander Thompson, Burlington, Vt.
102,067.—Detaching Hook.—J. W. Tuttle and Julius Peterson, Rochester, N. Y.
102,068.—Machine for Making Wrought-iron Chairs for Railroads.—Wm. Van Anden, Poughkeepsie, N. Y.
102,069.—Dovetailing Machine.—J. R. Van Epps, Albany N. Y.
102,070.—Machine for Molding Glass Buttons.—Charles Vigneron, Providence, R. I.
102,071.—Handle Seat for Plows.—Edward Wiard, Louisville, Ky., assignor to B. F. Avery.
102,072.—Locomotive and Car Brake.—J. C. Wilson, Winneconne, Wis.
102,073.—Feeding Apparatus for Nail Machine.—U. S Wolff, Burrel township, Pa.
102,074.—Belt Tightener.—Alvin N. Woodard, Fenton, Mich.
102,075.—Tool Handle.—Edwin L. Abercrombie, Florence Mass.
102,076.—Buckle.—J. J. Adair (assignor to W. J. Huey), Portland, Ind.
102,077.—Electrotyping.—Joseph A. Adams, Brooklyn, N. Y.
102,078.—Process for Facing Valve and Valve Seat for Steam Engines.—Q. S. Backus, Winchendon, Mass.
102,079.—Wheel Gear for Carriages.—Albert Baxter, Howard, N. Y.
102,080.—Stove for Railroad Cars.—G. Beeman, Ironton, Ohio.
102,081.—Grain Drill Teeth.—Lyman Bickford, Macedon N. Y.
102,082.—Hemmer for Sewing Machine.—A. W. Boomer and J. P. Haskins, Poultney, Vt.
102,083.—Washing Machine.—Samuel Brackett, Wenona Mich.
102,084.—Churn Dasher.—Isaac Brewbaker, Fincastle, Va. assignor to W. A. McCue.
102,085.—Globe Valve.—Isaac W. Brown, Jefferson City Mo.
102,086.—Hot Air Furnace.—Lorenzo W. Brown, Cleveland Ohio.
102,087.—Box Hook.—Charles Bruso, Worcester, Mass.
102,088.—Capstan.—E. Buel, Silver Creek, N. Y.
102,089.—Spring Bed Bottom.—J. N. Bull, Springfield, Mass Antedated March 31, 1870.
102,090.—Adjustable Hollow Drill.—C. E. Butler, Hudson, N. Y.
102,091.—Head-block of Saw Mill.—J. A. Clark, Leavenworth Ind

