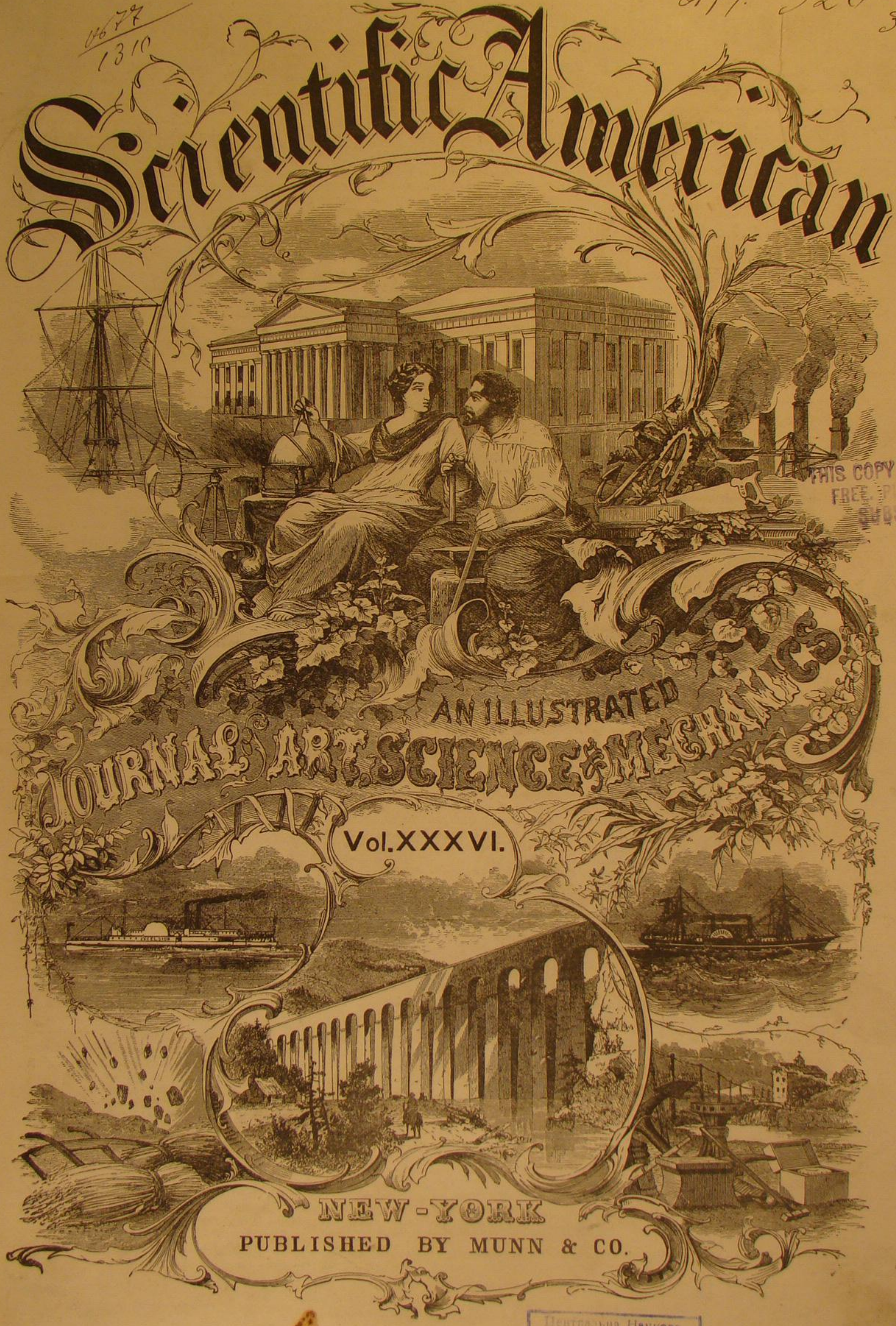
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# SCIENTIFIC AMERICAN

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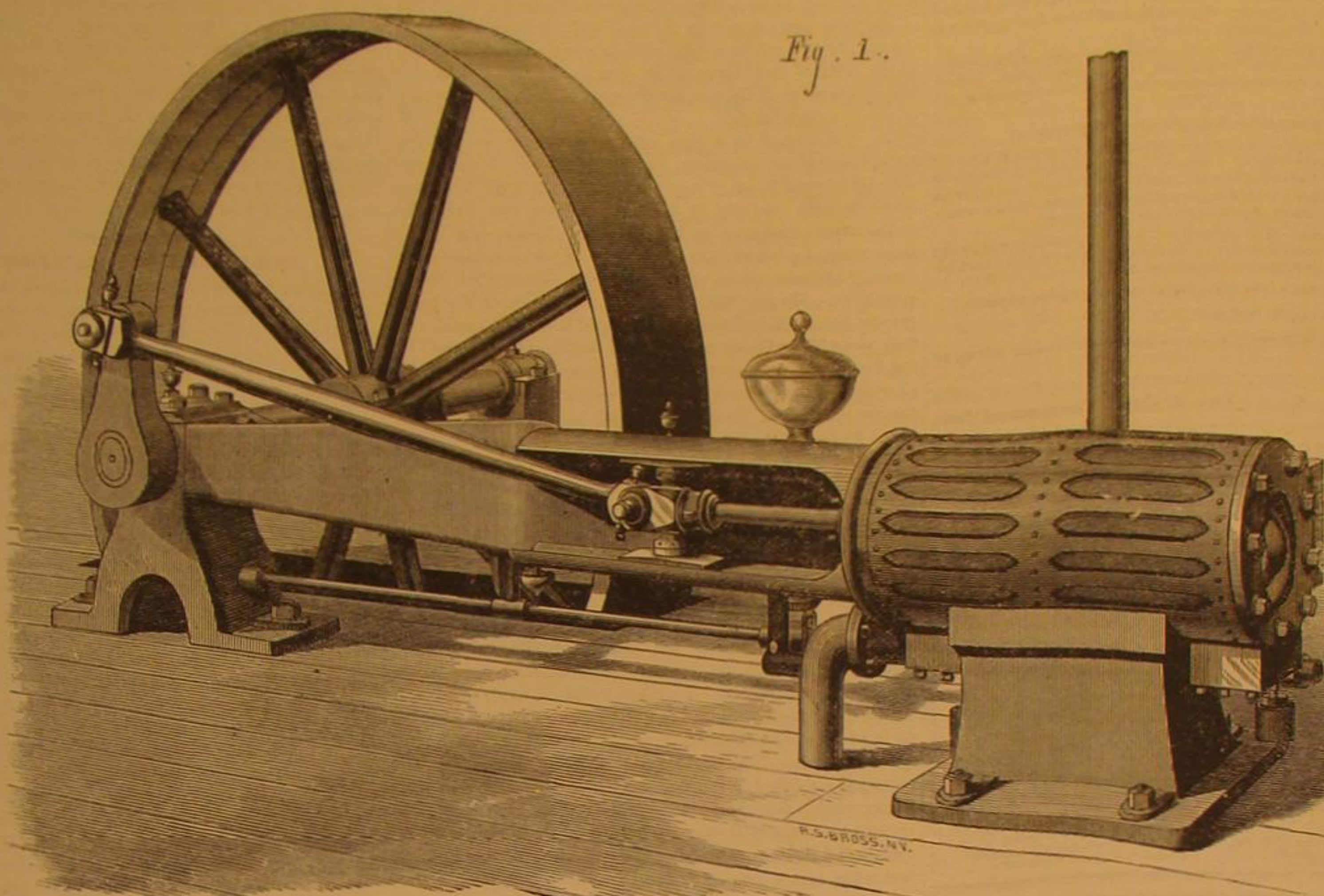
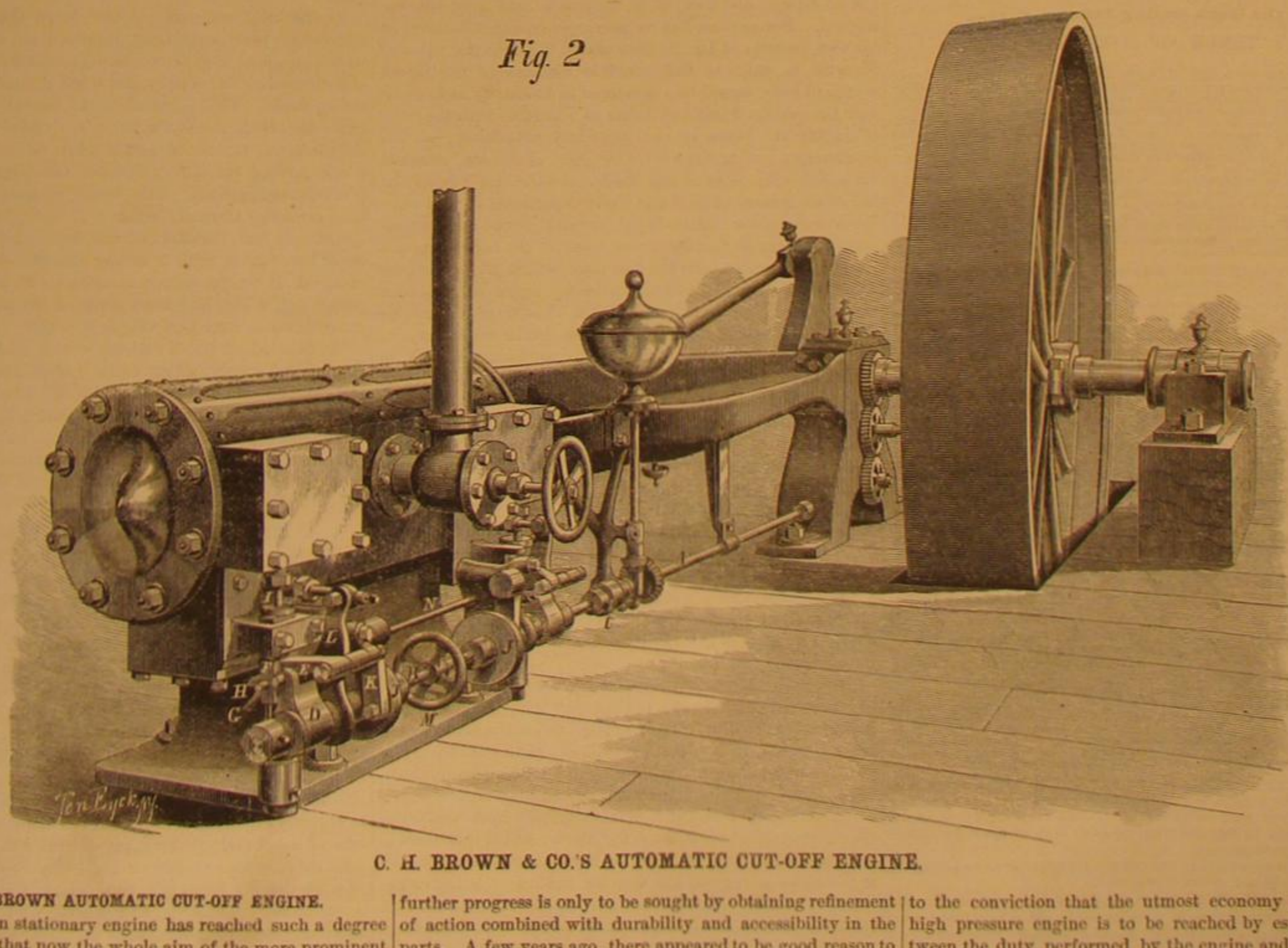



C. H. BROWN & CO.'S AUTOMATIC CUT-OFF ENGINE.

Fig. 2

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The modern stationary engine has reached such a degree of excellence that now the whole aim of the more prominent constructors is directed merely to designing simple, durable, and effective mechanical devices by which certain well understood functions may be performed. It appears, in fact, to be determined that we have reached a point of knowledge and mastery of the theory of steam engineering from which further progress is only to be sought by obtaining refinement of action combined with durability and accessibility in the parts. A few years ago, there appeared to be good reason to suppose that economy in the steam engine would be sought in the direction of using steam at much higher pressure than had then (or has since) been employed; and many efforts have, from time to time, been put forth in that direction. The mechanical world seems, however, to have settled down to the conviction that the utmost economy attainable in a high pressure engine is to be reached by establishing, between the duty performed by the engine and the supply of steam to the cylinder, a relation at all times equal, definite, and uniform: and further by avoiding wiredrawing and substituting therefor the using of the steam expansively. It follows then that, to accomplish this end, the action of the

(*Continued on eighth page.*)

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### Contents.

(Illustrated articles are marked with an asterisk.)



### THE SCIENTIFIC AMERICAN SUPPLEMENT,

**Vol. III., No. 53,**

**For the Week ending January 6, 1877.**

### TABLE OF CONTENTS.



**Terms:**—SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, $5.00. One copy of SCIENTIFIC AMERICAN and one copy of SCIENTIFIC AMERICAN SUPPLEMENT, one year, postpaid, $7.00. CLUBS.—One extra copy of the SUPPLEMENT will be supplied gratis for every club of five SUPPLEMENT subscribers at $5.00 each.

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## A WONDERFUL TREASURE TROVE.

That indefatigable explorer and archæologist, Dr. Schliemann, has recently made a discovery which, if future critical examination substantiate his present interpretation of it, will not only necessitate the re-writing of a great deal of ancient history, but will prove that many legendary and heroic personages, hitherto regarded only as myths, really existed. The surprise that all scholars will feel, on being assured that Agamemnon, "bravest of the Greeks," Clytemnestra, his wife (sister of Castor Pollux, and Helen, and daughter of Leda the Swan), Cassandra the true prophetess, loved and cursed by Apollo so that no one believed her predictions, and many other characters supposed to be fabulous lived and died, is as genuine as that which all would experience if the daily journals some morning should announce the discovery of the wine jars containing the bodies of the forty oil-scalded thieves, or of Aladdin's lamp with his name carved on it, or of the original plow invented by Dagon the fish-god of the Babylonians, or of the tomb of Perseus containing a mummy of the Gorgon's head.

Dr. Schliemann is a man of extraordinary genius for archæological investigation; and his labors have been fortunate far beyond those of most explorers. In 1868, he astonished classical students by claiming to have found remains of the home of Ulysses on the island of Ithaca; and in the same year, he began the studies at Mycenæ which have recently culminated in the wonderful discoveries above alluded to. He also undertook an examination of the topography described in Homer's Iliad; and becoming convinced that, even if the Greek poet himself was a myth, the story of the Trojan siege was not, he began excavations (at his own expense) on the plain of Hissarlik, which he considered to be the site of ancient Troy. In 1871-3, he dug to a depth of about 50 feet, unearthing layer after layer of ruins, showing that cities and towns had been built, one on the buried ruins of another. Finally, he exhumed vases and treasures of gold and silver and laid bare, as he maintains, the walls of Priam's palace and the streets of the Homeric city. But in his conclusions archæologists have failed to agree; and the prevailing opinion has been that he has merely found the site of some unknown Phœnician trading post, or some other ancient city of little historical importance.

Early in the autumn of last year, 1876, Dr. Schliemann returned to Mycenæ, the scene of his previous labors, where are located some of the grandest ruins of modern Greece. The site is a rocky hill on the northeastern extremity of the plain of Argos, on the eastern coast of the Morea, at present about two miles from the small village of Khayati. The ruins are notable for the colossal stones employed in their construction, the same being the largest blocks used in ancient building, with the exception of those found in the remains of Baalbec. Some of the stones are 25 feet long, 20 feet wide, and 4 feet thick, and tradition asserts that they were put in their places by the one-eyed giants, the Cyclopes. During the reign of Agamemnon, Mycenæ was the principal city of Greece, and here, it is supposed, that king was entombed. For any one but so uncompromising a believer in his own theories as Dr. Schliemann to dig into the ruins of Mycenæ, in order to find tangible remains of the Greek mythical hero, would be considered as foolhardy as to excavate the supposed tomb of Adam in Palestine with the hope of finding the bones of our legendary progenitor; but Dr. Schliemann, caring not a whit for general opinion, attacked the tombs with pickaxe and spade, and the result is that he has found a mine of gold and silver ornaments, etc., of enormous value even intrinsically, besides bones and human remains which he declares to be those of the hero-king and his contemporaries. In the first tomb which he opened, he found thirteen gold buttons, curiously engraved, besides a mass of gold blades scattered about. In the next tomb, he discovered a square ditch some 30 feet below the surface of the mount. This was surrounded by an immense wall, in which were human bodies which evidently had been burned. The bones of one person were covered with five thick gold leaves some 25 inches long, on which were inscribed crosses. Then, in a great circle of parallel slabs beneath the archaic sepulchral stones, Dr. Schliemann has discovered huge tombs containing jewelry. In one tomb, containing male and female bones, he obtained eleven pounds of ornaments of pure archaic gold, and two scepters with heads of crystal. Then he found a cow's head of pure silver, with great horns of gold; then a helmet, two diadems, a woman's large comb, a breastplate, vases, girdles, and an enormous quantity of buttons, all of the finest gold. There were some vases in silver, a number of arms in bronze, and a stag cast in lead; but no trace of iron work.

The above magnificent treasure trove was unearthed prior to November 15; but since that date, a telegraphic dispatch has reported the discovery of enough more treasure to fill a large museum, besides further evidence as to the identity of the human remains, and (according to Dr. Schliemann) showing them to be those of Agamemnon and his court.

Archæological authorities in this city, who have been asked for expressions of opinion on the above, admit that there is a much greater probability of Dr. Schliemann's being correct in his views as regards the Grecian than as relating to the Trojan remains. Mr. William Cullen Bryant believes that the tomb is not that of Agamemnon, but of some later king; but, with other authorities, he reserves any positive statement until further and more accurate details are obtainable. He suggests that the tomb of Achilles in Ithaca be searched for, as corroborative of Schliemann's views.

The treasure has been presented to Greece and will be placed in a national museum. Meanwhile it is probable that a gold fever will break out in that classic land, which will result in the wholesale digging up of her abundant ruins.

Apropos of this subject, we may add that, through the liberality of several of her wealthy citizens, New York has recently secured one of the most valuable archæological collections ever got together, many articles in which probably antedate the supposed period of Agamemnon. General Cesnola, whose first collection of Phœnician relics, found in the tombs of Golgos on the Island of Cyprus, the New York Art Museum already possesses, recently found, under the temple of Kurium, in the same vicinity, some 7,000 objects in gold and silver, stone, etc., all of the greatest historic interest as shedding new light on the habits and customs of the long-extinct race which fashioned them. The list includes jewelry, weapons, inscribed plates and coins, utensils, glass, sarcophagi, etc. For some time, the destination of the collection was doubtful, as the British Museum made strong efforts to obtain the objects, but was unwilling to pay General Cesnola's price—$60,000. Finally, to the intense and openly expressed disgust of the English press, after a canvass of three days, $40,000 was raised in this city by private subscription, and the antiquities were at once purchased. The remainder of the amount will be obtained after the delivery of the collection in this country.

## UNINFLAMMABLE THEATER SCENERY.

Mr. Dion Boucicault, the well known actor and dramatist, has, with very commendable promptitude, instituted experiments in accordance with some of the suggestions for rendering scenery fireproof, elicited by the recent calamity in Brooklyn. If we may judge from recent tests, held in Wallack's Theatre in this city, Mr. Boucicault's efforts have been entirely successful; and although, as he says himself, he has invented nothing, he at least is entitled to the gratitude of the public for his demonstration of the value of the fireproofing washes which he uses, and his public exhibition of the fact before the assembled managers and theatre owners of this city.

The process consists in first soaking the canvas in a solution of tungstate of soda. The solution is a weak one, and the exact percentage of the salt is not determined. Pure tungstate of soda costs about 75 cents per lb., crude tungstate (not quoted by prominent drug firms) probably considerably less, if bought in large quantities; so that the application is not an expensive one. If nothing further were done, this single saturation would be sufficient to prevent the blazing of the material; but as it is, the latter on ignition is apt to smoulder slowly. To prevent this, Mr. Boucicault, before painting on the fabric, applies a wash of silicate of soda (water glass). This answers as an excellent priming; or the pigments themselves may be mixed with the silicate instead of with glue, as is now done. The cost of the glue is thus saved, and the paint seems to have gained something in brightness by the substitution of the water glass as a vehicle.

At the trial referred to, two large squares of canvas, which had previously been prepared as above described, were suspended over the stage. Gas was led through a hose, and escaped at the nozzle; and when ignited, it gave a large, strong flame. This, applied to the canvas, wholly failed to ignite it. If the flame was persistently held against one spot, the place was blackened, and in a few minutes the jet forced a hole through the fabric; but not the slightest evidence of combustion appeared. The burnt material seemed to be a hard cement, externally brittle and easily crumbling in the hands. In fact, the effect of the chemicals appeared to be to cover the canvas with a strong coating of very refractory material. Rope, previously saturated with the solutions, and pine wood, which had been given a couple of coats of the same, likewise were perfectly fireproof.

Mr. Boucicault states that the entire cost of treating the rigging and scenery of an average sized theatre with tungstate and silicate will not exceed $200. There is no difficulty in applying the tungstate wash, which is merely a whitewash, and is put on in the usual rough way. It may be applied to the back of scenery already painted, and may serve as a priming for the paint in every part of the theatre.

## DEFECTIVE GEOMETRICAL TEACHINGS.

Although we give all possible credit to Euclid, the ancient Greek geometrician, for having for the first time collected the principal geometrical truths known in his time into a well connected system, based on strictly logical, progressive principles, it cannot escape the attention of any mathematician who has a clear insight into this sublime science that two defects, in the otherwise excellent books which Euclid left as a legacy to the world, have been the cause of much strife, contradiction, error, and loss of time among the unlearned, especially among beginners. These defects are, first, the insufficiency of his definitions of the point, line, and superficies; and second, the total omission of any information in regard to the relation between the diameter and circumference of the circle. As for many centuries the books of Euclid were the only ones used by students of geometry, the influence of these defects has been very great, while the works of Archimedes, Apollonius, and others, who came after Euclid and com leted his labors, were unfortunately either entirely ignored, or were studied by very few indeed. Euclid's authority in geometry being thus undisputed, his definitions were adopted as indisputable, and as the real base of the science of geometry; but those which he gives of the point, line, and superficies, which all subsequent geometricians have adopted, are by no means correct geometrical conceptions, but abstractions of things not only non-existent in nature, but which cannot possibly have independent existence.

In explanation, let us make a plain statement of the case, and we will begin with the definition of the limits of a body, or its *surface*, the limits of a surface, or *lines*, and, lastly, the limits or ends of a line, or *points*. Euclid proceeds in the reverse way, and speaks first of a point having neither length, breadth, nor thickness; then of a line having only length, and neither breadth nor thickness; and, lastly, of a surface having only length and breadth, and no thickness. The conclusion to which any one with a philosophical and critical turn of mind must arrive is that, these things being impossibilities, and having no material existence, a science based on such conceptions must have a very weak foundation; such a critic would be justified in his opinion.

The point, line and superficies, as defined by Euclid in this abstract way, can have no existence; and if geometry were really based on these principles, the science, renowned as the most positive of all positive sciences, would in reality be based on abstractions, mere notions concerning impossible things. No wonder, then, that these definitions of Euclid have been the points of attack aimed at by all those who have attempted to bring mathematics down to the level of the un certain and unprofitable speculations of metaphysics, such persons assuming that mathematics is based on definitions, of point, line, and superficies, which are absurdities in themselves.

These faulty definitions can be entirely corrected by following the suggestion made in the beginning of this article. We therefore begin with "Definition 1. The body. All bodies occupy a certain limited space, and, whether large or small, have three dimensions, length, breadth, and thickness." This is illustrated by a cube, parallelopiped, etc., and the science of physics investigates the properties of bodies (such as weight, color, hardness, etc.), and that of chemistry its component elements (such as carbon, hydrogen, oxygen, etc.); but in geometry we only consider the dimensions above given. "Definition 2. The surface. The limit of such a body is called its surface, and from this it follows that such a surface possesses length and breadth, but can have no thickness, as, by attempting to measure this, we necessarily would go either inside the body or outside of it." This is illustrated by placing a metal cube in water, and remarking that the limits between the metal and the water, where they touch, and where there is neither water nor metal, constitute the mathematical idea of a surface. "Definition 3. The line. The limit of such a surface where two sides of a body meet (its edges) is called a line; this line is common to both surfaces; and it possesses only length, and neither breadth nor thickness." This is again illustrated by a cube or pyramid, and we remark that, by attempting to measure the thickness of the edges, we necessarily would abandon one of the planes and move into the other. "Definition 4. The point. Where two or more such edges of a body meet, or the position whence anyone would start to measure the length of the edges, in geometry is called a point. Such a point cannot have any dimensions at all, being only a position relative to the body." This also is illustrated by the angles of a cube.

Thus it is seen that only bodies have a direct existence, that neither surface, line, nor point, exists independently, but that these ideas depend on the existence of the bodies, and are the component parts of the conception of the limits of their dimensions.

Thus we see that when geometry considers the limits of the dimensions of the bodies, the conceptions of superficies, line, and point are necessary consequences of these considerations, and are legitimate subjects for scientific research; at the same time, these conceptions or ideas do not subject the science to the objections already mentioned as being suggested by Euclid's faulty exposition.

The other defect in Euclid's books, the absence of any information as to the relation between the diameter and circumference of a circle, has been the cause of much more error. Euclid being the only light for thousands who have studied geometry, and as his books contained no information, the impression became general that the problem of ascertaining the proportion was insoluble, or at least had not, in Euclid's time, been solved. As the importance of this problem was evident to every one, it is not to be wondered at that many persons, ignorant of the labors of Archimedes, Metius, Van Ceulen, and others, have attempted its solution, to supply this, as they supposed, missing link in geometrical science. Few well informed persons have wasted their time in this direction, but the labor has been bestowed entirely by the ignorant, who, misled by a certain degree of self-conceit, imagined that they have discovered some new properties, which they attempted to use for the solution; the number of such would-be discoverers is very large; and as each went on his own erroneous road, it is not to be wondered at that each reached a different result; and as the premises of each were false, their results were every one inaccurate.

If the method of Archimedes (who first enclosed the circumference of the circle between circumscribed and inscribed polygons of 96 sides, and so found the limits between which the true circumference must be situated) could have been inserted in the books of Euclid, or had been appended to them, the world would have been saved from all the agitation in regard to the quadrature of the circle, and much valuable time would have been saved. But Archimedes lived after Euclid, and so the books of Euclid represent the state of geometrical science before the time of Archimedes; and their continued use in their original condition, for many centuries, has been nothing less than a great misfortune to thousands of students of geometry.

Lacroix, in his "Geometry," published in France in the beginning of this century, first gave a complete logical essay on inscribed and circumscribed polygons, with the method of calculating their peripheries and the peripheries of polygons of double the sides; and by continually doubling, he enclosed the circle in continuously narrowing limits. His method was not new, but he had the merit of so explaining it to beginners that, for its comprehension, a knowledge of only the first books of Euclid was necessary. His method has been adopted by others, and no one who has studied geometry from the books of Lacroix or his imitators can fall into the absurd error that the relation in question is an unknown quantity. We say "absurd error," because new light has been shed upon this subject from various sides, and mathematicians agree as to the figures expressing the relation, which are better known than those of any other irrational quantity; and the calculation has been made to 600 places of decimals, which shows much greater progress than has been made in ascertaining the square root of 2 or the square root of 3, problems which are apparently much simpler than the measurement of the circumference of the circle.

## THE FORM AND USE OF CALIPERS.

The use of calipers, in finishing work to a driving fit or a working fit, is a subject of great interest to the general machinist, and a few practical instructions upon the construction and application of calipers will be found useful.

If we notice the standard gauges made by makers of reputation, we shall find them to be, as compared to ordinary calipers, very heavy and strong, the object in thus making them being to prevent them, as far as possible, from springing. We say as far as possible, because deflection always takes place to some extent. Messrs. J. Morton, Poole & Co., of Wilmington, Del., demonstrated this deflection by a very simple experiment. They made a gauge of about 3 inches between the points, its form being that of a crescent, with the points turned towards each other; the width of the gauge at the middle was about $1\frac{3}{4}$ inches, the thickness of the steel being about $\frac{1}{16}$ inch. They made a wire inside gauge to fit the outside gauge so delicately that, if the outside one were held with the two hands, holding the gauge near the points, the inside one would be just sustained by the friction of contact of the outside one; while, if the latter were held in the centre by grasping with the thumb and finger, the inside gauge would fall, thus proving the deflection of the outside gauge by reason of its own weight.

This spring is usually the great disturbing element in taking an exact measurement, and it is here that inaccuracy is induced. To measure correctly with either inside or outside calipers, they must be set so that their contact with the work is scarcely if at all discernible. If we require to set inside and outside calipers to make a working fit, we must bear in mind that, if the outline of the work measured by the outside calipers is of exactly the same diameter as that of the hole into which it is to fit, the one will not enter the other; or, in other words, a pin must be smaller than the hole into which it is to go, in order to have a working fit. The amount to which it must be smaller is a measurable quantity, which is allowed for in solid male and female gauges. In the case of calipers, however, we proceed as follows: First, the points of the outside calipers should have a perfectly even contact when put together, or they may be slightly rounding in their width, as many prefer. Looking at the calipers with the flat sides of the legs towards you, the points should not be rounding, but should be shaped as follows: First, file the points to butt squarely and flat together when closed, and then open the legs and bevel off the end on the convex side to an angle of about 45°, leaving the extreme projecting point face about 1-32 inch wide. Then take a small smooth file, and carefully round over the points, and then harden them to a light purple. The object of making them of this shape is that the part of the points in contact, when measuring different diameters, will always remain the same; whereas such is not the case when the points are rounded, as is often seen in calipers. So, likewise, if the bevel at the points is placed upon the concave side of the points when the calipers are opened wide, the nearest point of contact will be on the bevel instead of at the points, rendering it difficult, in the inside calipers, to find those nearest points. The inside calipers should, instead of having the ends bent around to a curve, have them straight, and standing at an angle of about 45° to the main body of the leg. The part standing at an angle need not be longer than 5-16 inch on a pair of calipers 7 inches long; and the bevel at the points should, in this case, be on the short side of the angle, so that, no matter whether calipers are used upon a small or a large bore, the extreme points will always have contact with the work, and will always stand the furthest away from the centre of the joint. The advantage in this latter point is that we can measure clear to the end of a recess; whereas, if the points are bent around, the curve will, when the calipers are opened at all wide, prevent the points from passing to the back of the recess.

In measuring with the outside calipers we hold them by the joint in the right hand, between the finger and thumb. We then place them upon the work, steadying one leg of the calipers and detaining it in a fixed position by resting it, near the point, against both the work and one finger of the left hand, usually the forefinger. We then move the calipers so that the other leg traverses very slowly over the work, and watch very minutely how near the point approaches to the work. If the latter offers a sensible resistance to the free passage of the caliper point, on round work, we must open them; and when so set that the point will just pass over the work without having perceptible contact, we may try to move that point a little laterally. If we find that the least lateral movement causes contact, while there is one point at which contact is not discernible, the calipers are set. To apply the inside calipers, we hold them in the same manner as above, adopting the same means with the forefinger to hold one point upon the work in a state of rest; while the other point is set so that it is barely perceptible, upon very close examination, that it touches the work. We then hold the inside calipers so that one inside and one outside points contact at the middle of the points, while we pass the other point of the inside calipers past and about the other point of the outside calipers; and when the calipers, so adjusted, will just barely touch each other, the work will be of a working fit, providing it is turned and bored true.

The only difference from this arrangement for a driving fit is that the outside calipers must, instead of being set to just escape the work, be made to have very fine contact with the same. The allowance for a driving fit is so small as to be barely perceptible with a very careful adjustment and manipulation of the calipers, while, for a working fit there must be a perceptible difference, the contact with the inside calipers being more perceptible than that of the outside ones with the work. Here, however, we must remark that the length of the work is an element of consideration, because the standard of truth and parallelism, incidental to such work as is usually measured with calipers, has a great deal to do with this question. For example, we know of no means of boring that will produce so smooth and true a hole as we can finish with a lap; as a consequence we can practically appreciate that there are upon tool-finished work projections, as well as an uneven surface, and in a driving fit these projections act as elements to conform the fit of one part to the other. Suppose, for example, we carefully bore out a hole, 1 inch in diameter and $\frac{1}{4}$ inch deep, the difference in diameters necessary to a driving or a working fit will be almost inappreciable by the closest application of the calipers; and a very slight amount of hand labor, in forcing the one into the other by rubbing them together, will convert a driving into a working fit, the difference being in this case due to a compression of the high spots of the surfaces of the metal. If the surfaces are positively smooth and even, they will form mirrors. If, on the other hand, we take a piece of work, 3 or 4 inches long, the amount of metal on the surfaces which (even with the smoothest of cuts, as ordinarily taken) stands above the bottom of the tool marks, is sufficient to give the parts a driving fit. To appreciate this fact, it is only necessary to carefully turn in a good lathe a piece of iron, say 2 inches in diameter and 4 inches long, and then take a very fine French file and draw file it across the turning marks.

In using calipers upon flat surfaces, it will be found that the inside calipers can be adjusted finer by trusting to the ear than the eye. Suppose, for example, we are measuring between the jaws of a pillow-block. We hold one point of the calipers stationary, as before, and adjust the other point, so that, by moving it very rapidly, we can just detect a scraping sound, evidencing contact between the calipers and the work. If, then, we move the calipers slowly, we shall be unable, with the closest scrutiny, to detect any contact between the two.

In measuring flat work with outside calipers, we must always so adjust them that they barely touch the work; while, at the same time, one point being detained in a state of rest, the other will not move in any direction without positive contact, and this will give a driving fit. For a working fit, the outside calipers may be set so that they are free from contact, and have a barely distinguishable movement. In all cases, however, the truth and smoothness of the work is an important element.

## Cast Iron Roofs.

Iron is more used for architectural purposes in America than elsewhere, but not always in such a manner as to render the building fireproof. While corrugated iron roofs are an excellent protection against sparks, they yield too readily to any more intense heat. The Germans, who have generally employed tiles, and make the buildings themselves capable of sustaining such roofs, and even heavier ones, are now introducing cast iron plates for roofs. Those made at the Grœditz Iron Works weigh from 35 to 44 ozs. each, and cover a surface of 8x10, or about 80 square inches, making the weight 4 to 5 lbs. per square foot, or 25 kilogrammes per square meter. A square meter of roofing slate weighs 25 to 30 kilogrammes, and of tile 57 to 60 kilogrammes. The plates have projecting edges so they fit very tightly, and are held in place by 2 wire nails beneath the lap.

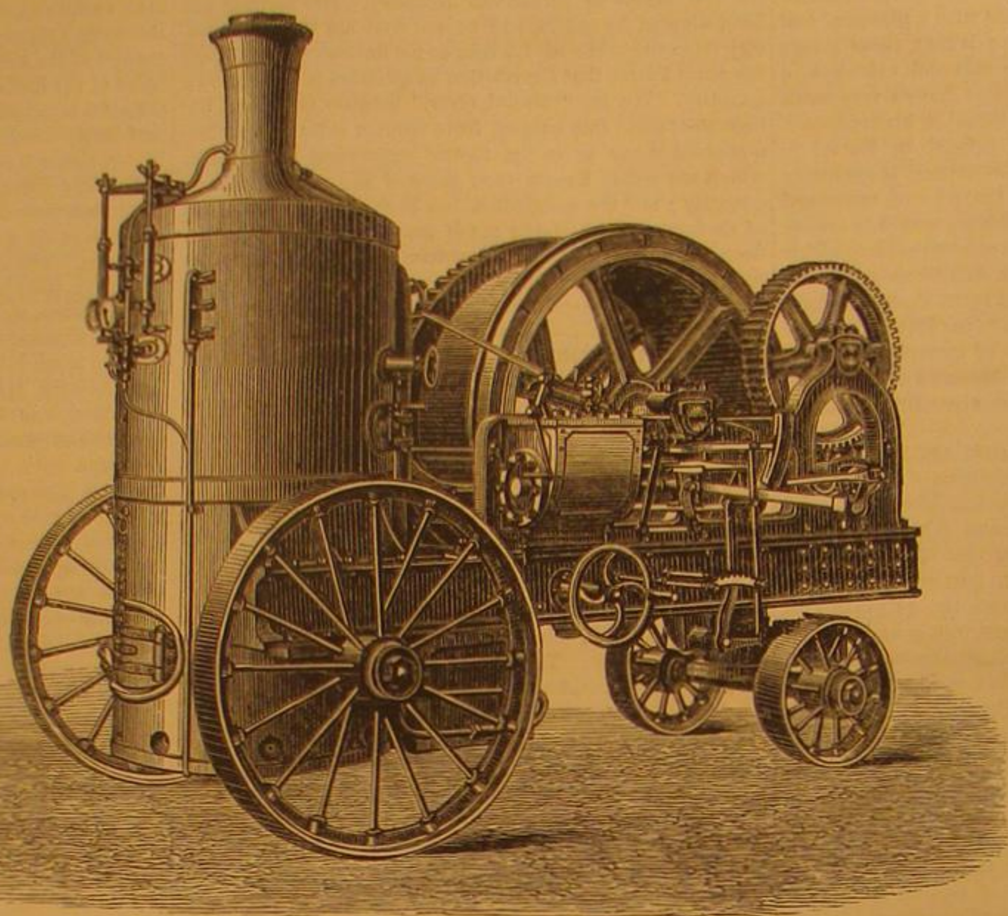
## Discovery of a New Pink Coral Bed.

The U. S. Steamer Gettysburg, while on her way from Fayal to Gibraltar, recently made a discovery of considerable importance, in the shape of an immense coral bank (hitherto totally unknown), in latitude 36° 30', longitude 11° 28'. Partial surveys were made, and the least depth of water noted was 180 feet, which in mid-ocean is very significant. Twenty miles west of the bank the sounding line marks 16,506 feet, and between the bank and Cape St. Vincent, 12,000 feet. The commander of the Gettysburg believes that in some portions the coral rises to the surface. How such a reef, in a part of the ocean which is constantly traversed by vessels, can have remained undiscovered is almost inexplicable. It is also stated that the bank is rich in valuable coral of light pink shades of color.

### A NEW STEAM CAPSTAN.

The steam capstan represented in the annexed engraving (which we translate from the *Revue Industrielle*) has lately been constructed by the Marcenelle and Couillet Company, of Belgium, for use in the mining districts. In order to remedy accidents to hoisting engines and cables, it has been customary to provide auxiliary apparatus at every mine The present machine, being portable, answers the same purpose for several mines, and thus a considerable saving is effected in cost of apparatus. It consists of a vertical tubular boiler of sufficient size to supply steam to the two horizontal engines which are connected to the driving shaft. The latter is geared to the drum shaft by heavy gear wheels, and carries a brake pulley, the brake of which consists of a steel plate encircling the entire periphery of the wheel, and it is loosened or tightened by a hand lever. The body of the carriage and wheels are of iron, and are very strongly built.

The machine is capable of lifting a load of 3,300 lbs. from a depth of from 1,500 to 1,800 feet, by means of a cable 6 inches in diameter and weighing about 4 lbs. per running yard. The cable is of galvanized iron wire, and contains a hempen core in which a number of copper wires are placed. These connect with a battery and with an electric bell near the engineer, so that they serve as a telegraph by which the workmen can signal when to hoist or lower. The total weight of the apparatus is about 14,000 lbs.



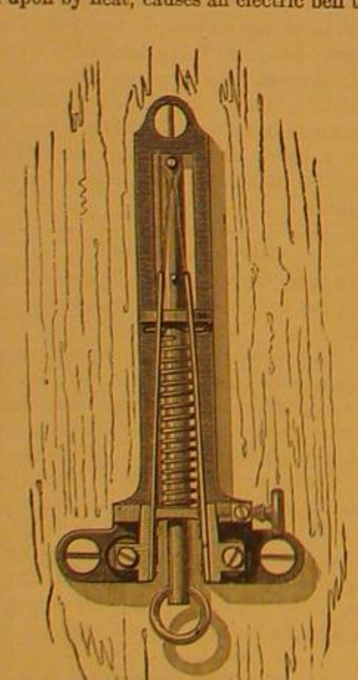
STEAM CAPSTAN FOR MINING PURPOSES.

### A New Way of Outlining Theater Scenery.

In the London theatres, scenic artists are now largely availing themselves of photography and the magic lantern as aids in the production of mimic representations of places where the action of plays is supposed to occur. In historical dramas, such as one based on the history of Joan of Arc, for example, the artist, instead of drawing on his imagination for a group of mediæval houses to represent the market-place at Rouen, procures a large photograph of the actual locality. This, by means of the oxyhydrogen light, he throws upon the canvas, the image being suitably enlarged in size. Then he follows the outline, and has an accurate picture. The realistic effect of scenery produced in this way is said to be wonderful.

### A NEW ELECTRIC FIRE ALARM AND BELL PULL.

The annexed engraving (which we select from *Les Mondes*), represents a new and simple fire alarm apparatus, which, when acted upon by heat, causes an electric bell to ring, and



which may ordinarily be employed in lieu of the common press button. In houses and hotels where electric bells are altogether used for purposes of communication, this little device provides a fire alarm wherever a bell-button is located, the locality of the fire being, of course, indicated by the prolonged ringing of the bell.

A plate of metal, secured by three screws to the woodwork or wall of the room, receives the conducting wires from beneath and at the base of two metal columns. To the latter are attached two thin elastic plates of metal, which form an acute angle with each other. They are prolonged upward by a sheet of steel which covers them outside the angle. The more dilatable metal being thus placed outside, the tendency of the plates on becoming heated is to curve inward, and thus contact is established at the summit of the angle, the current passes, and the gong, elsewhere located, sounds.

In the vertical axis of the supporting plate slides a rod, to the lower end of which a ring is attached, and to the upper end of which is secured a metallic index, which, when the rod is pulled down, comes in contact with the elastic plates which are separated otherwise by an ebony band on the rod. This movement (from up, down), is effected by an ordinary bell-cord attached to the ring, and a spiral spring serves to carry the rod back to its normal position after the pull has ceased. The apparatus may be adjusted so as to be very sensitive, and yet it cannot be put out of order by hardpulls on the cord. The set screw shown on the right, touches one of the elastic plates, and so adjusts it with reference to the other that contact between the two will occur at any thermometric degree of heat. A needle fixed on the head of the screw traverses a dial on the inclosing box of the apparatus. It is merely necessary to set the needle to the graduation in the dial corresponding to the degree of heat at which an alarm is desired. This ingenious device is the invention of M. Gaulnier, of Paris.

### To Obtain the True Meridian.

In all of the recent works on surveying, it will be found that Alioth, the first star in the handle of the Dipper, is designated as being directly opposite the pole, from Polaris, the north star. There was a time when such was the case, but now it is far from being correct.

The first published account of this method which we have been able to find, is in a revised edition of Abel Flint's work on surveying, published in 1833, which states that this method was communicated to the compiler, with permission to publish, by Moses Warren, of Lynn, Conn. It appears that this mode of reckoning had been in use among surveyors for some time previously; but we have not been able to find by whom or when it originated.

In 1800, Alioth was opposite Polaris; but a retrograde movement of the latter, of about 20' a year, has caused Alioth to be, at the present time, 25' ahead and brings Mizar, the second star in the handle, within 5' of being opposite to the north star; so that, in fifteen years more, Mizar will be exactly opposite. Polaris is on the meridian 25' after Alioth has passed the perpendicular, and 5' before Mizar reaches it.

C.

### Printing Photographs on Glass.

M. Siegwart, in the *Polytechnisches Journal*, directs the operator first of all to secure an image by means of gum, honey, etc., and bichromate of potash, and to dust this hygroscopic picture with red lead powder. The red lead image is then burnt in; and the more soluble lead glass thus obtained, is treated with concentrated nitric acid, whereby a dull, white image is produced, which may be viewed as a transparency.