102,092.—Combined Manure Fork and Scraper.—J. W. Clarke, Kingston, Wis.
102,093.—Extract for the Cure of Cancer and other Diseases.—P. A. Cobb, Lynchburg, Va.
102,094.—Pattern Chain for Loom.—H. D. Davis, North Andover, Mass.
102,095.—Horseshoe Blank.—John Day, Buffalo, N. Y.
102,096.—Operating Fan Tremolos.—J. H. Dow (assignor to himself and Darius Wilcox), Birmingham, Conn.
102,097.—Concrete Pavement.—N. H. Downs, Birmingham, Conn.
102,098.—French Bedstead.—R. C. Du Bois, Washington, D. C.
102,099.—Thill Coupling.—George W. Dubuisson, Norwich, Conn.
102,100.—Hame Attachment.—Charles H. Easte, South Boston, Mass.
102,101.—Lawn Mower.—Norman Eaton, Woburn, Mass.
102,102.—Road Scraper.—James C. Evans, Delaware, Ohio.
102,103.—Lunch Valise.—Sigmund Feust, New York city.
102,104.—Elastic Roll.—Jas. B. Forsyth and John J. Haley, Boston, Mass.
102,105.—Combination Tool.—Calvin A. Foster, Fitchburg, Mass.
102,106.—Scissors Sharpener.—Calvin A. Foster, Fitchburg, Mass.
102,107.—Wheel for Locomotive Land Conveyance, and Coal-Hoisting Apparatus.—James S. French, Alexandria, Va.
102,108.—Shutter Fastener.—Frederick W. Frost, Somerville, Mass.
102,109.—Metallic Cartridge.—Adonis N. C. Gavard, Paris, France.
102,110.—Wire Covering Machine.—Ambrose Giraudat, New York city.
102,111.—Screw Propulsion for Tug Boats.—Edward D. Gird, Syracuse, N. Y.
102,112.—Sawing Machine.—Allen Goodman and Hardin Goodman, Williamsburg, Mo.
102,113.—Fly Net for Horses.—John Graham, New York city.
102,114.—Stove Pipe Shelf, Heater, and Damper.—Edward Hall, Beloit, Wis., and F. D. Searl, Rockton, Ill.
102,115.—Brick Machine.—George W. Harlan, Cincinnati, Ohio.
102,116.—Non-Conducting Covering for Steam Boilers.—Washington Harris and Wm. Howell, Philadelphia, Pa.
102,117.—Pie Stamper and Cutter.—Allen Hawkes (assignor for one half to O. E. Bigelow), Providence, R. I.
102,118.—Mineral Paint.—Edward B. Heckel, Vincent, Pa.
102,119.—Stove Pipe Drum.—Jacob Heger, Jefferson, Wis.
102,120.—Faucet.—Joseph Heine and John Vonficht, Toledo, Ohio.
102,121.—Horseshoe.—John Henderson, Albion, N. Y.
102,122.—Mechanism for Making Wire Heddles.—E. T. Hertle and Richard Thompson, New York city.
102,123.—Cover for Tables, Floors, etc.—August Herzog, New York city.
102,124.—Sirup Pitcher.—John H. Hobbs, Wheeling, West Va.
102,125.—Hinge for Shutters.—Johann Hof and Philipp Brenneis, Baltimore, Md.
102,126.—Hydrant.—James P. Hyde, New York city.
102,127.—Axle Box for Carriages.—David Jewett, Lynn, Mass.
102,128.—Earth Closet.—George Baker Jewett, Salem, Mass.
102,129.—Stopper for Jars and Bottles.—H. W. Ketcham, New York city.
102,130.—Machine for Rolling Conical and other Tubes.—Charles Kewin, San Francisco, Cal.
102,131.—Harvester.—William A. Kirby, Auburn, N. Y.
102,132.—Knob for Safe Doors.—Joseph G. Kittredge, San Francisco, Cal.
102,133.—Animal Trap.—John O. Kopas and Geo. W. Bauer, Washington, D. C.
102,134.—Animal Trap.—John O. Kopas, Washington, D. C., assignor for one half his right, to S. I. Walles, Salisbury, Md.
102,135.—Treating Paraffine and Obtaining it in Crystals.—Frederick Lambe, London, England. Antedated Dec. 4, 1868.
102,136.—Rotary Pump.—Erwin Lavens and James C. Lamb, Middletown, Conn.
102,137.—Piston Rod Packing.—Harvey T. Lee, Marysville, Cal.
102,138.—Hame for Harness.—Josiah Letchworth, Buffalo, N. Y.
102,139.—Coffee Urn.—Eugene Martin, Waterbury, assignor to himself and Blaise Soules, Bridgeport, Conn.
102,140.—Rotary Pump.—Henry W. Mather, New York city.
102,141.—Brick Kiln.—William T. Mathews, Negaunee, Mich.
102,142.—Self-Winding and Balancing Curtain Fixtures.—F. C. D. McKay, Elmira, N. Y.
102,143.—Stove Grate.—Henry Miner (assignor for one half his right, to Louis Harter), Green Island, N. Y.
102,144.—Paving Brick.—David Moffatt and John Thomson, Philadelphia, Pa.
102,145.—Picker Check for Loom.—William Montgomery, Northampton, Mass.
102,146.—Manufacture of Steel.—Charles Motier Nes, York, Pa.
102,147.—Safety Valve.—H. J. Paine (assignor to himself and Joseph Kelly), Providence, R. I.
102,148.—Treating Tin Scrap to Obtain Useful Products.—D. D. Parmelee, New York city, assignor to W. K. Marvin.
102,149.—Car Coupling.—William B. Parsons, Short Tract, N. Y.
102,150.—Double Shovel Plow.—George Perry, Granville, Ill.
102,151.—Joint for Pitman Heads, Sickles of Harvesters, etc.—Iva Poffenberger, Champaign county, Ohio.
102,152.—Hulling Machine.—William Porter, Brooklyn, N. Y.
102,153.—Paper File.—John P. Quarles, Richmond, Va.
102,154.—Screen Attachment for Windows.—Geo. Reed, W. C. Hoagland, and J. J. Newson, Brooklyn, Cal.
102,155.—Machine for Uniting Boot and Shoe Soles to the Uppers.—T. K. Reed, East Bridgewater, assignor, by mesne assignment, to Gordon McKay, trustee of the McKay Sewing Machine Association, Boston, Mass.
102,156.—Apparatus for Pitching Beer and other Barrels.—Hermann Reutti and Philipp Winkelhaus, Hamilton, Ohio.
102,157.—Inking Apparatus for Color Printing.—Israel L. G. Rice, Cambridge, Mass.
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REISSUES.