### Hang up the Lantern.

No one should ever place a light or lantern on a barn-floor, or on a shop-floor where there are shavings. It is a very easy thing to upset a light so placed, and the result is likely to be the conflagration of the building. It is much more prudent to place hooks here and there about the premises, and have it understood that they are solely to hang the lantern upon, and that other things must be kept off them. An unprotected light should not be allowed in a barn under any circumstances. If the kerosene lamp had been hung up and not placed where a cow could kick it over, the burning of Chicago, and the consequent loss of millions of dollars, would not have happened.

### THE WILLES AND ROWE LIGHTNING DUMPER.

We illustrate herewith a new dumping bucket, which is excellently suited for loading and unloading carts and other vehicles, vessels, etc., when the same are used for transporting any substance which may be dumped without injury, such as earth, stone, coal, and grain. The invention will also be found useful in building operations, for handling mortar and concrete. It consists of a receptacle, triangular in section, and shaped either as shown in the engravings, or in forms slightly modified therefrom. This is suspended by a looped bail from the sides, as shown. One side, A, Fig. 1, is secured to a rod which enters apertures in the adjacent ends, so that said side, A, is pivoted or hinged above so as naturally to swing open, and thus allow the contents of the vessel to escape. To the middle of side A, is pivoted a bar, B, the motion of which is limited by long keepers, and the extremities of which, when the side is closed, fall into hooks on the ends of the bucket. One of these hooks turns upward, the other downward, so the bar, B, by being simply turned on its pivot, becomes engaged with them. It may then be fastened (so as not to be dislodged by any chance shock), by a pin passing through the bill of one hook, as shown at C. Of course, while the earth, etc., is in the bucket, the side, A, is kept closed; but when it is desired to dump the contents, the pin, C, is removed, the bar moved out of the hooks, and the side, A, is at once forced open by the weight of the material above it, which is thus discharged.

In the bucket shown in Fig. 2, a partition, D, is used inside the swinging side, A, so that the orifice made by the opening of the latter is thus rendered smaller. This arrangement is best suited for buckets used for sacking grain, where the discharge is made into a comparatively small aperture.

Fig. 1

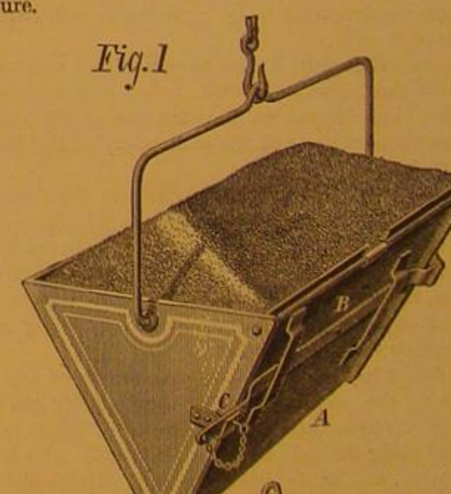
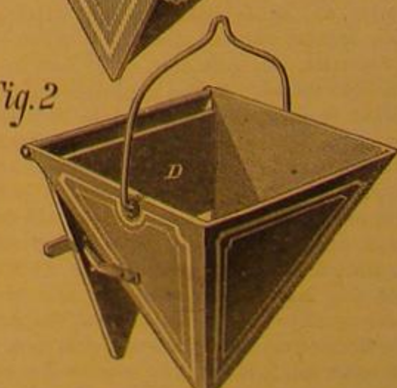



Fig. 2




Patented through the Scientific American Patent Agency, December 5, 1876. For further particulars relative to sale of State and County rights, address Messrs. Willes & Rowe, care of C. W. Stayner, Attorney, Salt Lake City, U. T.

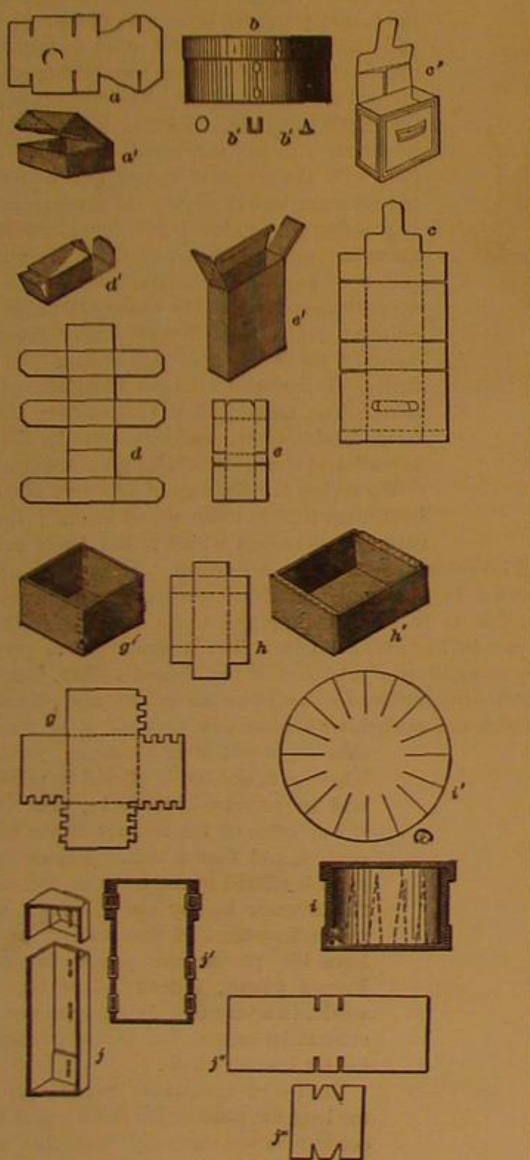
### New Investigations on Ruthenium.

M. Saint Claire Deville has recently noted that hyperruthenic acid ($RuO_4$), when heated to about 212° Fah., explodes violently, disengaging immense quantities of ozone. The same occurs if the metallic acid is placed in a very hot flame; and the fact is the more striking as it is well known that, under ordinary conditions, a temperature of from 318° to 414° is necessary in order that ozone may be disengaged.

## PAPER BOX MAKING.

It would hardly be imagined that paper boxes form the basis of an industry of sufficient magnitude to warrant the invention of costly and elaborate machinery; but if the reader will call to mind the thousands of uses to which these receptacles are now put, and further, that their employment is constantly increasing, it will be evident that a quicker means of production than hand labor has long since become necessary. If any one ever writes the history of paper boxes, he will find that, during the last three years, they have found a variety of new uses. Confectioners have almost abandoned the time-honored cornucopia for holding candies. Oyster saloons hang out the seductive sign: "Take home a fry in a box;" and even "stews" are now transported in cylindrical boxes of thick waterproof paper. Ice cream frozen hard and packed in paper boxes, is sold in the lobby of the opera and taken home from the confectioners, in place of candy, to the little ones. Retail dry goods dealers have lately adopted the box wherein to envelope small articles; and instead of becoming loaded with bundles of varying sizes, the "shopper" now carries her purchases in neat cases suspended by ribbons from the arm. The grocer ingeniously conceals a bottle in a case, which the purchaser takes with him unsuspected by the passers as to its contents. Besides, boxes, as Mr. Darwin puts it, have "differentiated." The old wall paper covered band box has become practically extinct, like the dodo, and instead, we have a neat light case, square or conical in shape, and stiffened with wood or wire. Look at the ingenuity expended in making paper collar boxes look like something else.

Fig. 1.



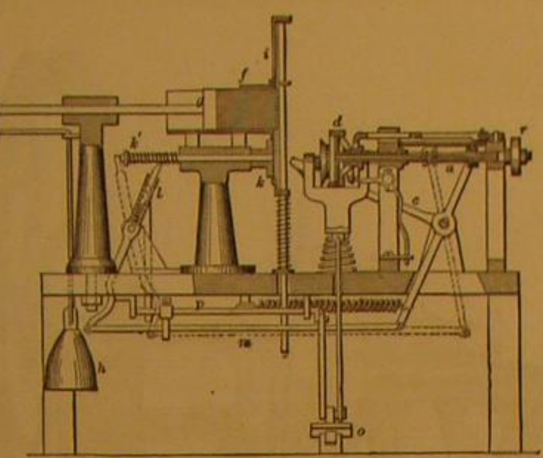
*Paper Boxes.*

Some of them are in the shape of miniature Swiss *chalets*; others resemble dressing cases and have looking glasses and pincushions within. Hair pin boxes furnish a field for similar endeavors; and jewelers' boxes are often marvels of delicate paper and velvet lining.

In Fig. 1, which we take from Knight's "American Mechanical Dictionary,"* is shown how some of the different forms of boxes are made. In producing a pill box, paper from a coil is wrapped around a former, making a cylinder of a thickness depending upon that of the paper and the number of plies. The inside surface of the paper is coated with paste, and thus the joint is made. Such boxes are completed by pushing a disk of paper into the cylinder. The lid is but a shallow box, a trifle larger. Such boxes are also made by coiling a wide sheet of paper on a mandrel in the manner described, and then cutting it into lengths as desired. Lids are made in the same way. Colored boxes are made by an outer ply of colored paper. Such boxes are also made by machinery. In one mode of covering, the strip which is to cover the cylindrical portion has gored margins, which lap over upon the bottom of the box or the top of the lid, as the case may be, and match together.

Boxes are also made from a roll of paper, which is bent over into shape, cut off, the bottom folded in against a former, the contacting portions being pasted *in transitu:* also of paper or pasteboard cut from the roll, shaped, and secured by rivets or staples, and also from blanks of the required size and shape, the machine taking them from the pile, shaping and fastening the parts together, as will be described further on. *a a'* are, respectively, a blank and a box made therefrom, the scale of the latter being enlarged somewhat. With the exception of two slight gores on the edges of the lid flap, no portion is wasted. Some portions of the box are double and others treble. Parts secured by paste or rivets.

Fig. 2.



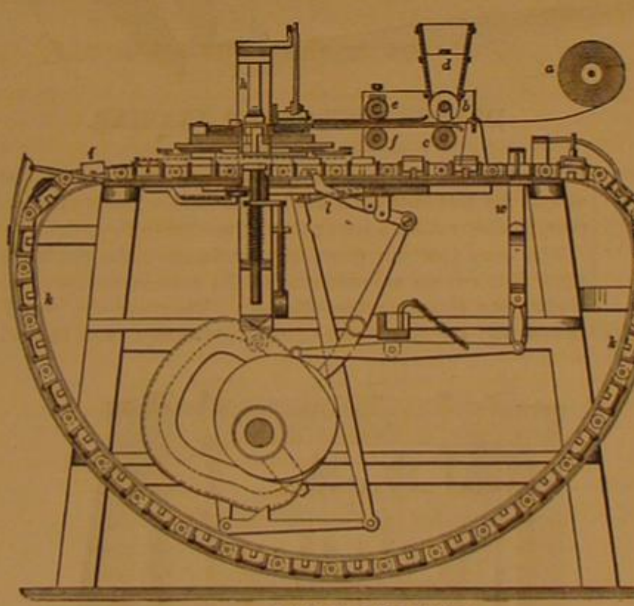
*Hatfield's Paper-Box Machine.*

*b b' b'* show a round box and the metallic fastenings which hold the lapped portions. *c c'* are the plan of the pattern and the folded box with a tuck and keeper. *d d'* illustrate another mode of shaping and folding. *e e'* is still another, with a lapping lid. *g g'*, a paper box with dovetailing angles. *h h'*, the plan of a blank and the box made from a similar larger blank. *i* is a box made from a circular blank, cut on the principle of *i'*, but of larger size. *j j' j'' j'''*, Heyl's box, whose overlapping pasteboard flaps are secured by rivets.

Seamless paper boxes, lamp shades, hats, and other hollow articles of paper, are made upon formers which are dipped into the pulp; the latter collects on the reticulated surface by means of a partial exhaustion of the air from the interior of the former, the air being withdrawn through an elastic pipe communicating with a bellows or cylinder.

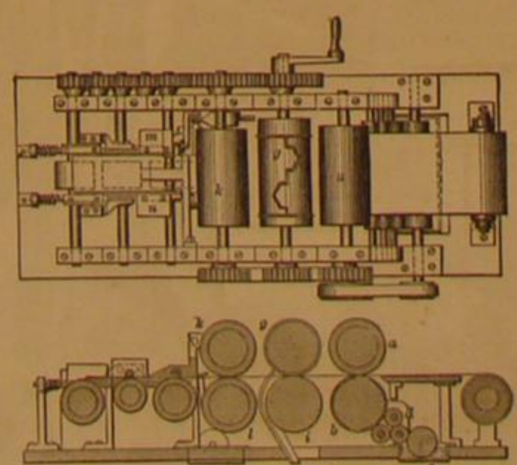
The water being drawn through the perforations, a film of pulp adheres to the surface of the former, which is then raised from the vat, and, the coating of paper pulp being removed and dried, forms a seamless article which requires no further manipulation for most ordinary purposes, but for ornamental uses may be covered wholly or in part with a second coating of colored pulp, and embossed or otherwise ornamented by stamps, swaging, or perforation.

Fig. 3.



*Gates's Paper-Box Machine.*

Fig. 4.



*Jaeger's Paper-Box Machine.*

Figs. 2, 3, and 4 are machines for making boxes from the roll or from blanks of paper.

HATFIELD'S MACHINE.

Fig. 2 is designed for attaching the bottoms to cylindrical paper box bodies previously formed by another machine. The shaft, *a*, is hollow, and through it works a spindle, operated by means of a hand-lever, *c*, and carrying a fixed head or disk.

On the end of the shaft, *a*, is an expanded head, *d*, formed in segments, which are pushed radially outward by links operated by a lever and arm.

*f* is a tube containing the bottoms of the boxes; these are pressed by the follower, *g*, kept in contact therewith by a cord and weight, *h*; *i* is a plunger cut-off by which the bottoms are pushed down one by one into contact with the follower, *k*. This is advanced by a lever, *l*, operated by the hand-lever *c* through the medium of the rod, *m*; *o* is a treadle connected by cranked arms and rods to the rock-shaft, *p*, of the lever, *l*, and to the arm of a lever having a divided head in which a roller is journaled.

The head, *d*, is rotated by the pulley, *r*, on its shaft, and the treadle depressed; this throws the roller out of contact with the expanding head, *d*, and also partially rotates the rock-shaft, *p*, throwing the latch, *l*, into position to engage the plunger-rod, *k*. A box-body is slipped over the expanded head, which is then expanded. The lever, *c*, is depressed, thrusting out the disk within the expanding head and bringing it into position to receive one of the bottoms which has been pushed down by the plunger cut-off, *i*. By an upward movement of the lever the box-bottom is pushed into contact with the disk, which, by the same movement, is withdrawn and brings the bottom into contact with the box-body on the expanding head; a slip of prepared paper, pasted on one side, is applied to the junction, the treadle is released, bringing the roller in contact with the side of the box, the rotary movement of which winds the strip around it, where it is fixed by the roller and vibrating fingers on an eccentric.

GATES' MACHINE,

shown in Fig. 3, is for making rectangular boxes. The paper web from the roll, *a*, passes between the rollers, *b c*, by the upper one of which paste from the trough, *d*, is applied to its edges. It is then carried forward by the feed-rollers, *e f*, and the necessary slits cut by a vertically reciprocating cutter, after which it is subjected to the action of a plunger, *h*, which shapes it by forcing it within one of a series of moulds, *i*, on an endless chain, *k*, advanced intermittingly by a pawl, *l*, operated by an oscillating lever from the driving-shaft. The boxes are carried around by the endless chain until they successively arrive in a sufficiently dry condition at a point over an aperture, where they are forced out of the molds by a vertically reciprocating plunger, *w*. Fig. 4 is

JAEGER'S MACHINE.

In this an address or label is imprinted and the box cut out and formed at one continuous operation. The paper passes first between the impression roller, *a*, and the type-roller, *b*, which is supplied with ink from the trough, *c*, by inking rollers, *d*.

Circular knives and creasers on the roller, *g*, cut it into the shape shown on the plan view during its passage between that and the roller, *i*. Paste is applied to its edge by the rollers, *k l*, in connection with a smaller roller not shown. Proceeding onward, two of the flaps are turned up and secured by pivoted wings, *m n*, the other two being similarly treated by other wings, leaving the end flaps to be folded in by hand.

## The Reproduction of Steel Engravings by Photography.

The photo-engraving process has lately been brought to a wonderful degree of perfection. Not content with reproducing the coarser lines of wood-cuts and pen-drawings, the Photo-Engraving Company of this City have recently prepared plates from fine steel line engravings. The result is certainly remarkable. Several impressions now before us, printed on heavy paper, present a depth of color, crispness and brilliancy of line, and absence of blur, which would enable them to be readily mistaken for impressions from the original steel plates by any but an expert eye.

This is not the first time that attempts have been made to reproduce fine artistic work in a similar way; but the preceding efforts have not as a rule been satisfactory, inasmuch as the qualities above-noted, which constitute the valuable characteristics of an engraving, have not been reached. The public may congratulate itself on work of this kind. We sadly need art education in this country; and the popularization of admirable artistic productions, by placing accurate copies within reach of straitened pockets, is well calculated to foster a healthy and valuable taste for art.

## A Safeguard Against Rats.

Rats are accomplished rope-walkers, and are able to make their way even along very small cords. Consequently so long as they can mount upon the lines, nothing edible suspended therefrom is safe from their attacks. A correspondent of the *Boston Journal of Chemistry* uses wires, upon which circular pieces of tin are strung, and hangs his meat, grain, etc., between the tin pieces. The rats cannot pass the tin circles, because, as they attempt to climb over them after walking out on the wire, the pieces revolve.

DYEING LIGHT ROSE.—For 22 lbs. fabric, use 10½ ozs. oxalic acid, 5½ ozs. tin crystals, ¾ oz. cochineal. Boil, cool, enter and dye at a boil. Both dark and light rose shades are much better produced with eosine. For dyeing chamois on flannel, dye as for light rose, and add for 22 lbs. fabric, from ½ to ¾ oz. flavin, according to shade.

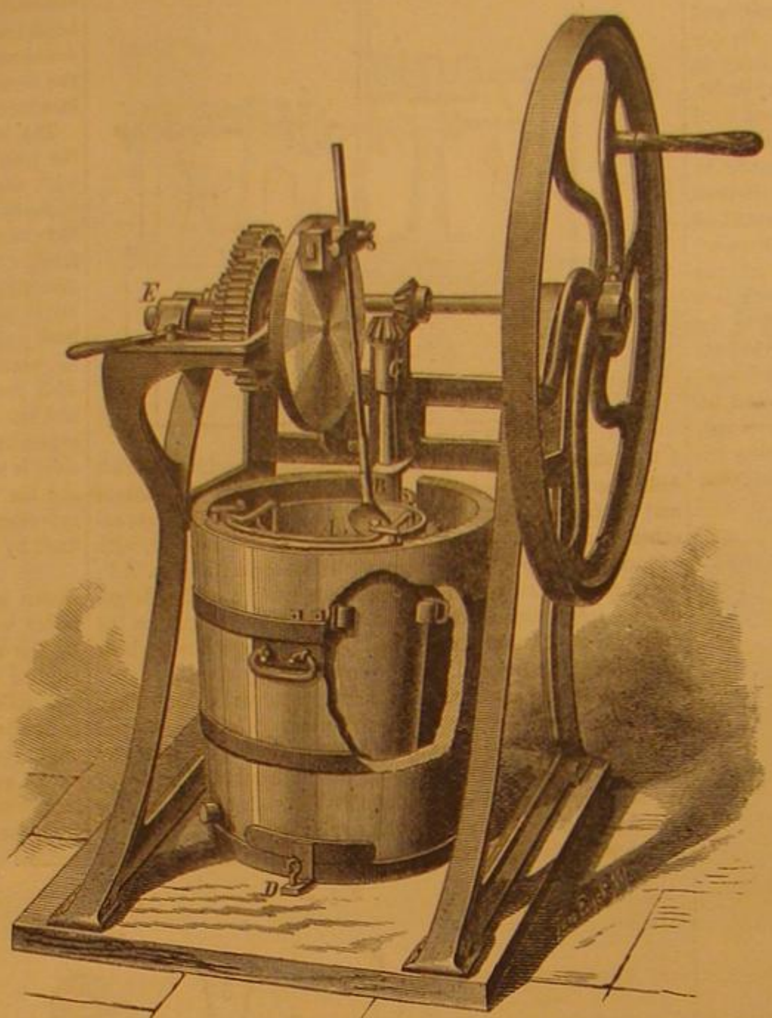
*Published by Messrs. Hurd & Houghton, New York city.

### IMPROVED ICE CREAM FREEZER.

In making ice cream without machinery, it is always found necessary, after the freezing begins, to beat the cream with a paddle by hand. This facilitates freezing, and at the same time secures a smooth and uniform congelation. In machinery for freezing cream on a large scale, it is desirable that this beating be done automatically, and the closer the action of the paddle imitates the movement imparted by the hand, the better. In the apparatus illustrated herewith, the above is accomplished by simple mechanism; at the same time, there is improved machinery for rotating, and scraping the interior of the freezing can, the whole being so constructed that a large quantity of ice cream of excellent quality may be quickly produced by a small expenditure of power.

The machine consists of ice tub, can, scrapers to remove the cream from the sides as it freezes, the paddle, and the lid. The tin scrapers, attached at A, are bent to conform to the shape of the can, so as not to bear hard on the metal and thus scrape off the tin. The paddle, B, is a bar of galvanized iron, having a tin blade protected by a wooden point. The lid is of iron or tin, with apertures at the flange, so that it may be placed over the scraper supports. The cream, being suitably prepared, is placed in the can, and the tub is filled with ice and salt. The scrapers are inserted in place and the lid is attached. In the side of the tub is cut a recess, through which a pinion on the vertical shaft, C, enters, and engages a circular rack on the can. When these parts are brought into gear, the tub is held in place by the pin, D. The vertical shaft, C, is now rotated by bevel gear connected with the main horizontal shaft, which last is turned by the crank shown. The can is thus revolved until the cream becomes quite thick. The paddle, which is secured to the disk on the left, is now thrown into operation by the lever, E, on moving which gearing connected with said disk is engaged with gearing on the main shaft. The oscillations of the paddle are continued until the cream becomes stiff and hard. The can is open during the entire operation, and hence its contents are always under the eye of the operator. The inventor states that a boy of 14 years alone can easily make 30 quarts of ice cream at a time without assistance. The cans may hold from 12 to 40 quarts, and there is no churning of the cream into butter by this apparatus, which may be operated by steam, if desired.

Patented through the Scientific American Patent Agency, August 15, 1876. For further information relative to building machines on royalty, etc., address the inventor, Mr. C. L. Dexter, 245 South 15th Street, Philadelphia, Pa.




DEXTER'S ICE CREAM FREEZER.

### IMPROVED PORTABLE GANG SAWMILL.

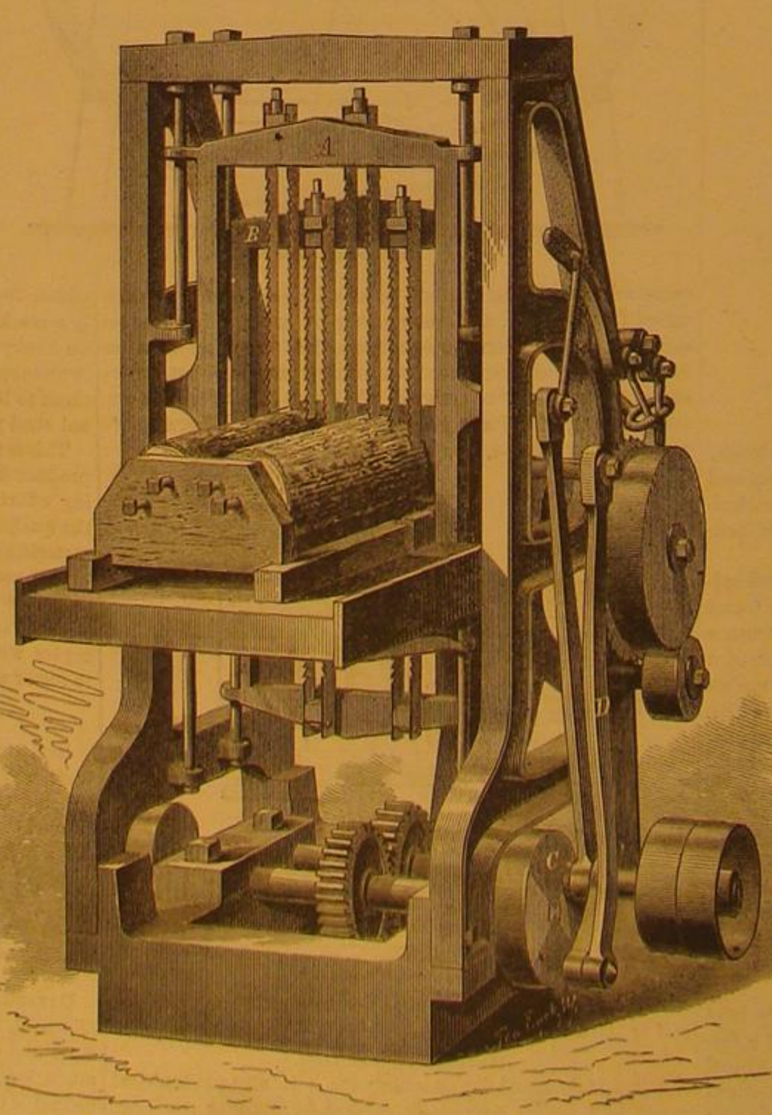
In the machine herewith illustrated, a series of vertically reciprocating saws cut, simultaneously, a number of boards from a log. It will be remembered that the old form of gang saw embodies but a single gate, the saws in which, of course, act upon the log only in one direction. In the present apparatus, two gates are employed, each carrying a number of pairs of saws, the pairs in one gate being arranged in alternation with those in the other. The teeth in the alternate saws in each gate are oppositely directed, so that one set of saws is always acting during each part of the stroke. The gates counterbalance each other, and in this way, it is claimed, the troublesome springing and trembling of the log (which often occurs when a single gate is used), are entirely avoided. Another new feature is found in the reversed blocks, which are fitted to notches at the ends of the saws, and by means of which the distance between the saws is regulated. Screws passing through said blocks are provided for tightening the blades. The log carriage is constructed in the usual way, and is provided with head blocks and dogs for engaging the log between each pair of saws, so that the latter may run completely through the log and leave no stub. The feed motion is adjustable as to rate of feed, and the usual friction apparatus is provided for carrying the carriage quickly back.

The important feature of the machine lies in the arrangement of saws. The two gates, A and B, are similar, and both slide upon ways in the main frame. On the cross-bars of the frames are projecting studs, which support the saws; each pair of blades is connected at the bottom by means of a pin, which is drawn against the under side of the stud by the straining device. The latter consists of a reversed block, the lugs formed on which are fitted to notches cut in the edges of the saw. A screw passes through the block and bears on the projecting lug on the cross-bar beneath, so that, by turning said screw, the pair of blades is quickly stretched out. The reverse direction of the teeth of alternate saws is plainly shown in the engraving, all the teeth being of course turned toward the front of the machine.

A shaft, journaled in the bed-piece, carries, at each end, similarly arranged double cranks, C, the wrist pins of which are placed diametrically opposite each other. D are rods which connect the pins with studs that project from the gates. By this ingenious mechanical device, the cranks impart, as they rotate, a reciprocating motion to the gates.

The saws that cut down are overhung at the top, while those that cut up are overhung at the bottom, so that there is always a clearance for either set. They are also so adjusted that the front part of the cuts comes even in line. Among the advantages claimed is, that long and slender logs may be sawn without difficulty, as the force is equally exerted from above and below. Owing to the absence of jarring, the speed may be increased; and the strain on the frames being lessened, the latter may be much lighter in construction. The inventor informs us that, by this machine, he can saw 2,000 feet in 10 hours with the same power that is required to drive a 52-inch circular saw, and that a saving of 20 per cent. is effected over the latter in saw kerf and slabs. The width of the kerf of each saw is only one-third that of a circular saw. He further states that a machine heavy enough to saw a 3-foot log, will saw equally well three 1-foot logs simultaneously.

Patent pending through the Scientific American Patent Agency. For further information relative to sale of rights, etc., address its inventor, Mr. D. J. Marston, Amesbury Mills, Amesbury, Mass.




MARSTON'S PORTABLE GANG SAWMILL.

### A Valuable Opportunity for Inventors.

The object of the French *Société d'Encouragement pour l'Industrie Nationale* is indicated by its name. It was founded in 1801 for the purpose of fostering improvements in all branches of French industry; and to that end it causes all new inventions or processes submitted to it to be examined by the ablest scientists, and reports prepared, which are published in its monthly *Bulletin* of proceedings. The society awards medals and money prizes for inventions of superior value, and distributes medals and other honors to operatives in manufacturing establishments who become distinguished for good conduct and ability in their trades. Lastly, it furnishes the workman who has conceived a valuable invention, with the means of developing and patenting the same, and of paying the subsequent taxes imposed by French law; and it also extends aid, pecuniary and otherwise, to inventors who, by reason of age or infirmities, become unable to support themselves. The society is under Government control, and directly under the supervision of the Minister of Agriculture and Commerce. It derives its means from bequests and foundations, subscriptions of members, Government subsidies, etc., and it extends its aid to inventors and workmen wholly gratuitously.

We review the features of this very admirable institution thus in some detail in order that the nature of the offers which it has lately made to all inventors may be fully understood. These offers are embodied in a recently published programme of prizes and medals to be competed for and to be awarded during the years 1877 to 1882 inclusive. The programme was prepared by committees of scientists of the highest ability, and it embodies suggestions for forty-two inventions and discoveries which are needed, with some few exceptions, as much all over the world as in France in particular. The sum of $21,000 is offered in prizes. It will be perceived, however, that the intrinsic value of the awards is the least incentive, and that a much greater inducement is offered by the fact that the successful inventor in any one case will receive the indorsement of the society, and will have his production placed before the French people, indeed before the whole world, in a way that is likely to secure its substantial success and create a ready market for it everywhere.

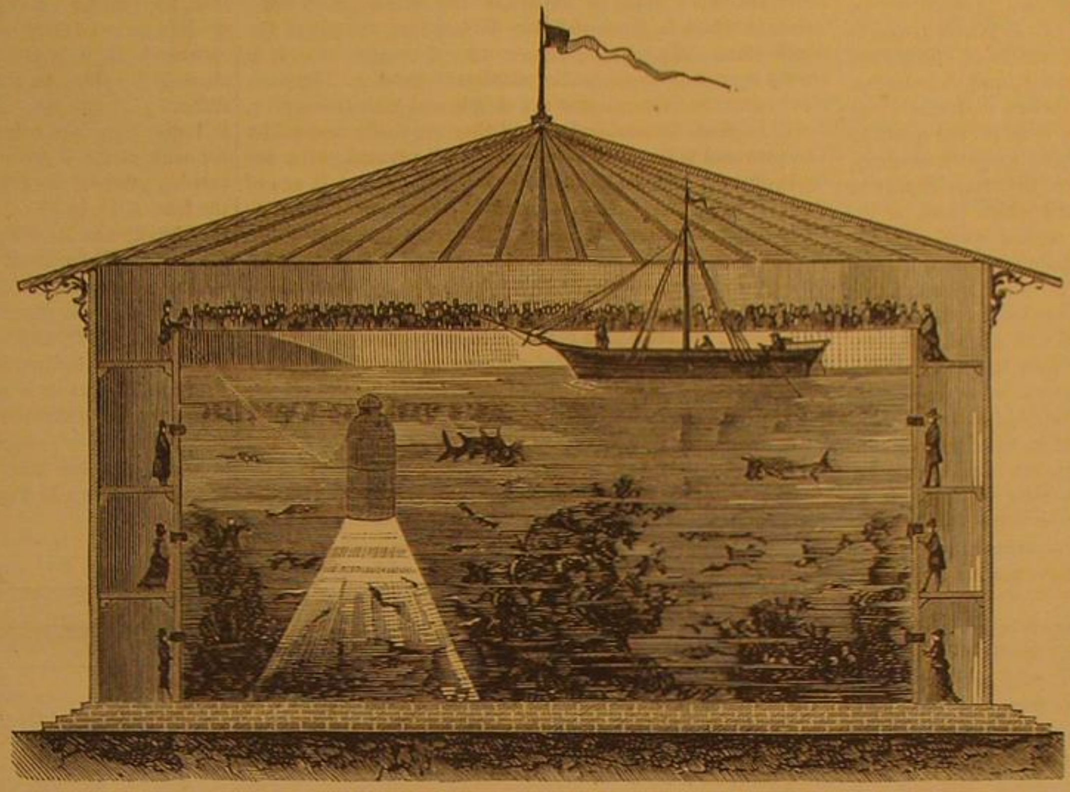
The list of inventions required is much too long for publication here; and in this connection we can only state that it calls for a new domestic motor, a light weight steam engine, new alloys, new utilizations of minerals, and waste substances, new modes of preserving meat, and so on through the several departments of science. Prizes range from $1,200 to $100 for each invention, and in some cases, inventors will be assisted during the progress of their investigations. We shall publish the whole programme in the SCIENTIFIC AMERICAN SUPPLEMENT, giving the names of the inventions desired, the prize to be awarded to each, and the period by which each must be ready for entry for competition. To each requirement is also added a brief review of the conditions which render the invention necessary, and a host of valuable suggestions, pointing out what means are now available for the work, and in brief, giving just such hints, from those familiar with the particular industry referred to, as will enable the inventor to set about his investigation in an intelligent manner. The programme will extend through three numbers of our SUPPLEMENT, beginning with the issue of the present week, No. 53.

THE CENTRAL spire of Rouen Cathedral, France, has just been completed. It is 492 feet high, and is of cast iron.

## A COLOSSAL AQUARIUM.

M. Toselli, whose ingenious grappling irons and other marine apparatus we have frequently described, has devised an ingenious and novel plan for exhibiting his inventions under conditions of actual use, and in connection with a mammoth aquarium to be erected at the French International Exposition of 1878. He proposes to erect a circular iron edifice, some 32 feet in height, by 60 feet in diameter. In this will be a huge tank, which will be furnished with rocks and marine vegetation, and will contain a large number of fish of all kinds. On the sides of the tank, are to be inserted powerful lenses, and the annular space between tank and building will be divided into galleries, so that visitors in each gallery may look through lenses and thus view submarine life at various depths. In the tank will also be placed M. Toselli's submarine mole, a curious invention somewhat analogous to the diving bell, but which carries its own air supply and is capable of locomotion and also of illuminating the water in its vicinity by means of the electric light. After viewing the descent of this apparatus from the upper gallery, the visitor is to be conducted to the gallery next below. This corresponds to a descent of about 10 feet below the surface, at which point the water still retains its blue color. On the next floor below, a depth of 22 feet is reached, and here the water becomes green, the summits of the rocks on the bottom become visible, and the motions of the huge fish can plainly be followed. On the lowest floor, the visitor will be able to see the interior of the submarine mole as it rests on the bottom, and at the same time will view the sponges, corals, and other inhabitants of the ocean bed illuminated by the electric light.

M. Toselli will occasionally wreck a small vessel loaded with ten tons or so of stone, allow her to sink and then will raise her again by a new automatic apparatus, which he calls the air-hydric chain. Visitors will also be carried down in the submarine mole, which is large enough to accommodate four persons. The general construction and disposition of the tank and galleries will be understood from the annexed sectional view of the building, which we extract from the *Revue Industrielle*.



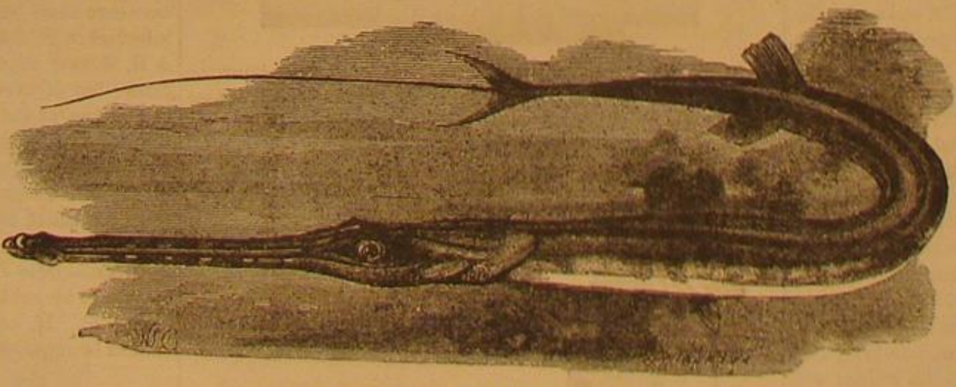
THE AQUARIUM FOR THE PARIS EXPOSITION. 1878.

### A Cunning Old Fox.

A farmer near York, Pa., says the *Daily* of that town, recently set a trap to catch a fox which was making severe depredations in his hen roosts. At each of fourteen successive visits, he found the trap sprung, a stick of wood between its jaws, and the bait eaten up. The circumstance, so often repeated, surprised him. There were no other tracks to be seen but his own and those of the fox, and who sprung the trap was a question that puzzled him sorely. By continuing to rebait his trap he hoped to catch the author of the mischief. On the fifteenth night he found a fine old fox hung to it by the nose, and in his mouth was a stick of wood.

## THE TOBACCO PIPE FISH.

In the remarkable tube of fishes known to zoölogists as *fistularidæ*, the snout is greatly prolonged as in the *centriscidæ* or spike-bearing fishes, and it bears the mouth at the end of a long tube. The body is long and snake-like, and there is no long spine to the dorsal fin. One of the most singular members of this family is the tobacco pipe fish shown in our engraving; it is found in many parts of the tropical Atlantic. The body is without scales, and the tail fin is deeply forked, the two central rays being sometimes united and prolonged into a lengthened filament, and at other times being separate, but still elongated. The outer edge of the tube is either smooth or very slightly notched. The color is greenish-olive and the upper parts of the body are marked with blue streaks and spots. In some specimens of this curious race, the back takes a reddish brown hue.



FISTULARIA TABACCARIA.

### Iron Pyrites—"Fool's Gold."

The name pyrite is derived from *pur*, fire, and originally referred to the sparks produced by friction with steel. Pliny mentions several varieties of pyrites, and among them there is a kind resembling brass or copper; this was, in all probability, the substance now known as pyrites. But with it were confounded copper pyrites (chalcopyrite), marcasite, and pyrrholite, none of which produce sparks.

Pyrites occur abundantly in rocks of all ages, from the oldest crystalline to the most recent alluvial deposits. It usually occurs in small cubes, but sometimes in nodular or concreted masses, often radiated within. It is found both stalactitic and amorphous in form and veins, in clay-slate, argillaceous sandstones, the coal formation, etc. Cubical crystals of gigantic dimensions have been found in the Cornish mines, England, the island of Elba, and elsewhere. Nickel, cobalt, thallium, and copper sometimes replace a little of the iron in the pyrites, or else occur as mixtures; and, in auriferous districts, gold is sometimes present: distributed invisibly through it. Yellow and white or magnetic (marcasite) iron pyrites are dimorphous forms of the bisulphuret of iron ($FeS_2$); the first named is the most common of crystallized minerals. When in the form of minute scales it is very often taken for gold, although it is considerably lighter in color. It is nearly as hard as flint (from 6 to 6.5), of a pale brass yellow, nearly uniform in color; it is brittle, and gives out fire when struck with steel. It is represented by the formula $Fe.S_2$, and consists of sulphur 53.3, iron 46.7, parts in 100. Iron pyrites are chiefly prized as a source of sulphur, for making sulphuric acid, alum, Spanish brown, and copperas (sulphate or iron); and immense quantities of it are used in the arts for dyeing, etc. The sulphide is subjected either to a process of roasting or to slow oxidation (fermentation).

In Nature, pyrites readily change to sulphate of iron by oxidation, some sulphur being set free, also to limonite (on the surface), brown clay, ironstone (sometimes in concretionary nodules of brown and yellow ochre), and afterward throughout by the action of soluble bicarbonate of lime, which carries off the oxidized sulphur as sulphuric acid, with which the lime forms an almost insoluble salt. This salt is gypsum, the source of plaster of Paris. The limonite changes to red oxide of iron.

If a small fragment of pyrite be placed in a small narrow glass tube, closed at one end, and gradually heated over a spirit lamp, or in a Bunsen flame, a rapid decomposition will ensue; and the cool portions of the tube will immediately become encrusted with a sublimate of yellow sulphur. If, after subjecting the test fragment in the tube to the influence of the hot flame for a few minutes, and removing it from the tube by breaking the glass, it is presented to a small magnet or vertically poised compass needle, it will be found to have become possessed of strong magnetic properties. This is due to the artificial formation of magnetite (lodestone), a compound containing both the protoxide and sesquioxide of iron. If a fragment of pyrite be subjected, on a piece of charcoal, to the inner flame of a blowpipe, the blue flame of burning sulphur will be readily recognized, accompanied by the pungent and characteristic odor of sulphurous acid gas, which is evolved in large quantity from the burning sulphur. The residue, like that in the former experiment, will be fouud to be magnetic; but if subjected for a moment to the outer top of the flamc it will lose this property, and become completely converted into the red or anhydrous sesquioxide of iron. Polished plates of the concretionary variety, as well as the small, perfectly formed cubical crystals of pyrites, have at times been employed as jewelry. It forms very beautiful ornaments; but the polished surfaces do not hold their lustre and brilliancy very well, unless protected by a film of varnish from contact with moist air. The compound is not worth working for its iron.

This *pseudo* gold, from its wide dissemination throughout the earth's crust, has caused more high-flown hopes and disappointments than any other mineral known to Science. From what has been said, it is obvious that the most elementary acquirements in the science of chemistry or metallurgy would suffice to dispel at once these delusive hopes. By the use of the true philosopher's stone, applied chemistry, thoughtful and enterprising investigators have at last succeeded in transforming even the common pyrites into gold, by extracting the useful constituent, sulphur. In view of the deceptive and pretentious appearance of pyrites to the eye of the unlearned, it has been well said that no more appropriate title could well be attached to the mineral than that by which it is most commonly known—"fool's gold."

### Curious Inter-Fertilization of Pear Trees.

A curious instance of natural mingling of species recently came under our notice, which offers a valuable hint to fruit growers. In an enclosure some 50 feet wide by 150 feet long were set out, about nine years ago, a number of pear trees. Several varieties were included, notably the Bartlett, Sheldon's, Flemish Beauty, and other fine species, together with three or four trees which bore coarse, late ripening winter pears, scarcely fit for anything but cooking purposes. All the trees bore abundantly; and until the last two years the pears of each variety showed no change. Recently, however, and in a more marked degree during last summer than during 1875, it was found that all the fine pears were slowly becoming of a single hybrid species, or rather series of modifications, of the winter pears. The Bartletts especially are showing the characteristics of the winter pears in a remarkable manner, and the "puckery" taste of the latter is especially observable. It is curious that the active part is taken by the winter pears in influencing the others, while they themselves, as yet, show no modification. The question is, how could the winter pear exert this predominating influence, not only over the trees in its immediate neighborhood, but over others at the opposite end of the enclosure. It is, of course, probable, that while the trees were in blossom, the pollen of the winter pear flowers was transported to the flowers of the other trees. The phenomenon is in any event doubly suggestive: first, in that it is an instance of a new species being gradually formed by the action of Nature; and second, in that it indicates to fruit growers the danger in placing fine pear trees in proximity to those of inferior variety.