3,921.—Treating Organic Materials with Air.—Rudolph D'Heureuse, New York city.—Patent No. 93,182, dated August 3, 1869.
3,922.—Hoisting Machine.—Wm. Miller, Cincinnati, Ohio.—Patent No. 48,579, dated July 4, 1865; reissue 2,066, dated September 5, 1865.
3,923.—Grain Separator.—G. B. Turner, Cuyahoga Falls, Ohio, assignee of G. B. Turner and James A. Vaughn.—Patent No. 1,013, dated April 9, 1861.
3,924.—Gas Generator.—Benjamin Best, Dayton, Ohio, assignee of Patrick Kelly.—Patent No. 92,317, dated July 6, 1869.
3,925.—Mill.—J. B. Brown, Peekskill, N. Y., assignee of C. B. Hutchinson.—Patent No. 29,490, dated August 7, 1860.
3,926.—Mill.—J. B. Brown, Peekskill, N. Y., assignee of C. B. Hutchinson.—Patent No. 29,490, dated August 7, 1860.
3,727.—Hand Stamp.—B. B. Hill, Chicopee, Mass.—Patent No. 59,395, dated November 6, 1866; reissue 2,836, dated January 14, 1868; reissue 3,261, dated January 12, 1869.
3,928.—Oiler for Loose Pulleys.—C. A. King and D. B. Wesson, Springfield, Mass., assignees of C. A. King.—Patent No. 15,912, dated October 19, 1869.
3,929.—Baker's Oven.—M. A. E. McKenzie, Brooklyn, N. Y., assignee to Duncan McKenzie.—Patent No. 28,130, dated May 1, 1860.
3,930.—Roller for Clothes Wringer.—Woonsocket Rubber Company, Woonsocket, R. I., assignees of J. F. Holt.—Patent No. 49,030, dated July 25, 1865.
3,931.—Machine for Sawing Marble.—P. J. Torney, for himself, and Charles W. Hayden, and J. L. Kidwell, assignees of P. J. Torney, Washington, D. C.—Patent No. 84,518, dated December 1, 1868.

DESIGNS.

3,973.—Masonic Chart.—James Ames, Indianapolis, Ind.
3,974.—Buggy Body.—William M. Armstrong, Middletown, Ohio.
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3,977 to 3,983.—Carpet Pattern.—E. J. Ney, Dracut, assignor to Lowell Manufacturing Company, Lowell, Mass. Seven patents.
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Pulverulent Acid for use in the Preparation of Soda Powders, Farinaceous Food, and other Purposes.—E. N. Horsford, Cambridge, Mass.—Letters Patent No. 14,722, dated April 22, 1856; reissue 2,597, dated May 7, 1867; reissue 2,979, dated June 9, 1868.