### Human Leather.

The question is whether, in this age of utilization, we are going to allow the bodies of the dead to remain unutilized. Although the majority of mankind will doubtless promptly dispose of this not over agreeable consideration by an unequivocal affirmative, two shoemakers in this city think otherwise; and they exhibit a handsome pair of boots made from human leather in support of their views. The skin was furnished from the front and back of a dissecting room subject, who had died suddenly from accident, and upon whom decay had not yet begun to act. It was placed in a solution of hemlock and white oak barks, and, after the tanning, which lasted three weeks, emerged in the shape of a soft, pliable, light brown leather, like fine calf skin, but more porous. The available skin on a good sized man, says these progressive Crispins, will make the legs and uppers of two pair of boots after allowing for reasonable waste. This is the second utilization that has been proposed. The other was to cremate the bodies in gas retorts, and to convert the volatile matter into illuminating gas, and the bones into phosphates.

### Asphalt Tiles.

At the Bavarian Industrial Museum there has recently been exhibited a new kind of flooring tiles made from asphalt, in a very simple way. The drawing of the intended design is first made on coarse heavy paper. Then it is covered with bits of china and glass, so as to form a mosaic. Lastly, a border is made to the sheet, and liquid asphalt is poured upon it. After the whole has been covered, the paper is taken away with cold water, and the tile is finished. This flooring is said to be handsome in appearance, and to resist damp for an indefinite period of time.

(*Continued from first page.*)

induction valve must, both at the time of opening and closing, be very quick, otherwise wiredrawing inevitably takes place, and this will be evidenced in the rounded corners at each end of the steam line, on the indicator diagram.

It is inherent in simple high pressure steam engines that the power imparted to the driving shaft be variable; because, if we disregard the question of economy, and permit the steam to follow the piston during as large a portion of its stroke as possible, the necessity of having a free exhaust, especially with a high piston speed, demands that the exhaust valve shall open freely before the completion of the piston stroke: while if, on the other hand, we use the steam expansively, the pressure upon the piston (and hence the power communicated by it) decreases from the moment that the induction valve closes until the end of the stroke: in other words, during the whole term of the expansion. It is also found in practice that, even under the most favorable of conditions, the load driven by the engine is variable, and it becomes, therefore, a somewhat complicated problem to devise a mechanical movement that shall sacrifice none of the qualities essential to prevent the wear and tear due to quick motions, that shall establish between the duty and the steam supply to the cylinder are always equal ratio, and which shall, at the same time, maintain a uniformity of engine speed notwithstanding variations in the amount of the duty and in the boiler pressure. In this connection, it may be borne in mind that the variation which may take place in the load of the engine, after the steam supply has been cut off and during the term of expansion, is an element tending to vary the speed of the engine. Nor can this element be counteracted or compensated for, except during the period of admission in the next stroke of the piston. The method which, by common consent, has been adopted to secure economy and regularity of speed, notwithstanding these disturbing elements, is to so attach the governor to the induction valve that the action of the former is communicated instantaneously to the latter, the valve being opened by a positive motion and closed by the action of the governor.

We present in the accompanying engravings views of the Brown engine; and the means by which the before described functions are performed in this engine, may be thus briefly described: In Fig. 2 is shown the valve motion. The steam and exhaust valves are griddle valves, which ensure a large area of opening in proportion to the amount of movement, and give free ingress and egress to the steam; and this it is which, together with the quickness of the valve movement, secures the sharp admission corner and the freedom of exhaust shown in the indicator cards taken from this engine. The valve seats are formed of plates, which may be taken on and off the cylinder; and the part over which the valve travels is raised so that, to true up the seats, the plates may be taken off, and either filed or planed in a few minutes, the operation making no difference to the height of the slide spindles from the seating, thus avoiding a very common defect while simplifying the operation.

The governor is operated by the cut gear wheels shown, which impart a rotary motion to the shaft, A, which operates the governor and communicates rotary motion to the valve shaft, B. Between these two shafts, however, is the friction device, C, which is so constructed as to permit the shaft, B, to be operated by hand independently of the shaft A: and thus the valve motion may be operated by hand independently of the cut gears, which is a great convenience to the engineer in starting the engine. Upon the shaft, B, are the eccentrics, the ends of the straps of which connect with the horizontal lever or arm, E; and the end of the latter extends into the square slot in the slide spindle guide to the catch of the tongue. It is obvious then that, as the shaft, B, revolves, the end of the lever, E, will reciprocate vertically in the said square slot. Turning now to the valve stem and guide, the valve stem is attached to the guide, F, and in the slot shown in the latter is a tongue, G, pivoted by the pin shown in the guide. The upper end of this tongue has a projecting catch upon it; and beneath this catch stands the end of the arm, E. Now the induction valve is closed when at the bottom of its travel, and the weight of the valve and stem and the pressure of the steam (acting on an area equal to the area of the valve stem) are, combined, always acting to keep the valve at the bottom of its travel, that is, in its normal position; and there it remains until lifted for the admission of steam. The manner of effecting this admission is as follows: The end of the arm, E, acting against the catch on the upper end of the tongue contained in the slot shown in the slide spindle guide, F, lifts the valve and holds it open so long as the tongue is not tripped. The instant, however, that the latter action takes place, the valve, from its weight and the action of the steam upon the area above mentioned, closes, the movement being cushioned after the valve is completely closed by means of the small dash-pot shown beneath.

It is evident then that, by regulating the eccentrics, the valve may be given any desired amount of lead, and that the duration of the period of admission may be varied by tripping the tongue before referred to; and this is accomplished by the engine governor in the following manner: The governor acts upon the rod, N, shown in our engraving, the end of the governor spindle being attached to a crank arm attached to the rod, N. Upon this same rod, and immediately behind the induction valve spindle guide, F, is an arm, standing vertically and carrying a pin, H, standing horizontally. Now the tongue, which, at one end, acts as a catch to the eccentric arm at the other end, protrudes from the back of the slide spindle guide, and stands directly beneath the above mentioned pin; so that, when the rod, E, lifts (through the medium of the tongue catch) the induction valve, the latter continues to lift until the tail of the catch, G, contacting with the pin, H, thus tripping the tongue; and the valve instantly closes, returning to its normal position. The action of the governor, then, by *controlling* the position of the tripping pin, H, controls the period of steam admission, the movement being performed without the interposition of either springs or weights. The exhaust valves lie horizontally, and are operated as follows: Upon the shaft, D, are the discs, J, which are provided with cam grooves. The rocker arm, K, carries a friction roller extending into the cam groove, the upper arm, L, being attached to the exhaust valve spindle. To compensate for the circular motion of the arm, and the vertical movement of the valve spindle, the connection between the two is made by the eye of the spindle, containing a slot, in which is fitted a sliding die to which the pin of the arm is fitted. To regulate the amount of compression, it is merely necessary to adjust the position of the disc. The parts composing the valve motion are simple and plain, involving, it will be seen, no intricacies; and they are easily accessible. The pins and bolts, as also the eyes of all pivoted parts, are made of steel, and are hardened. The rods, A and B, are of steel. The slide spindles and stuffing boxes are of brass, so finely fitted that they are steam tight from the fit without the aid of any steam packing whatever; and it is stated that some of these spindles thus fitted have run a year without requiring any packing. The piston rod and connecting rod are of steel; the crosshead is provided with brass gibs, which are adjustable to take up the wear by means of the check nuts shown. The crank pin and crosshead pin, and all the bolts, nuts, pins, and studs about the engine, are of steel.

The workmanship upon these engines is, both for fit and finish, of the very first order. The joints of parts fitted together cannot be distinguished, nor can the seating of the nuts against the cylinder cover washers be defined by the eye. The whole of the working parts are finished and have a polish upon them equal to silver plating. The governor is of the ordinary fly belt type, and is, for security and safety, enclosed in a polished cast iron casing.

The indicator cards, taken from each end of the cylinder, show the admission and steam lines to be notably perfect, with the corners fully and sharply defined; while the exhaust and air lines are one, at all times when the cut-off takes place so late that the expansion curve does not pass below the atmospheric line.

One of these engines supplied the motive power for the Sawmill Building at the Centennial, and received the highest award in the form of a medal and a special judges' report. Another drove part of the machinery at the recent American Institute Fair, and was awarded the coveted Centennial gold medal. For further particulars, address C. H. Brown & Co., Fitchburgh, Mass.

## PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES.—Number XVII.

### PATTERN MAKING.

We need not dwell upon the half core box, which is necessary for this pattern, if the branch stands at a right angle to the body, or the full one, necessary if it is required to stand obliquely. When the body of the T is much larger in diameter than is the branch, we may joint the two in a simpler way, which, so long as it does not entail a great weakening of the body, will be found more advantageous than the method described. This simpler method is: Having found the amount of the length of the branch necessary to allow for curvature of the body (by the process shown in Fig. 116)

Fig. 124.

we turn upon the branch end an additional projection or stem, as shown in Fig 124, somewhat smaller in diameter than is the branch itself; and we then cut in the body a recess to receive the branch and turned stem or projection, which recess may be either cut out with a gauge or turned out in the lathe, the latter being, for obvious reasons, the best method. For this latter operation, we take a chuck similar to that described in Fig. 58, as a cement chuck;

Fig. 125

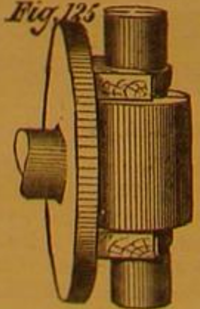
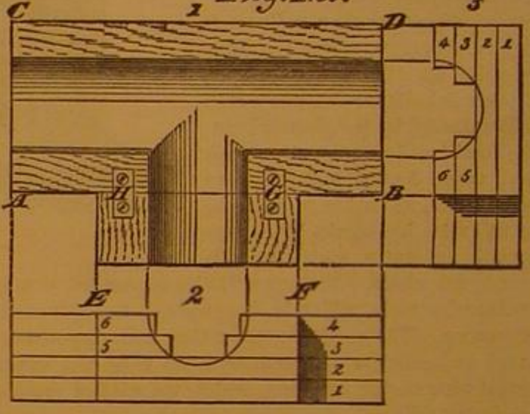


Fig. 126.

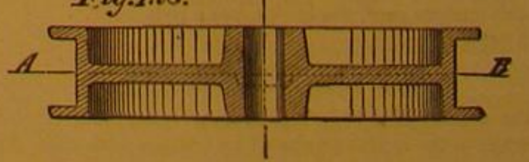

and having verified that the point and the face of the chuck run quite true, we draw a centre line across it, set the apexes of the two V blocks exactly over this line, and then fasten them. Having marked upon the body the centre of the branch, we find a point diametrically opposite to it upon the body, and place the body so that the steel centre point enters the point so found at the same time as the body rests in the V's. We then fix it in this position, by thin straps of hoop-iron, or any other contrivance that will not project so as to prevent the lath rest (or tool rest, as it may be more properly termed) from being brought close to the work. The work must be securely screwed to the chuck, on account of the high velocity of the lathe in turning. To cut out the recess, we commence by placing a centre bit in the back lathe centre, and boring a *hole*, as large as convenient and very nearly to the required depth. A screw bit is not available for this purpose, for it would in many cases be right through the work before there was time to stop the lathe, which is not usually sufficiently under control. We may next take a turning tool, and turn out the recess to fit the end of the branch; and after taking the job from the lathe, we fasten each half of the branch by glueing and screws. In connection with this method, there is yet another advantage: it is that, by cutting away the body instead of the branch, it renders us indifferent as to whether the shape of the body be spherical, as in a globe valve, or elliptical, or even vase-shaped: because, in this case, the shape adds nothing to the difficulty of the job. Should it occur that one end of the T is larger than the other, we may find the height necessary for each of the V pieces (whereon the body rests during the turning process) as follows: Draw upon a piece of board, the line, A D, in Fig. 126, which will represent the plane of the chuck; and let the *point*, C, represent the centre point of the lathe. Then, from C, we square up the line D; and we set the compasses to the radius of the body of the pattern at the centre of the place where the branch is to be. We take a radius from C, and about $\frac{1}{16}$ inch up from the line A B, and with this radius, we mark on the line D, the point E. From this point as a centre, we strike the axes, E and F, whose radii correspond to the unequal sizes of the pattern where the V's are required to be. Then we draw tangents to each of these arcs, and complete the forms of the V blocks, as shown in Fig. 127, in which half of each V block is shown.

Fig. 127.




We have now to make a core box for our T; and for clearness of illustration, we will make the drawing somewhat larger than those for the T itself. Fig. 127 represents three views of the core box; that portion which projects below the line, at B, may be made separately, and need not therefore be given any consideration. Having drawn the plan of the box, as shown in Fig. 127 at 1, we draw the end and side views, as shown at 2 and 3, and divide these latter into courses of a thickness to suit the stuff at hand from which the core-box is to be made. The courses may be made of equal or unequal depth. Courses 1 and 2 are got out of the full size of the box, while courses 3 and 4 must be of the length of the box, but their width will differ according to the curvature of the half circle of the core, as shown in Fig. 127, at 2 and 3; 5 and 6 will be similar to 3 and 4, and may be marked from them. All these pieces must be planed to a true surface and glued together, each course being allowed to dry before the next one is put on; but for greater expedition, nails, in addition to the glue, may be used, in which case care must be taken that they do not come so close as to interfere with the cutting out of the half circle. The part, A B, if very short, say under 3 inches, may be made in one piece; but if over 3 inches and not over 6 inches, we take two pieces, of the required length and width, and of half the thickness, and chuck them in the manner previously explained for making flanges in halves; then we place the work in the lathe, and bore a hole for the core, then take them from the chuck and glue them, first together and next to the body of the core box. We next turn the body part of the core to a semi-circle of the required size, and all that will then remain to be cut is that part of the branch that is above the line A B. If, however, the part below A B, in Fig. 127, should be required still longer, then it had better be built up

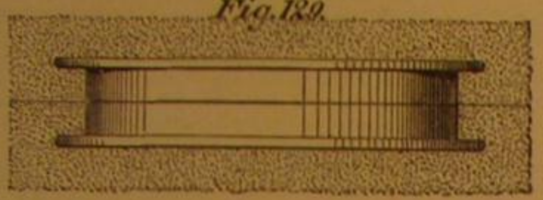
Fig. 128.




in the same manner as the other part. The lengths of the pieces forming the courses will be the same, and may be measured on Fig. 127, from A B, outwards. The widths will differ and may be measured from E or F, inwards. This separate portion, from the grain of the wood being enduric, cannot be firmly fixed to the main body of the box with glue; we must, therefore, in addition, place battens below the box, and let in pieces of hard wood or metal above, as represented in Fig. 127, at G and H.

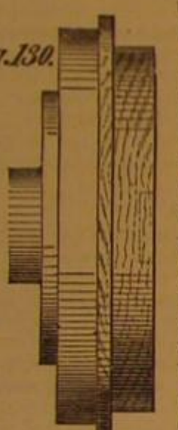
Our fourth example is a double flanged pulley, shown in section in Fig. 128; and our first consideration is how it shall be moulded. It evidently should lie in the sand in the position shown in Fig. 129; but it will be observed that the sand is confined between two flanges, rendering it practically impossible to retract the pattern from the mould, if it is made in one piece. We say, practically impossible, meaning that it cannot be done economically; for strictly speaking, an expert moulder with every requisite appliance, can mould almost anything, as any one will conclude who examines the various works of art in bronze which appear in art exhibitions and elsewhere. Our pattern must, for ease of moulding, be made in two parts. If the disc (or spokes, if it be a spoke-wheel) be sufficiently thick to allow it, the division may be made at the centre, that is to say, on the line A P, in Fig. 128. The operation of the moulder may be understood

Fig. 129.



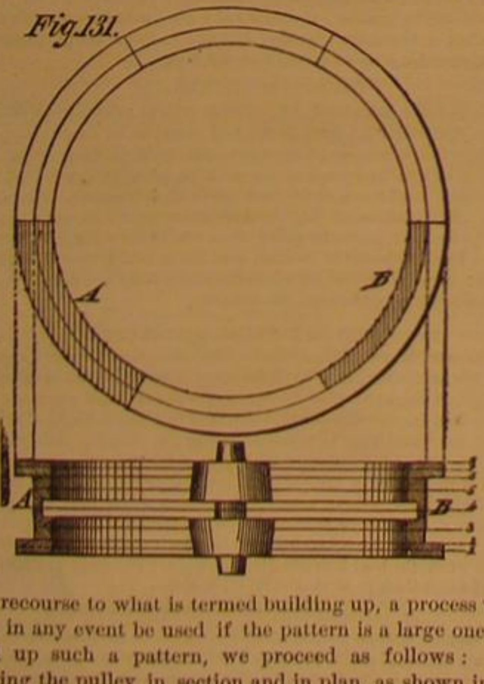
from Fig. 129, three distinct beds of sand being necessary. It may be that a part of a flash is used for each bed, or it may be arranged as shown in Fig. 129, it being a matter of indifference to the pattern maker. In either case, however, draught should be allowed both inside and outside, that is to say, both the interior and exterior diameters of the pattern should be made smallest at the line of parting, the diameters increasing slightly as they approach the flanges. The hubs also should, in like manner, be slightly tapered. Inside sharp corners should be avoided; they should, in fact, always be rounded by cutting them out with a round-nosed tool. To construct this pattern, we proceed as follows: For a small pattern, we take two pieces, somewhat thicker than half the thickness of the finished pattern, and large enough to allow for turning. We then chuck them, as shown in Fig. 130, and turn them up. The recesses shown at the centre by the dotted lines, must be made of equal size in the halves of the pattern; and we prepare a chuck with a projection across the centre to fit into the recess, and thus rechuck the pieces and turn out the opposite sides, cutting the hubs out of the solid. We may then fit a plug into the recess in one half of the pattern, and glue it fast, allowing it to project so as to fit into the recess in the other half; and the pattern is complete, unless the hole in the hub is to be cored, in which case it will be necessary to fix core prints on the top and bottom, in the manner described in our first example.

Fig. 130.



A useful hint may here be given to the effect that when it is decided to fix prints in the centre of a piece of turned work, a slight recess may be made to receive the print, which is then sure to stand true; and should it at any time get accidentally knocked off, as prints often do, another may be immediately affixed without the trouble of finding the centre. The pattern now supposed to be made, though good enough for many purposes, has one great defect which will be readily perceived when we bear in mind our remarks on the properties of timber. It is that it will gradually become oval; and to avoid this, we must

Fig. 131.




have recourse to what is termed building up, a process which must in any event be used if the pattern is a large one. To build up such a pattern, we proceed as follows: After drawing the pulley in section and in plan, as shown in Fig. 131, we divide the whole height of the section into courses, the number of courses being regulated so as to have each of a convenient thickness. It is advisable, however, to have at least two courses in the flange, which will greatly increase its strength. After dividing one of the circles in the plan view into six parts, we draw lines from the points of division to the centre, as shown; and then we make a template of one division, as shown at A, which must be made a little larger than the division, and this forms a template whereby to cut out the segments forming the courses which make up the flanges. A similar template, cut out somewhat larger than the space devoted to B, in Fig. 131, will serve to cut out the sections to be used in forming the body of the pattern. The flanges being made in two courses each, and there being six sections in each course, we shall require 26 pieces of the size of the large template; and allowing each half of the body likewise to consist of two courses, we shall require the same number, to form the body of the pattern, of the size of the small template.

## Heating City Houses by Main Pipes.

A paragraph is going th rounds of the newspapers just now, stating that a very novel and at the same time interesting experiment is soon to be attempted in Lockport, N. Y., by Mr. Holly, the waterworks pump inventor. This experiment is to heat the whole city with steam, after the same manner as it is lighted with gas. Pipes are to run to the different houses, and all the occupant has to do is to turn on a faucet and obtain all the heat he wants.

But unfortunately for Mr. Holly, the idea of heating cities from furnaces is not new. It has been suggested a number of times by different persons, and if we mistake not, Mr. L. W. Leeds, author of a work on ventilation and an engineer, in this specialty, tried to organize a company for heating this city by hot air or steam from furnaces placed in different sections of the city and connecting the heat by pipes to our houses in the same way as water and gas are supplied.

## Artificial Butter.

*To the Editor of the Scientific American:*

Owing to the receipt of much correspondence concerning my article on artificial butter, which appeared in the SCIENTIFIC AMERICAN SUPPLEMENT, N. Y., Nos. 48 and 49, I wish to state that I own no patent on the process. The only patent held is Mége's, which is owned by the United States Dairy Company, 6 New Church Street. All letters, therefore, should be forwarded to that address. The process I described in my article is simply an elaboration of that patented by Mége, and cannot be used without infringing on the United States Dairy Company's patent.

HENRY A. MOTT, JR., E.M., PH. D.

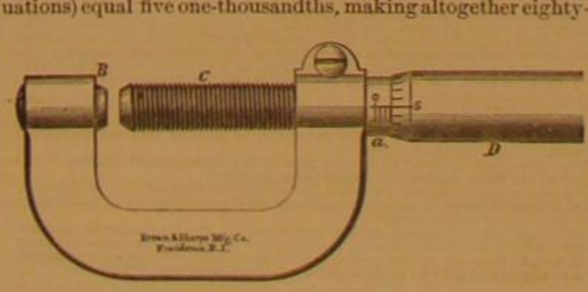
New York City.

## A New Use for Gun Cotton.

A wad of old gun cotton, the staler the better, is reported by M. Jacquemin to be an excellent test object for adulteration of wine by fuchsin or orchil. If it be heated with the suspected wine for a short time, it becomes dyed if any foreign coloring matter be present. On moistening the wad with ammonia, if orchil be present, it turns violet; while the fuchsin dye, which cannot be washed out in water, slowly bleaches.

## A MICROMETER CALIPER.

IN the accompanying engraving we illustrate a valuable workshop tool, the utility of which, as a reliable and convenient substitute for the vernier caliper for all measurements less than one inch, will be at once apparent. The main piece of the caliper is bow-shaped, with a projecting shank *a*, into which is fitted the screw *c*, which is accurately cut with a thread of 40 pitch. The shank, *a*, has a line of graduations of same pitch as the screw, *c*. The hollow cap, D, which is firmly attached to the right hand end of the screw *c*, fits upon the outside of the shank, *a*. One revolution of this cap opens the caliper twenty-five thousandths of an inch. Parts of a revolution are shown on the line of graduations upon the circumference of the beveled end of the cap, *d*, the value of each graduation being one one-thousandth of an inch in the opening of the caliper. Thus, three whole turns and one fifth of a turn would equal eighty-one thousandths of an inch, inasmuch as three turns equal twenty-five thousandths, and one fifth of a turn (or five of the circular graduations) equal five one-thousandths, making altogether eighty-




one thousandths of an inch. Though graduated to read to thousandths of an inch, half and even quarter thousandths are easily obtained, and measurements are read without the use of a glass. It is provided with screws for adjustment and for holding it securely at any given size. Being made wholly of steel, all the parts are durable, the points of contact also being tempered. It is small, light, well adapted for use as a pocket tool, and will prove invaluable to the better class of machinists and fine tool makers. It is made by the Brown & Sharpe Manufacturing Company, of Providence, R. I.

DYEING COCHINEAL RED ON FLANNEL.—For 22 lbs. flannel, use 1 lb. 10 ozs. oxalic acid, $8\frac{3}{4}$ ozs. tin crystals, 2 lbs. 3 ozs. cochineal, and $\frac{5}{8}$ oz. flavin are boiled well together, cooled, the goods entered and winced till the desired shade is produced. If a blue tone is required, no flavin is added; but for yellow tones as much as $1\frac{1}{4}$ oz. flavin may be used.

## ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

The computations and some of the observations in the following notes are from students in the astronomical department. The times of risings and settings of planets are approximate, but sufficiently accurate to enable an ordinary observer to find the object mentioned. M. M.

### Positions of Planets for January, 1877.

#### Mercury.

Mercury sets so much later than the sun in the early part of January that it will probably be seen in the twilight. On January 10, Mercury is at its greatest angular distance from the sun, and can be easily found, some degrees north of the point of sunset. On January 1, Mercury rises at 8h. 41m. A. M., and sets at 5h. 47m. P. M. On the 31st, Mercury rises at 7h. 29m. A. M., and sets at 4h. 28m. P. M.

#### Venus.

Venus must be looked for in the morning. On January 1, it rises at 5h. 11m. A. M., and sets at 2h. 34m. P. M. On the 31st, Venus rises at 6h. A. M., and sets at 3h. 10m. P. M.

#### Mars.

Although Mars differs from Venus only 1h. 22m. in right ascension, it rises more than 1h. 30m. before Venus, because it is in greater northern declination.

On January 1, Mars rises at 3h. 37m. A. M., and sets at 1h. 26m. P. M. On the 31st, Mars rises at 3h. 18m. A. M., and sets at 0h. 31m. P. M.

Mars is now very small, but it can be known among the stars by its being nearly in the same diurnal path with Venus, and about 20° west of that brilliant planet. Mars can also be known by its position relative to the bright star Antares. On January 24, Mars is a few degress north of Antares.

#### Jupiter.

Jupiter can scarcely be seen at all. On January 1, it rises at 5h. 54m. A. M., and sets at 3h. P. M. On the 31st, it rises at 4h. 24m. A. M., and sets at 1h. 27m. P. M. On the 31st, Venus, Mars, and Jupiter can all be seen in the morning. Jupiter is the farthest south.

#### Saturn.

Saturn, which has been so well situated for evening observers during several months past, now comes to the meridian in the afternoon, and on January 1, is in the southwest when first seen, after sunset. On the 1st, Saturn rises at 10h. 22m. A. M., and sets at 8h. 58m. P. M. On the 31st, Saturn rises at 8h. 32m. A. M., and sets at 7h. 16m. P. M.

Low as it is, in the southwest, Saturn, even on January 31, can be seen with small telescopes. A telescope of two and a half inches object-glass will show the curious and wonderful ring, and the largest of its many moons.

#### Uranus.

On January 1, Uranus rises at 8h. 7m. P. M.; and as it is in good northern declination, it can be well seen by 10h. P. M. A telescope of small power will show it round, and like a very small full moon.

On January 31, Uranus rises at 6h. 3m. P. M., and comes to the meridian at 1h. A.M. When on the meridian, Uranus is almost exactly in a vertical line with the star *Mu Leonis*, and 12° below it. Uranus can also be found from the neighbourhood of the bright star Regulus. At the time of meridian of Regulus, Uranus is 5° west of, and 2° above that star.

#### Neptune.

Neptune's position is good, in the early evening, but only large telescopes will show it to any advantage.

On January 1, Neptune rises at 0h. 38m. P. M., comes to meridian at 7h. 21m. P. M., and sets at 1h. 55m. the next morning. On January 31, Neptune rises at 10h. 40m. A. M., and sets at 11h. 58m. P. M.

#### Sun Spots.

A remarkably large spot, followed by a very small one, and surrounded by faculæ, is observed at the present date, December 17, just coming on.

For a very long time, from November 24 to December 17, the sun's disc has appeared to be free from spots, visible with a glass of two and a half inches aperture.

## BOTS.

BY PROFESSOR C. V. RILEY.

A correspondent, engaged in the tanning business, asks why "wormals" get into the backs of cattle, and how they undergo their transformations.

Almost all cloven-footed animals, and many other herbivorous species, are infested with bots. These are legless grubs which fall into three categories: 1. Gastric, or those which are swallowed by the animal infested, and which live in the stomach in a bath of chyle. 2. Cervical, or those which crawl up the nostrils and inhabit the frontal sinuses. 3. Cutaneous, or those which dwell in tumors just beneath the skin. They are all the larvæ or early state of two-winged flies (diptera) belonging to the family *œstridæ*, characterized by having the mouth parts entirely obsolete, and popularly called gad flies or bot flies. In the first series, of which the horse bot (*gastrophilus equi*) is the most familiar example, the eggs are attached by the female fly to the hairs of the body, and principally on those parts of the body within easy reach of the animal's mouth. The egg opens with a lid, and the young maggot upon hatching clings to the tongue as the animal licks itself, and is thus carried into the fore-stomach, to which it holds tenaciously by a series of spines around the body, but principally by a pair of sharp hooks at the head. When fully grown, they leave their post with the fæces, burrow in the ground and undergo the final transformation. In the second kind, of which the sheep bot (*œstrus ovis*) will serve as an example, the egg generally hatches within the body of the parent, and the young grub is deposited alive on the slimy nostrils of its victim. By means of a pair of long and sharp hooks at the head, and of bands of minute spines on the venter, the young grub works its way into the sinuses of the head, and when full grown permits itself to be sneezed out, when it also burrows in the ground and transforms. In the third kind, the parent lays the egg on those parts of the body which cannot well be reached by the mouth of the animal attacked, and the young grub, which soon hatches, burrows into the flesh and subsists upon the pus and diseased matter which results from the wound inflicted and the irritation constantly kept up. The well-known wormal, or ox bot (*hypoderma bovis*) so common along the backs of our cattle, and especially of yearlings and two-year-olds, and dreaded as much by the tanner as by the animal it infests, is typical of this kind. Residing in a fixed spot, we no longer find in this species the strong hooks at the head, and the spines around the body are sparse and very minute: the parts of the mouth are soft and fleshy.

All these bot larvæ breathe principally through two spiracles placed at the blunt and squarely clocked end of the body, and in the ox bot these are very large and completely fill up the hole to the tumor in which the animal dwells. When ready to transform, it backs out of its residence, drops, and burrows into the ground, and there, like the other species, contracts and undergoes its final change to the fly. The eggs of this ox bot are elliptic-ovoid, slightly compressed, and have at the attached end a five-ribbed cap or stout stalk with which to strongly attach them to the skin of the back.

The gastric bots are best prevented by proper grooming of the horses to remove the eggs or nits from the fore legs and flanks. Horses, too, that are properly stabled and kept in the shade during the hotter summer months are less frequented by the parent fly. Scarcely any mode of drugging will dislodge the bots when once they are attached to the stomach, without injuring the parasitized animal. Cervical bots are also with difficulty dislodged except when they are fullgrown and ready to naturally let go their hold. Animals may, however, be measurably protected, by enabling them to smear their noses with tar, or by enabling them to bury their noses when the parent fly is seeking to deposit. This they will instinctively do if portions of their pastures be turned up and the ground kept loose. The cutaneous species may be removed by pressure of the thumb and finger, or destroyed by the application of kerosene. If removed while small, the wound in the skin heals up, and no hole will occur in the hide.

Manhattan, Kan.

### Domesticating the Buffalo.

A correspondent of the *Turf, Field, and Farm* sends some interesting facts regarding the domestication of the buffalo in Nebraska. He began with two cows and a bull, which he kept with his tame stock. In the spring the cows calved, and in three years the calves became mothers, yielding an an average of 14 quarts of the richest milk daily, for an average of five months. The buffalo strain now extends through a large part of Howard county, in the above State, and the half and quarter breed animals are found to be very hardy.

Our contemporary adds, that sufficient experiments have been made in crossing the buffalo with native and grade short horn cattle, and have been attended with such successful results that the most skeptical people cannot fail to be satisfied as to the advantages and value of the intermingling of breeds.

AMERICAN manufacturers of woodworking and other machinery, who desire to find a market for their products in Europe, are referred to the advertisement of B. Dambacher, of Hamburgh, Germany, in another column.

## NEW BOOKS AND PUBLICATIONS.

CHAMBERS' ETYMOLOGICAL DICTIONARY OF THE ENGLISH LANGUAGE. Edited by James Donald, F.R.G.S., etc., editor of Chambers' "English Dictionary," etc. London and Edinburgh: W. & R. Chambers. New York City: R. Worthington, 750 Broadway.

This very compendious volume is a complete dictionary of the English tongue, giving the etymology, pronunciation, and meanings of all the words. The derivations are evidently written by a scholar of the highest attainments, and the significations are given with the nicest discrimination, showing the wealth of the English language, which is, as Macaulay says, "less musical indeed than the languages of the South, but which is, for all the purposes of the poet, the philosopher, and orator, inferior to that of Greece alone." The simplicity and correctness of language in which the definitions are given, deserve praise, and the meanings of technical and scientific terms are made clear. The typography of this volume is excellent, and the book is of conveniently portable size.

MANUAL OF THE RAILROADS IN THE UNITED STATES FOR 1876 AND 1877, showing their Mileage, Cost, Traffic, Expenses, etc., with an Appendix showing the Debts of the United States and of the Several States. By Henry V. Poor. New York City: H. V. & H. W. Poor, 68 Broadway.

The nine hundred pages of this volume contain full accounts of the history and present condition of every railroad in this country, the collection and compilation of which indicates the extent of the labor which has been bestowed on the work. It is a book that will prove itself to be of the greatest value to investors, bankers, and capitalists.

THE ATLANTIC MONTHLY. Subscription price, $4 a year. New York City: Hurd & Houghton, 13 Astor Place.

This established favorite with all lovers of high-class literature sends us a prospectus announcing several attractions for the coming year. Among the authors named are Messrs. Longfellow, Whittier, Holmes, Lowell, Stedman, Aldrich, Howells, Clemens (Mark Twain), C. F. Adams, Jr., and others. The introduction of original music into its pages will be a new feature of much interest and value; and the series of portraits, commenced last year by a likeness of Longfellow, will be continued by one, by the same author of W. C. Bryant. The *Atlantic* has been in existence for nineteen years, and an index for that period, covering the first thirty-eight volumes, is in preparation.

SIMPLIFIED WEIGHTS AND MEASURES, on a Natural System Applicable to Most Civilized Nations. By Louis D'A. Jackson, A.I.C.E., author of "An Hydraulic Manual," etc. Price, $1. New York City: E. & F. N. Spon, 446 Broome Street.

The author of this work has, like many of his fellow laborers, an ease task before him in demonstrating the inconvenience of the weights and measures now in common use in English-speaking countries; but the difficulty introducing a new one, however reasonable and harmonious in itself, he entirely fails to appreciate. The very little progress made by the French metric system, which is admirable as a theoretical scheme, and is practically successful in France and elsewhere, should convince advocates of a new methods of the immense task that lies before them when they essay to assimilate the practice of all countries in the world. But we must admit that Mr. Jackson is an able and conscientious advocate of his ideas.

AN INTRODUCTION TO QUALITATIVE ANALYSIS. By F. Beilstein. Translated by I. J. Osborn. New York City: D. Van Nostrand, 23 Murray and 27 Warren Streets.

This useful little manual gives practical instruction by directing the student how to make his own researches, commencing with the list of special indications given by common salt, and ending with some of the most complicated of organic compounds. The instruction contained in it is thorough, correct, and comprehensible.

REPORT ON THE TRANSPORTATION ROUTE ALONG THE WISCONSIN AND FOX RIVERS, in the State of Wisconsin. By Gouverneur K. Warren, Major of Engineers and Brevet Major-General U. S. A. Washington, D. C.: Government Printing Office.

The examinations and surveys for the important investigation described in this report were made in 1866 and 1867, and some minor ones in 1868 and 1869. Major Warren reports adversely to the permanent improvement of the Wisconsin River by a system of canalization or rectification of its high and low water channels, and recommends a canal along its banks as the only method of remedying the difficulty.

THE USEFUL COMPANION AND ARTIFICERS' ASSISTANT, including nearly Six Thousand Valuable Recipes, and a Great Variety of General Information and Instruction. New York City: The Empire State Publishing Company.

A handy volume of household workshop and general information. It is well arranged, and the recipes and instructions are carried down to the latest date. The compiler has covered very extensive ground, gives his readers instruction in agriculture, telegraphy, practical mechanics, harmony and counterpoint, book-keeping, photography, billiards, cribbage, and letter-writing. The chapter on health and medical advice is very full and explicit, and the recipes are judiciously selected from a variety of authorities, native and foreign. This book contains seven hundred pages of closely arranged matter. Price only $2. It is probably the cheapest work of the kind that has been published.

WE have another trade catalogue before us, which is suggestive not so much for the manner in which it is gotten up, which is very neat and tasteful, but for the subject to which it relates. It is a series of representations of fine clocks made by Seth Thomas' Sons & Co., and it exhibits time-pieces in bronze and marble, showing a high degree of art workmanship. The home manufacture of such clocks—which hitherto we have imported mainly from France—shows how closely we are entering into competition with the countries which have hitherto held almost a monopoly of the art industries of the world.

WE are not sufficiently versed in the inner working of the cork and hardware trade to understand why the advertising catalogues and pamphlets (such as firms engaged in other businesses prepare in a simple and inexpensive manner), must be issued in the most elegant style of typography, upon the finest paper and embellished lavishly with costly engravings. Such, however, appears to be the custom; and the large hardware concerns vie with each other in preparing volumes which regular publishers would regard, so far as dress goes, as *editions de luxe*, to be sold at fancy prices by first-class retailers only. We have just received a supplement to the catalogue of the Hopkens & Dickenson Manufacturing Company, to which the above description especially applies. It is certain that books of this class cost a great deal of money, and the simple fact that the trade indulges in such very costly advertising, proves that the same must pay. So that, after all, the books are agreeable evidence of a good state of business.

## DECISIONS OF THE COURTS.

### United States Circuit Court—District of Massachusetts.

EDWIN L. BRADY *vs.* THE ATLANTIC WORKS.

[In Equity.—Before Clifford, J.—Decided September 29, 1876.]

Letters patent for a new and useful improvement in the construction of boats for dredging under water were granted to the complainant on the 11th of December, 1867, as appears by the original patent annexed to the bill of complaint. Nothing is suggested to show that the patent is not regular in form, and the complainant alleges that the respondents are making and constructing a dredge-boat of the same construction as that described in his specification, and which is an infringement of his patent, and he prays for an injunction and for an account of all such gains and profits as they, the respondents, have received by their unlawful and wrongful acts and doings.

The court gave a decree in favor of the patent, and held as follows:—

In a suit for the infringement of letters patent the burden of proof is upon the patentee to show that he is the original and first inventor, and that the defendant has infringed.

The patent, if regular in form and introduced in evidence, affords a *prima facie* presumption that the patentee is the original and first inventor of what is therein described as his improvement.

This presumption is not overcome by evidence introduced to impeach the novelty of the invention which does not clearly show that the alleged anticipating device embodied the same construction and mode of operation as that claimed.

The English rule that the patent prohibits all the subjects of the sovereign, except the patentee, from using the invention, but that it extends no further, and is not intended to deprive the Government itself of the use of the invention, does not hold good under our laws.

These patents are monopolies granted by the sovereign, and may be granted or refused in the royal discretion.

In this country Congress has legislated, in pursuance to the power conferred by the Constitution, and have provided that persons who have made inventions such as specified in sec. 24, (act of July 8, 1870,) may obtain a patent therefor, granting to them, for the term of seventeen years, the exclusive right to make, use and vend the said invention or discovery throughout the United States.

No exception is made in favor of the Government, and it cannot, after the patent is issued, make use of the improvement any more than a private individual, without license of the inventor, or making just compensation to him.

The invention secured by letters patent is property, and as such is entitled to the same protection as any other property.

Private property cannot be taken for public use without just compensation, except in cases of extreme necessity, in time of war, or of immediate and impending public danger.

Although the infringing device was made by the respondents under a contract with the Government, they derived no power, by virtue of their contract, to take the property of private individuals without their consent, and to use and apply the same in fulfilling their contract obligations.

### Inventions Patented in England by Americans.

From October 6 to November 15, 1876, inclusive.

AIR BRAKE.—C. A. Bonton (of N. Y.), London, England.
AIR EJECTOR.—John Y. Smith (of Pittsburgh, Pa.), London, England.
ANCHOR.—R. M. Robinson *et al.*, Philadelphia, Pa.
BREECHLOADING FIRE ARM.—W. L. Headley, Brooklyn, N. Y.
CATCHING FISH.—B. F. Smith *et al.*, Philadelphia, Pa.
CHANDELIER, ETC.—J. H. Hobbs, Wheeling, W. Va.
CHEST PROTECTOR.—H. Hayward, New York city, *et al.*
COAL SIEVE, ETC.—P. Peckham, New York city.
CUTTING SCREWS, ETC.—E. Schlenker (of Buffalo, N. Y.), London, England.
EVAPORATOR.—H. Hughes, San Francisco, Cal.
EXERCISING APPARATUS, ETC.—J. D. L. M. Lozier, Orange, N. J.
GAS ENGINE PISTON.—G. B. Brayton, Exeter, N. H.
GRAIN SEPARATOR.—Howes & Co., Silver Creek, N. Y.
HARVESTER.—C. H. McCormick, Chicago, Ill. Three patents.
HAT MACHINERY.—D. Brown, Massachusetts.
HORSESHOE MACHINE, ETC.—J. R. Williams, Pittsburgh, Pa.
INJECTOR.—J. F. Hancock, Jamaica Plains, Mass.
LASTING BOOTS, ETC.—G. W. Copeland, Malden, Mass.
LIGHTING CIGARS, ETC.—H. B. Stockwell, Brooklyn, N. Y.
MAGIC LANTERN.—E. Wilson, Philadelphia, Pa.
MAKING SCREWS.—American Screw Company, Providence, R. I.
MAKING STEEL.—J. Baur (of Brooklyn, N. Y.), London, England.
MARINE SIGNAL.—E. E. Mann, Lawrence, Mass.
PAPER FOLDER.—W. Braidwood, Mount Vernon N. Y., *et al.*
PAVEMENT.—W. T. Crim, Beloit, Wis.
POTATO DIGGER.—L. A. Aspinwall (of Albany N. Y.), London, England.
PRESERVING FOOD, ETC.—G. W. Scollay, St. Louis Mo.
PRINTING CHECKS.—W. A. Simmons, Penge, England.
REFRIGERATOR.—J. J. Craven, Jersey City, N. J.
SADIRONS, ETC.—T. H. Ashbury, Philadelphia, Pa.
SCREW MACHINERY.—S. Vanstone, Providence, R. I.
SHOE VAMPING.—L. R. Blake, Boston, Mass.
SOLDERING CANS.—W. H. J. Howe, North Salem, N. J.
STONE DRESSING.—J. Woods, Nicholasville, Ky.
STOVE.—Jewett *et al.*, Buffalo, N. Y.
TURBINE FOR SMALL MACHINES.—J. Fletcher, Philadelphia, Pa.
VALVE STOPPER.—E. B. Requa *et al.*, New York city.

# Recent American and Foreign Patents.

## NEW AGRICULTURAL INVENTIONS.

### IMPROVED STEAM PLOW.

George F. Bratt, New Orleans, La.—This machine consists mainly of the following elements: 1. Circular rotary cutters (attached to a drum) which divide the sod into parallel strips or slices; 2, rotary spades or cutters, which follow immediately behind the aforesaid circular cutters, and cut or divide the strips or slices into small pieces and then turn said pieces top side down, operating in this respect like the mouldboard of a plow. They likewise cooperate with the circular cutters in propelling the machine, thus rendering unnecessary all supplementary driving mechanism which does not aid in cultivation. The invention consists, 3, in blades attached radially to a shaft, and which follow the diggers and rotate at higher speed, so as to cut, break up, and thoroughly pulverize the soil dislodged by said diggers, thereby completing the work of reducing it to the desired fineness of tilth.

## NEW MECHANICAL AND ENGINEERING INVENTIONS.

### IMPROVED VENTILATOR FOR CARS, ETC.

John C. Bates, Cold Spring, N.Y.—This invention relates to an improved ventilating apparatus specially designed for railway cars, but applicable to and intended for buildings also. It consists in the construction and arrangement of parts in which an inlet pipe for the air, leading from the top of the car, carries from the motion of the car a current of air down into a cylinder having a deflecter and water trap to eliminate the cinders, the air passing from thence through an externally heated drum into the car. The said drum is constructed with end chambers connected by tubes and is located in a containing case into which hot air is admitted from a heater below the car, and from which it is drawn by a pipe terminating in the open air, a chamber being formed in the containing case of the ventilator which connects with a pipe leading to the top of the car, which receives the impure air from the bottom of the car and discharges the same in accordance with the law of convection.