DISCLAIMERS.

Horse Hay Rake.—Mary G. Pratt of Marple township, Pa., administratrix of Randall Pratt, deceased.—Letters patent No. 40,067, dated January 8, 1856; reissue 1,893, dated February 28, 1865.—Filed Jan. 7, 1870.

Composition for Inking Rollers, Pads, etc.—Lewis Francis and C. H. Loutrel, New York city, assignees of Lewis Francis and F. W. Letmate.—Letters patent No. 43,192, dated June 21, 1864; reissue 2,805, dated November 26, 1867.—Filed March 28, 1870.

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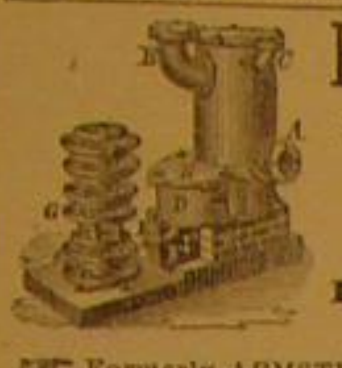

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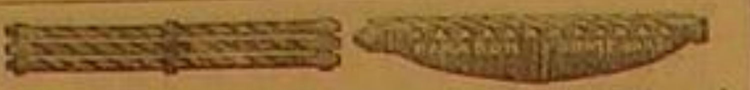

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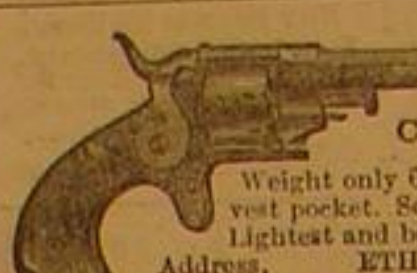

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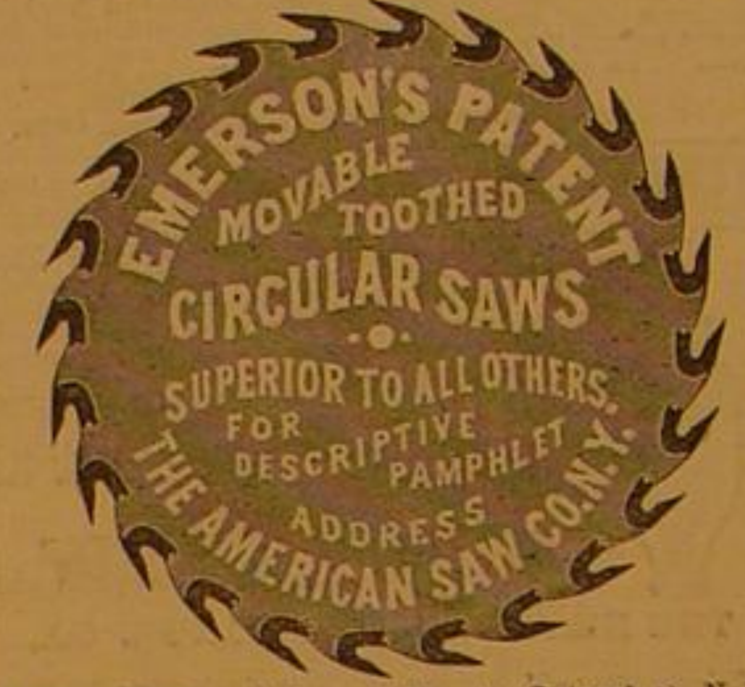

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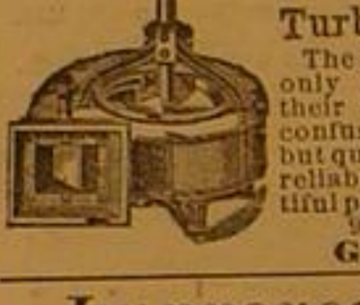

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