### IMPROVED LATTICE PIERS FOR TIMBER TRUSS BRIDGES.

Lewis Scott, Brighton, Mich.—In this invention two sets of posts are so arranged in a truss bridge that they will incline in opposite directions, and be located on opposite sides of the girts. They are all sustained upon a common base that is thus connected with a superposed beam so as to form a reinforcement brace or support to each other. This has the effect of dividing and evenly distributing the weight or strain along the whole length of the foundation or base.

### IMPROVED SWING.

William Mogle, Anoka, Minn.—This is a swing which may be adjusted for the use of a child or a grown person, and the novelty consists of inner and outer vibrating rods, to the lower ends of which the foot board is applied by lateral pivot rods in a vertically adjustable manner, the seat being applied by arms and supporting braces to the inner vibrating rods. The weight of the person on the seat oscillates the swing in one direction, while the pressure of the feet on the foot board oscillates the swing in the opposite direction, in the customary manner, the swing working easily with little pressure on the vibrating foot board.

## NEW MISCELLANEOUS INVENTIONS.

### IMPROVED TOBACCO PIPE.

Martin Bourke, Mineral Ridge, Ohio.—This device is an improvement in the class of cigar pipes or pipes having the form and general appearance of a cigar, and designed for smoking fine cut tobacco. The improvement relates particularly to the provision of a detachable inner tube or cylinder for holding the tobacco, and to the form of the inner end of the mouthpiece against which the tube abuts; also to a spring attached to a detachable endpiece or plug, and whose function is to hold the tobacco tube against the mouthpiece.

### IMPROVED FOOT WARMER FOR VEHICLES.

Henry P. Buckland, Stary Ridge, Ohio.—The object of this invention is to furnish a device for keeping the feet and lower extremities warm while riding in the winter months. It consists of a receptacle for containing hot water, having a triangular chamber for one or more lamps, extending through it, provided with doors and a smoke flue.

### IMPROVED OIL CAN.

Leonidas R. Shell, Richmond, Va.—This invention relates to an oil can, having attached within it a force pump and measure, so constructed and arranged that the oil may be pumped from the barrel or cask, either into the can itself or into the contained measure; the latter being provided with a gauge, which, at all times, shows how much oil it contains. When it is desired to fill the can the oil may, by this arrangement, be made to pass, first into the measure, gallon by gallon; thus readily showing how much is transferred from the barrel to the can; and, when selling the oil by retail, any definite quantity may be drawn, immediately from the can, by means of the contained pump, measure, and guages.

### IMPROVED LAUNCHING APPARATUS.

Martin Bourke, Mineral Ridge, Ohio.—This invention has for its object to enable life and other boats to be launched from the deck of a vessel, with safety and dispatch. The invention consists of ways which are pivoted to the deck in such manner that the outer end which projects beyond the side of the vessel, may be raised or lowered by suitable tackle, as required by the size of the vessel, or the height of the deck above the water. The sides of the groove in the ways are notched or provided with ratchet teeth, and with these, a pawl, attached to the keel of the boat, engages in such manner as to hold the boat stationary on the ways until ready to be launched. Said pawl is also constructed in such form as adapts it to act as a brake when the boat is descending the ways. The ways are made in sections to adapt them to be stowed in small space.

### IMPROVED LIFE BOAT.

Martin Bourke, Mineral Ridge, Ohio.—The object of the invention is first to produce a life boat which will insure perfect protection to the passengers from the waves, which shall be of such shape that it cannot remain capsized, and also combines maximum strength, lightness, and cubical capacity. The object is, secondly, to provide a life boat with a deck or cover to perfectly protect the passengers from wind and waves, and which may be readily detached by the passengers to facilitate their escape when the boat is about to encounter reefs, rocks, or other obstacles, or is otherwise in extreme danger of destruction. The third part of the invention relates to propellers or paddles, which may be held locked in such position that they will not impede the progress of the boat when sails are being used. The invention relates, fourthly, to an improved construction of paddles and deadlights.

## Business and Personal.

*The Charge for Insertion under this head is One Dollar a Line for each insertion. If the Notice exceeds Four Lines, One Dollar and a Half per Line will be charged.*



## Notes & Queries

L. S. will find directions for dyeing ostrich feathers on p. 11, vol. 32.—A. W. will find directions for preserving natural flowers on p. 204, vol. 28.—G. D. will find instructions for tanning skins with the hair on on p. 233, vol. 26.—C. E. B. can drill glass by following the directions on p. 218, vol. 31.—B. M. M. will find a method of solving his trigonometrical problem in any elementary work on trigonometry.—L. W. will find instructions for constructing a windmill on p. 241, vol. 32.—W. M. will find a statement of the lifting power of hydrogen on pp. 74, 139, vol. 31. For a method of generating hydrogen, see p. 341, vol. 27.—A. C. will find directions for polishing artificial marble on p. 283, vol. 30.—E. A. H. will find directions for constructing a water filter on p. 282, vol. 34.—J. W. B. will find directions for cutting and polishing agates on p. 138, vol. 30.—J. W. C. will find directions for arranging compound gears for screw-cutting on p. 107, vol. 34.—W. W. will find an article on the passage of water through orifices on p. 48, vol. 29.—O. J. P. will find directions for making skeleton leaves on p. 99, vol. 34. To bleach leaves, etc., see p. 405, vol. 34.—G. T. B. will find directions for kalsomining on p. 133, vol. 31.—S. S. will find directions for getting rid of echoes in large rooms on p. 139, vol. 35.—O. J. C. will find instructions for extracting sugar from beets on p. 264, vol. 28.—W. M. W. will find a description of a petroleum engine on p. 308, vol. 24.—M. W. will find directions for frosting glass on p. 264, vol. 30.—J. B. will find that an aqueous solution of dextrin will make a good mucilage for use in spatterwork.—J. T. R. can polish tin articles by following the directions on p. 57, vol. 34. For stove polish, see p. 219, vol. 31.—E. R. will find an article on the madstone on p. 266, vol. 26. Only ignorant people believe in its virtues.—E. J. B. will find a recipe for cochineal ink on p. 200, vol. 30.—T. K. McD. will find an answer to his query as to the commencement of the day on p. 401, vol. 28.—P. S. A. will find directions for making rubber stamps on p. 155, vol. 31.—L. T. D. can remove inkstains from paper by following the directions on p. 154, vol. 30.—C. W. W. will find an explanation of the difficulty from oil leaking from a stove-pipe on p. 266, vol. 26.—P. S. K. will find a recipe for a rosewood stain on p. 154, vol. 30. French polishing is described on p. 11, vol. 32.—J. W. W.'s query as to alcoholic strength of liquors was answered on p. 156, vol. 35.—Z. F. H. will find an answer to his query as to wheels on a curve on p. 268, vol. 35.—A. W. T. should polish his skates by following the directions on p. 169, vol. 33.—G. W. W. will find a description of mica on p. 88, vol. 25.—J. R. will find directions for polishing metals on p. 37, vol. 34.—W. H. S. will find a recipe for a sympathetic ink on p. 267, vol. 34.—J. V. H. will find a description of the compression engine on p. 66, vol. 34.—L. J. T. will find directions for hardening plaster of Paris on p. 43, vol. 34.—H. B. W. will find directions for soldering brass to steel on p. 251, vol. 28.—F. K. is informed that there is no rule for finding the horse power of a boiler.—C. T. D. will find a recipe for a white alloy on p. 139, vol. 31.—C. W. will find directions for calculating the teeth of gear wheels on p. 147, vol. 34. For proportions of speed pulleys see pp. 26, 73, vol. 25.—F. M. will find a good recipe for shoe blacking on p. 27, vol. 34.—M. J. H. can cut and polish stones by following the directions given on p. 138, vol. 30. To drill glass, see p. 218, vol. 31.—M. R. will find a recipe for a depilatory on p. 186, vol. 34.—M. A. will find recipes for fireproof cement for roofs and fireproof paint on p. 280, vol. 28.—G. A. C. will find an answer to his query as to a cannon on a car on p. 273, vol. 32.—J. H. B. will find directions for preserving ornithological specimens on p. 159, vol. 32. We know nothing of the process of inlaying which he describes; but it is easily tried.—G. H. can nickel plate his iron castings. See p. 186, vol. 34. Pure rubber is white when first made, but turns black after exposure to the atmosphere.—E. P. M. will find a recipe for a cement for leather belts on p. 300, vol. 33.—J. W. R. can copy his drawings with a pantagraph. See p. 179, vol. 28.—N. C. can clean and polish shells by the method described on p. 122, vol. 27.—P. F. will find directions for making condensed milk on p. 343, vol. 30.—W. D. will find a description of the Vienna bread manufacture on p. 240, vol. 34.—N. J. S. will find directions for making paste that will not sour, on p. 299, vol. 35.—P. M. will find directions for nickel plating with a battery on p. 186, vol. 34.—F. B. F. will find directions for constructing a windmill on p. 241, vol. 32.—S. R. will find a recipe for a black walnut stain for use on white wood, on p. 337, vol. 33.—D. A. L. & B. will find directions for precipitating lime from water on p. 379, vol. 35.—L. M. D. V. will find answers to his queries as to the sinking of a body in deep water on p. 208, vol. 33.—F. S. will find directions for making dried yeast on p. 204, vol. 33.—J. S., M. A. R., J. V., W. W., C. A. S., J. D. H., W. T. M., I. K. B., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) R. N. says, in reply to E. S., who requests a formula for finding the diameter of a pipe from its sectional area, that is, from the area of a circle to find its diameter. For all such calculations, I once devised a formula which is very convenient to carry in one's head; that is, add to the area ·273 of itself, and the square root of the sum will be accurate within ·0001. The convenience lies in this, that 273=3+90×3, so that 3 and 9 are the only numbers to be remembered. Thus, to find the diameter corresponding to the area ·78539816; multiply by 3, setting the product beneath and three places to the right; then multiply this product by 9, setting the new product beneath the former, but one place to the left; add up, and find the square root, which is less than ·0001 of 1 (the true value of the diameter). Thus:

| | |
|---|---|
| Area | 0·78539816 |
| × 3 | 235619448 |
| × 9 | 2120575032 |
| | 0·99981185768 |
| Square root | 0·999906 |

A similar formula for the diameter of a sphere of given contents is even more accurate. From double the contents subtract ·09 of said contents; the cube root of the remainder will show the diameter of the sphere within less than 1-40000th. Thus:

| | |
|---|---|
| Contents | ·523598775 |
| Doubled | 1·047197550 |
| × ·09 | ·04712388975 |
| | 1·00007366025 |
| Cube root | 1.000024 |
| Error | 0·000024 |

(2) B. F. H. asks: Will an instrument that will work on 500 feet wire work on shorter distances without addition of wire? A. Yes, on the shortest lengths.

(3) R. C. C. says: I have a glass jar (1 gallon) and a zinc cylinder, a porous cup, and carbon cylinder. Please inform me with what materials shall I charge them to make a battery? A. Put nitric acid in the porous cell with the carbon, and 1 part sulphuric to 20 water in the glass jar.

(4) E. R. B. asks: What is the best plan to put on a tin roof? Do you recommend the standing or flat seam? A. The flat clinched and soldered seam is the best. If the tin is brought down over the edge of the roof or gutter and carefully nailed, with the nails rather close, the wind will not get under it to blow it off. Every plate of the tin should be nailed to the roof, also, in laying it.

(5) A. E. G. asks: 1. Is it any advantage, in the construction of a refrigerator, to fill the space between the inner and outer box with some non-conducting materials? A. Great advantage. 2. Does not a confined stratum of air prove a perfect non-conductor? A. It is an excellent non-conductor. 3. Is there anything better for filling as above than cork chips? A. They answer well. Any non-conducting body containing in its pores large quantities of air, answers well, as charcoal, mineral wool, cork, etc.

(6) S. M. J. says, in reply to J. O. G., who says that you state that an English fire engine lifted water 32 feet in a perpendicular line, and inquires if it is possible for a fire engine with its many joints and imperfections to raise a column of water to that height, 32 feet, without the intervention of a foot valve in the suction). I am in charge of an English fire engine that has four lengths of suction, each 8 feet long, and a screen 1 foot 6 inches long, in all 33 feet 6 inches. I have stood on the bank of a river with the suction pipe perpendicular, with the exception of less than a quarter circle at the engine; and the suction pipe would not stay under water until I put a man to hold it under, after which I had no trouble whatever in raising water and working a fire not less than 600 feet from the engine.

(7) I. V. asks: How can I make the ink used with stencils? The kind I have reference to is in hard cakes and makes a plain and clear mark. A. It consists principally of lampblack, boneblack, sulphate of indigo, and dextrine or gum arabic, mixed well together, moistened, pressed into cakes and dried thoroughly. Another marking ink consists of lampblack and soap.

(8) L. P. C. says: Please state if oxygen can be made from saltpeter? A. Oxygen can be obtained readily from saltpeter by treating the salt above 660° Fah. in a glass vessel. The proportion of the gas, however, is much less in quantity than is obtainable from the chlorate of potassa, besides being contaminated by nitrites, free nitrous and nitric acid and nitrogen, which corrode the connections and render the gas from this source objectionable for many purposes.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

J. N. C.—It is infusorial earth. See p. 240, vol. 35.—W. D. M.—No. 1 is black mica. No. 2. contains sesquioxide of iron, free sulphur, and clay (silicate of alumina). No. 3 is felspar containing crystals of red hematite (sesquioxide of iron). No. 4 is clay containing carbonaceous matter. No. 5 might be used as a polishing powder and in glass manufacture.—G. W. D. B.—Your sample of peat does not contain tannic acid; but like all bodies containing woody fiber, when subjected to distillation in close vessels or incomplete combustion in the air, pyroligneous acid may be found with the products, the substance may be made to yield a considerable quantity of illuminating gas, pyroligneous acid, etc., by proper distillation.—J. S.—Both of these are very fine granites. Granites consist of intimate admixtures of quartz, felspar, or orthoclase, and mica. Most of them contain here and there, especially after having been exposed to the weather, blemishes of carbonate of lime, traprock, greenstone, pyrites, large crystals of quartz, etc. There is no granite that we are aware of which is wholly free from these. Consult some good work on geology.

P. S. K. asks: How can I make a pianoforte sounding board, of wood, the four edge lines being one plane, and the middle rounded like the belly of a violin, without cutting or scraping the wood?—A. A. asks: 1. In making violins, what kind of wood is the top made of, and how is it stained or colored? 2. What is the best way of finishing violins, with shellac or other varnishes?—W. E. T. asks: 1. Please give me a good recipe for putting up spiced salmon and trout? 2. What is the proper mode of canning fresh mackerel?—A. C. W. asks: In playing a game of whist, my opponent on my right cut me the ace of spades three times running. What are the chances of such an occurrence?—E. A. H. asks: How is Indian corn hulled to prepare it for hominy?—S. W. G. asks: What is the best material for japanning or putting an enamel finish on stove plate?

### COMMUNICATIONS RECEIVED.

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

On the First Steamboat on the Mississippi. By F. L. J.
On Boiler Explosions. By E. G. A.
On Aeronautics. By C. E. D.
On Bridges in Pennsylvania. By M. B. S.
On American Silk Manufactures. By L. L.
On Constructing Theaters. By S.
On the Keely Motor. By M. C.
On a Grain Dryer. By J. O'C., by R. S. E. and by S. S. S.
On a Flying Machine. By C. S. A.
On Weight on and in the Earth. By S. A. C.

Also inquiries and answers from the following:
J. M. A.—L. J. C.—J. F. W.—L. V. H.—S.—F. L. S.—W. C. T.—C. F. S.—W. O. L.—J. D. H.—J. M.—F. C.

### HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Enquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells white litharge? Who sells convex glass, made to size? What is the cost of the finest glass per ton? Who sells chromate of lime? Who sells American cigarette or rice paper? Who sells old, straight-grained mahogany, suitable for stove patterns? All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

## INDEX OF INVENTIONS

FOR WHICH

**Letters Patent of the United States were Granted in the week Ending**

**November 21, 1876.**

**AND EACH BEARING THAT DATE.**

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Air and water bed, G. M. White ........ 184,487
Air exhaust, car brake, T. Cooper ........ 184,460
Air pump, pressure attachment, D. E. Bangs ........ 184,456
Alloy as a back for mirrors, depositing, C. A. Laval ........ 184,632
Animal tether, P. A. Reichert ........ 184,663
Anvil and vise, W. E. Canedy ........ 184,508
Arch bridge, metallic, J. Abbott ........ 184,450
Automatic brake, H. McCalip ........ 184,538
Automatic musical instrument, P. Ehrich ........ 184,600
Axle grease, M. Andersson ........ 184,492
Baking alter bread, P. H. Horan ........ 184,623
Bale tie, G. S. France ........ 184,607
Bale tie, H. H. Moore ........ 184,650
Baling press, W. B. Duncan ........ 184,514
Baling press, A. D. Miller ........ 184,539
Baling press, W. A. Wright ........ 184,684
Barbed fence wire, W. Watkins ........ 184,486
Base for wooden columns, M. McDevitt ........ 184,645
Batten roof or wall, R. Bentley ........ 184,576
Bedstead, H. B. Coyle (r) ........ 7,396
Beer pump, R. & E. Mudd ........ 184,475
Belt fastener, H. Niemann ........ 184,654
Blind adjuster, R. J. Stuart ........ 184,556
Book binder's cloth, etc., A. G. Fell ........ 184,467
Book rest for lecture chairs, A. L. Williston ........ 184,488
Bottle filling apparatus, W. Gee ........ 184,608
Bottles, manufacture of E. N. Curtice ........ 184,588
Breech loading fire arm, T. Woodward ........ 184,683
Brush, G. R. Davies ........ 184,510
Brushes, making metallic, R. Ashworth ........ 184,494
Buckle, V. A. Bond ........ 184,456
Burglar alarm, W. F. Maurice ........ 184,642
Bustle, Barkshire & Davis ........ 184,571
Butter package, A. J. Finnegan ........ 184,605
Butter package, S. C. Williams ........ 184,567
Car axle box, O. L. Smith ........ 184,670
Car brake, Gue & Field ........ 184,614
Car brake, J. Rhoads ........ 184,664
Carpet sweeper, S. F. Leach ........ 184,633
Carriage pole head, G. Bray, Jr. ........ 184,496
Cartridge box, S. T. Satterwhite ........ 184,668
Cement for stove putty, A. Wainwright ........ 184,485
Churn, O. Eliason ........ 184,601
Cider mill, J. A. Schwob ........ 184,548
Cider press, J. C. Salisbury ........ 184,667
Circular knitting machine, E. Tiffany ........ 184,483
Cloth-measuring machine, J. Wayland ........ 184,677
Clothes pounder, H. P. Lentz ........ 184,634
Coffee and spice mill, T. H. Darling ........ 184,596
Commode cover, F. Foster ........ 184,606
Conductor's punch, J. H. Davis ........ 184,463
Convertible chair, A. T. L. Davis ........ 184,597
Copy holder, H. H. Hendrix ........ 184,525
Corn husker and sheller, G. E. Luckey ........ 184,535
Corn planter, H. R. Scott ........ 184,549
Coupon nipper and punch, F. Walker ........ 184,561
Cracker machine, E. P. Waste ........ 184,562
Crupper fastening, A. Meharry ........ 184,647
Cultivator, T. I. Teagle ........ 184,674
Current water wheel, D. O. Benjamin ........ 184,575
Curtain cord tightener, J. A. Svedberg ........ 184,557
Die for making hoes, J. Graff ........ 184,468
Dish drainer, H. Stone ........ 184,672
Door lock, Whitson & Hush ........ 184,680
Double plow, W. Clark ........ 184,590
Draft attachment, R. Beem ........ 184,574
Earth-boring apparatus, W. H. Yarborough ........ 184,685
Electric light buoy, Smith, *et al.* ........ 184,553
Electromagnetic alarm, D. H. Whildin ........ 184,679
Electromagnetic motor, G. F. Green ........ 184,469
Electro vapor bath, Johnson & Cherry ........ 184,528
Ellipso pantograph, A. Anderson ........ 184,493
Endless rope railway, A. E. Hovey ........ 184,624
Envelope, W. H. Hart ........ 184,617
Expansion engine, A. S. Cameron ........ 184,587
Extension table, C. A. Bretz ........ 184,580
Extension table slide, L. Menzer ........ 184,648
Fare box, Adler & Freimuth ........ 184,491
Fare register, W. Pigott ........ 184,661
Farm fence, D. B. Groff ........ 184,612
Feathering paddle wheel, F. J. Leisen ........ 184,532
Feeding air to furnaces, C. J. Hagstreem ........ 184,519
Fence, J. A. Burnham ........ 184,502
Fence builder's gauge, S. B. Coates ........ 184,459
Fence post, S. N. Lennon ........ 184,635
File, W. T. Nicholson ........ 184,543
Fires, extinguishing, J. B. Logan ........ 184,534
Flange joints, etc., securing, H. A. T. Ehrhardt ........ 184,599
Flexible blackboard, J. R. Minehart ........ 184,541
Flour bolt, Hurd & Simpson ........ 184,470
Folding chair, J. A. Ware ........ 184,676
Folding table, J. S. Corban ........ 184,508
Food from dessicated eggs, C. Peck ........ 184,479
Foot rest for chairs, J. H. Travis ........ 184,559
Force pump, O. W. Grover ........ 184,613
Freight car, J. D. Imboden ........ 184,625
Frictional electric machine, C. H. Hinds ........ 184,621
Fringing machine, J. B. Lincoln ........ 184,637
Fruit box, C. W. Weston ........ 184,565
Fruit jar, T. G. Otterson ........ 184,478
Fruit picker, J. Sager ........ 184,547
Furnace door, H. A. Laughlin ........ 184,473
Gauge, F. D. Hazelton ........ 184,524
Gang plow, W. M. Richardson ........ 184,665
Gas, indicating power of, W. T. Sugg ........ 184,673
Gas binder, C. H. Hinds ........ 184,620
Gas cock, P. Becker ........ 184,573
Gas oven or summer range, B. Shourds ........ 184,551
Gas regulator, G. Taylor ........ 184,482
Gate, R. E. Stephens ........ 184,555

Glass bowls, etc., making, G. L. Fessenden ... 184,604
Grain elevator, A. J. Smith ... 184,552
Grain elevator and measure, J. M. Harper ... 184,616
Grain separator, J. J. West ... 184,564
Hall pendant, P. J. Clark ... 184,506
Hanging saw gangs, O. C. Meigs ... 184,474
Harrow, J. Woolridge ... 184,489
Head block for saw mills, G. Herrnstein ... 184,619
Heating device, etc., boiler, W. H. Harris ... 184,465
Heating stove, Droege, et al. ... 184,513
Hook and ladder truck, J. Pine ... 184,667
Horse hay rake, H. Y. Cahill ... 184,585
Hose coupling, S. H. Loring ... 184,639
Hubs to axles, attaching, J. Buckner ... 184,592
Injector, E. Korting ... 184,631
Japanning small articles, C. Radcliffe ... 184,662
Knife scourer, S. M. Haskell ... 184,533
Lamp bracket, S. S. Barrie ... 184,577
Letter box, J. Katz ... 184,529
Liquors, ageing, H. G. Dayton ... 184,464
Loom, G. Crompton ... 184,592
Loom, J. F. Wicks ... 184,681
Lubricating compound, P. Sweeney ... 184,481
Marble mantle clamp, J. Passmore ... 184,659
Melting snow and ice, I. Kendrick ... 184,628
Mop head, E. & E. G. Street (r) ... 7,398
Mosquito net frame, R. C. Millings ... 184,469
Motion, converting, A. F. Eells ... 184,598
Motor, sewing machine, J. B. Button ... 184,458
Nut lock, M. Neill ... 184,476
Ores, reducing, W. H. Sterling ... 184,554
Ornamental fur, J. F. & G. S. Mathias ... 184,536
Oscillating steam engine, S. Gibson ... 184,609
Packing metallic piston, Tripp et al. ... 184,484
Padding machine, E. Marble ... 184,640
Paper and metal box, A. D. Chase ... 184,504
Paper bag, J. H. Percy ... 184,544
Paper, manufacture of, A. G. Fell ... 184,466
Peanut roaster, J. Esposito (r) ... 7,397
Picker for looms, S. E. Avery ... 184,569
Pillow sham support, A. S. Whittemore ... 184,678
Pipe and heater, petticoat, C. B. Winans ... 184,692
Pipe cutter, G. Muller ... 184,652
Plaiting machine, Burcky, et al. ... 184,584
Planchets, etc., cutting out, Briggs & Boutwell ... 184,579
Plow, G. W. Parish ... 184,657
Plow attachment, G. S. King ... 184,629
Potato digger, M. B. Riggs ... 184,480
Pump, A. S. Cameron ... 184,586
Pump, W. B. Farrar ... 184,603
Reciprocating churn, J. P. Goodhue ... 184,517
Refining and bleaching hair, J. Bene ... 184,577
Revolving buddle for ores, W. Hooper ... 184,622
Rice cultivator, G. W. Parish ... 184,658
Riding attachment for plows, J. Bailey ... 184,570
Sample shoe holder, J. H. Jewett ... 184,626
Sash fastener, W. G. Bulkley ... 184,501
Sawing circular slabs, J. J. Dimond ... 184,511
School desks, etc., fastening backs, J. W. Childs ... 184,589
Screw threads, cutting, T. J. Waters ... 184,563
Seat hooks, making iron bars for, W. G. Collins ... 184,591
Seed planter, cultivator, etc., L. Flatan ... 184,516
Self-closing hatchway, A. G. Stevens ... 184,671
Sewing machine, C. S. Cushman ... 184,594
Sewing machine, J. McCloskey ... 184,644
Sewing machine, J. O'Neil ... 184,477
Sewing machine, C. B. True ... 184,560
Sewing machine tucker, A. W. Brown ... 184,500
Shoe for driving pipes, Brown et al. ... 184,497
Signal box, fire, D. H. Whilldin ... 184,566
Soap, A. Dove ... 184,512
Solar camera, C. R. Jenne ... 184,526
Speed indicator, J. M. Napier ... 184,653
Split wheel, B. T. Mills ... 184,540
Spring bed, C. C. Allen ... 184,568
Spring bed bottom, C. E. Brown ... 184,498
Spring bed bottom, Olive et al. ... 184,655
Spring seat, Littlefield & Sheridan ... 184,533
Steam and vacuum pump, J. R. McPherson ... 184,646
Steam pressure regulator, T. R. Morgan ... 184,542
Street lamp, combination, L. O. Cameron ... 184,588
Stud for boots and shoes, M. Bray ... 184,457
Sulky plow, M. Brown ... 184,499
Swivel attachment, fishing, F. Jones ... 184,627
Table leaf support, P. J. Liljeholm ... 184,636
Tan bark for transportation, R. Loercher ... 184,638
Tape line lumber measure, W. L. May ... 184,537
Tapping pipes under pressure, J. Miller ... 184,686
Telegraph insulator, Cunningham et al. ... 184,509
Telluric globe, J. F. Rose ... 184,546
Thermostat, W. H. Markland ... 184,641
Thill, W. Benson ... 184,578
Time lock, W. F. Kistler ... 184,630
Tobacco bag, W. J. Cassen ... 184,595
Tobacco-cutting machine, E. Goodwin ... 184,518
Tool handle, A. Eckert ... 184,157
Truss bridge, Hammond, et al. ... 184,520
Tube expander and cutter, S. Engel ... 184,602
Tuck marker, A. Johnston ... 184,472
Turn table, T. L. Johnson ... 184,527
Umbrella, Valentine & Morrison ... 184,756
Umbrella stand, L. E. Ladd ... 184,530
Underwaist, E. W. Philbrook ... 184,545
Upsetting tires, machine for, N. Sawyer ... 184,669
Vacuum brake for cars, T. Cooper ... 184,507
Vacuum chamber, brake, T. Cooper ... 184,461
Vacuum chambers, making, T. Cooper ... 184,462
Vegetable cutter and slicer, A. Iske ... 184,471
Vehicle seat, F. Oppenheim ... 184,656
Wagon brake lever, J. B. McAfee ... 184,643
Wash board, J. M. Gorham ... 184,611
Wash board, G. Muller ... 184,651
Wash boiler, G. H. Robertson ... 184,666
Washing machine, G. Buchanan ... 184,581
Watch key, adjustable, F. A. Hardy ... 184,615
Water motor, hight, J. A. Svedberg ... 184,558
Water wheel, Shattuck & Stahlman ... 184,550
Wheel plow, A. H. Burlingame ... 184,583
Wheel plow, I. R. Gilbert ... 184,610
Wire twister for self binders, E. Chapman ... 184,505
Withe band for ship masts, G. A. Lane, Jr ... 184,531
Woods, finishing hard, J. Hawksley ... 184,618
Wrought iron girder, D. Hammond ... 184,522
Wrought iron post, D. Hammond ... 184,521

## DESIGNS PATENTED.

9,640, 9,641.—CENTRE PIECES.—H. Berger, New York city.
9,642, 9,643.—CENTRE PIECE.—J. Blankenberg *et al.*, Buffalo, N. Y.
9,644.—BRACELETS.—H. Carlisle, Jr., Philadelphia, Pa.
9,645.—WALL POCKET MIRROR, ETC.—W. Clapp, South Bend, Ind.
9,646.—GLASS BOTTLES.—C. Dorflinger, White Mills, Pa.
9,647.—GLASSWARE.—J. H. Hobbs, Wheeling, West Va.
9,648 to 9,650.—OIL CLOTH.—C. T. Meyer, *et al.*, Bergen, N.J.
9,651.—SKATE RUNNER.—A. F. Migeon, Wolcottville, Conn.
9,652.—CARRIAGE.—D. P. Nichols, *et al.*, Boston, Mass.
9,653.—STATUARY.—J. Rogers, New York city.
9,654.—WOOLEN FABRICS.—R. Scott, *et al.*, Lawrence, Mass.
9,655.—STOVES.—J. Van Wormer, Albany, N. Y.

FOR THE WEEK ENDING NOVEMBER 28, 1876.

Air engines, utilizing exhaust of, F. F. Schnake ... 184,913
Alloy, composition, Merrell & Wilder ... 184,884
Animal trap, G. W. Gibson ... 184,772
Ash leach, H. B. & S. Locke ... 184,788
Axe, J. O. Rollins ... 184,799
Axle grease, G. H. Merrill ... 184,885
Back comb, J. E. Morse ... 184,750
Bale tie, J. M. Pollard ... 184,901
Bale tie, C. H. Victory ... 184,789
Barbed fence wire, G. W. Billings ... 184,694
Barbed fence wire, E. M. Crandal ... 184,844
Barrel heads, making, A. C. Blount ... 184,750
Bed bottom, J. De Camp ... 184,703
Bed spring, G. Pirrung ... 184,899
Bee hive, H. Hatfield ... 184,778
Bee hive, R. T. Vanvalkenberg ... 184,809
Beveling glass plates, A. Vogley ... 184,863
Bilge water alarm, A. F. Eells ... 184,851
Blackboard rubber, C. J. Higgins (r) ... 7,400
Blind fastening, Star Tool Company (r) ... 7,409
Bobbin winder, R. Whitehill ... 184,937
Body jack, A. M. Colt ... 184,841
Boiler and limekiln, J. Cowan ... 184,843
Bolting reel, F. B. Lewis ... 184,878
Boot nail, H. L. Marshall (r) ... 7,402
Bottle stopper, etc., J. L. Megret ... 184,883
Bottle stoper, W. A. Root ... 184,908
Bottle stopper, F. Schlich (r) ... 7,408
Breech-loading fire arm, C. A. King ... 184,716
Brick, T. M. Clark ... 184,757
Bridges, pin for bars of, P. Munzinger ... 184,888
Broom, T. B. & T. O. Lewis ... 184,879
Broom machine, Walrath & Bronson ... 184,935
Bucket bail ear, P. O'Grady ... 184,922
Burglar alarm, J. P. Everts ... 184,705
Burglar alarm, H. Gill ... 184,773
Bustle, S. H. Doughty ... 184,765
Camp stool, E. L. & T. W. Moore ... 184,721
Car axle box, O. Tomlinson ... 184,808
Car brake, J. Kuntze ... 184,876
Car truck, C. Bleakley ... 184,823
Card-grinding machine, B. S. Roy ... 184,909
Carding machine, J. F. Foss (r) ... 7,399
Carpet stretcher, W. W. Potts ... 184,902
Carpet sweeper, E. W. Smith ... 184,735
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Cereal food, L. S. Chichester ... 184,837
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Churn, Milling & Jones ... 184,886
Circuit closer, signal, J. I. Conklin, Jr ... 184,842
Clasp for looping skirts, W. J. Lynch ... 184,789
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Cloth cutter, G. D. Ferris ... 184,769
Clothes pin, A. G. Cummings ... 184,846
Clothes pounder, J. G. Lindsey ... 184,787
Coat, A. P. Silva ... 184,802
Collar bands, etc., turning edges of, R. S. Norton ... 184,891
Cooking range, T. J. Whitehead ... 184,810
Cooking stove, W. Burrows ... 184,831
Corn planter, H. P. Hall ... 184,710
Corn sheller, C. C. Burroughs ... 184,756
Corn-shelling implement, Boobyer & Williams ... 184,826
Corrugating sheet metal, W. F. Perryn ... 184,897
Cracker machine, J. Parr ... 184,895
Cracker machine, J. Parr (r) ... 7,403
Cultivator and chopper, W. B. Killough ... 184,783
Cutter head, I. F. Thompson ... 184,806
Cutting and stamping metal articles, W. J. Gordon ... 184,708
Cutting fibrous materials, J. Sangster ... 184,912
Detaching horses, C. J. Walser ... 184,934
Disinfectant, fumigator, etc., J. Commins ... 184,700
Drawbars, making face plates for, J. Green ... 184,850
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Driven well, W. S. Blunt ... 184,695
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Dumping scow, D. Allen ... 184,744
Earth auger, Shapeley & Phillips ... 184,916
Edge plane, I. A. Dunham ... 184,767
Edge plane and shave, J. Lureux ... 184,720
Electric gas-lighter, J. P. Tirrell ... 184,807
Elevating and carrying, J. B. Dow ... 184,848
Elevating hogs, T. D. Tompkins ... 184,930
Enameling metal ware, Quinby & Whiting ... 184,798
Explosive composition, C. De Lacy ... 184,762
Farm fence, J. L. Sullivan ... 184,924
Fence, T. J. Oliver ... 184,893
Fence, portable, H. L. Jones ... 184,712
Ferrule, C. T. Allen ... 184,687
Finger board, spinning, N. I. Allen ... 184,816
Fire arm aiming attachment, G. W. Wingate ... 184,743
Fire box for steam boilers, H. F. Hayden ... 184,866
Fire escape, M. Howie ... 184,871
Fire extinguisher, C. L. Garfield ... 184,857
Fire ladder, J. A. Groshon ... 184,861
Floor-closing device, B. S. Roy ... 184,910
Flour-bolting machine, Bernheisel & Young ... 184,821
Fly trap, T. Scantlin ... 184,730
Fog alarm, portable, J. B. Tarr ... 184,737
Folding chair, J. A. Ware ... 184,936
Food-steaming apparatus, T. B. H. Andrews ... 184,745
Fountain pen, W. A. Brice ... 184,754
Furnace door for steam boilers, H. F. Hayden ... 184,865
Galvanizing, preventing dross in, J. Bond, Jr ... 184,825
Gang plow, R. D. Christman ... 184,838
Gondola car, C. A. Thompson ... 184,928
Grain separator, J. Koons ... 184,785
Grapnel float, P. Mihan ... 184,792
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Harness saddle or coach pad, S. E. Tompkins ... 184,929
Harvester, J. F. Kingwill ... 184,784
Harvester frame, C. O. Gardiner ... 184,856
Harvesters, adjusting wheels of, J. D. Wright (r) ... 7,410
Hat brim luring machine, A. Hill ... 184,780
Heater, lamp chimneys, E. W. Brown ... 184,696
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Hoisting and setting stone, E. Due ... 184,766
Hoisting machine, Benham & Leeds ... 184,820
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Horse hay rake, C. La Dow (r) ... 7,407
Horseshoe nails, cutting, J. B. Wills ... 184,812
Horseshoe nail making, D. B. Loring ... 184,719
Hose coupling, C. C. Parsons ... 184,723
Hose spanner, C. Sibert ... 184,733
Hot air car heater, etc., H. A. Gouge ... 184,858
Hot air furnace, R. F. Brown ... 184,829
Hydraulic accumulator, W. Sellers ... 184,732
Hydraulic organ blower, W. Shriver ... 184,801
Hydrocarbons, treating, W. Adamson ... 184,815
Implement, compound, W. M. Gray ... 184,775
Inking apparatus, A. Campbell ... 184,946
Inkstand, S. Darling (r) ... 7,406
Inerfering gutrl for horses, T. A. Millen ... 184,887
Iron fence, T. Rebholz ... 184,906
Jig for separating ore, W. Hooper ... 184,870
Journal box, E. H. N. Clarkson ... 184,839
Knitting machine, C. J. Appleton ... 184,689
Knitting machine needle, F. Burns ... 184,833
Lamp, D. Dickson ... 184,766
Lamp, J. Funck ... 184,855
Lamp, W. & W. Stachlen, Jr. ... 184,923
Lamp burner, C. W. Soule ... 184,863
Lamp extinguisher, J. T. Williamson ... 184,813
Leak stopper, boiler tube, J. McConnell ... 184,790, 184,791
Lifting jack, O. A. Edgerton ... 184,850
Lifting jack, W. S. Shannahan ... 184,915
Lock and latch combined, A. W. O. Kleinan ... 184,874
Lock for doors, etc., A. W. O. Kleinan ... 184,875
Lubricating oil, J. M. C. Thomas ... 184,927
Magazine fire arm, H. F. Wheeler (r) ... 7,405
Malt drying process, J. G. & M. White ... 184,942
Marble shooter, A. D. Laws ... 184,717
Metallurgic gas furnace, J. J. Reed ... 184,905
Mill, fruit, C. E. Whitman ... 184,941
Millstone facing hammer, E. F. Lemoine ... 184,877
Miter machine, W. E. Eastman ... 184,704
Miter machine, A. H. Putnam ... 184,725
Motive power, W. W. Corey ... 184,761
Mucilage holder, E. H. Grover ... 184,776
Nut lock, J. H. Champion ... 184,835
Nut lock, P. Zeiher ... 184,945
Overalls, E. F. & J. H. Stacy (r) ... 7,404
Packing caustic alkali, method of, T. C. Taylor ... 184,925
Paper-box machine, Heyl et al. (r) ... 7,401
Paper-cutting machine, G. R. Clarke ... 184,699
Paper-feeding machine, S. Scholfield ... 184,731
Paper, uniting sheets of, S. Smyth ... 184,736
Pasteboard, making, E. L. Perkins ... 184,896
Pavement, C. R. Anderson ... 184,817
Peg float machine, W. B. Arnold ... 184,746
Perambulator, J. N. Hazelip ... 184,867
Photograph cabinet, H. E. Rile ... 184,728
Picture exhibitor, Bowman & Stull ... 184,753
Pile driver, R. Hillyer ... 184,779
Pitman and connecting rod, B. S. Roy ... 184,914
Pliers, H. Smith ... 184,734
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Refrigerator, J. J. Bate ... 184,748
Refrigerator, H. B. Walbridge ... 184,740
Register, printing, Herold & Le Van ... 184,869
Revolving grater, R. Soper ... 184,921
Rolling shutter, J. G. Wilson ... 184,944
Rotary engine, G. C. Hale ... 184,862
Rotary engine, J. M. Simpson ... 184,919
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Sealing cans, W. W. Karshner ... 184,713
Self detaching boat hook, G. Cosgrove ... 184,701
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Sewing machine stand, T. Crane ... 184,702
Sewing machine take up, A. Bocher ... 184,824
Shaving case, C. P. Rallo ... 184,904
Shears for cutting slips, W. A. Scripps ... 184,914
Sheer boom, E. Hennebery ... 184,868
Shirt bosom, J. Fisher ... 184,770
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Signals, etc., transmitting, J. S. Gisborne ... 184,773
Silk-doubling frame, G. K. Preston ... 184,724
Snap hook, J. R. Haines ... 184,709
Snap hook, Kempshall & Nash ... 184,873
Soldering machine, Brooks and Gornall ... 184,755
Spark arrester, A. W. Farrand ... 184,606
Spindle step, spinning, Whorwell & Blauvelt ... 184,742
Spring air pistol, G. R. Carey ... 184,698
Spring bed bottom, metallic, C. A. Le Quesne ... 184,880
Spring bottom for beds, etc., W. P. Rees ... 184,727
Stave jointing machine, J. M. Childers ... 184,836
Stave making machine, A. C. Blount ... 184,751
Steak tendering machine, T. Jones ... 184,872
Stove door knob, J. Olmstead ... 184,794
Stove grate, I. A. Sheppard ... 184,917
Stove pipe damper, D. C. Breed ... 184,752
Stove pipe ventilator, J. Briggs ... 184,828
Sucker rod joint, W. J. Lewis ... 184,718
Surgical saw, F. A. Stohlmann ... 184,804
Tampico, etc., dressing, E. B. Whiting ... 184,940
Tampico, combing and dressing, G. Willett ... 184,943
Tap and faucet, A. Pfeiffer ... 184,796
Temporary binder, J. R. Barrett ... 184,747
Tobacco or cigar press, H. Sage ... 184,800
Toy, T. A. Curtis ... 184,847
Toy clock, A. E. Hotchkiss ... 184,711
Transit instrument, N. Spofford ... 184,922
Tree protector, E. C. Bates ... 184,749
Trundle toy, Nangel & Langshaw ... 184,889
Tuck creaser, R. Whitehill ... 184,939
Tuck marker, J. F. Kellogg ... 184,715
Twisting hay, etc., for fuel, N. Ford ... 184,853
Upholstering stools, etc., G. W. Archer ... 184,818
Umbrella, E. Folsom ... 184,771
Umbrella support, A. T. Martin, Jr ... 184,782
Vegetable washer, E. G. W. Parks ... 184,894
Velocipede, J. Fishwick ... 184,852
Vent valve for casks, etc., Peter et al. ... 184,795
Ventilating rooms, G. C. Quezada ... 184,797
Wagon coupling, J. W. Odaniel ... 184,892
Wall guard, M. D. Rouse ... 184,729
Washing machine, G. Bumgardner ... 184,697
Washing machine, W. Doan ... 184,764
Water filter, Simes & Tate ... 184,920
Waterproof hose, making, T. L. Reed ... 184,907
Water wheel, L. A. Struble ... 184,805
Weather strip, J. Baldwin ... 184,691
White lead, making, E. Milner ... 184,947
Window shade roller, D. Willis ... 184,811
Wood for charcoal, etc., treating, H. M. Pierce ... 184,898
Wrench, G. W. Bradley ... 184,827
Yarn tester, J. R. Brown ... 184,830
Yarn-winding regulator, S. Jackson ... 184,782

## DESIGNS PATENTED.

9,656.—CENTER PIECES.—J. Blankenberg *et al.*, Buffalo, N. Y.
9,657.—EMBROIDERY.—E. Crisand, New Haven, Conn.
9,658.—HAT HOLDER.—J. Hall, Newark, N. J.
9,659.—WATCH CASE.—J. Laurent, New York city.
9,660.—HINGE.—J. Leger, Providence, R. I.

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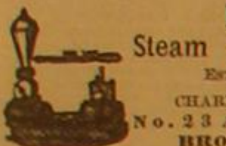

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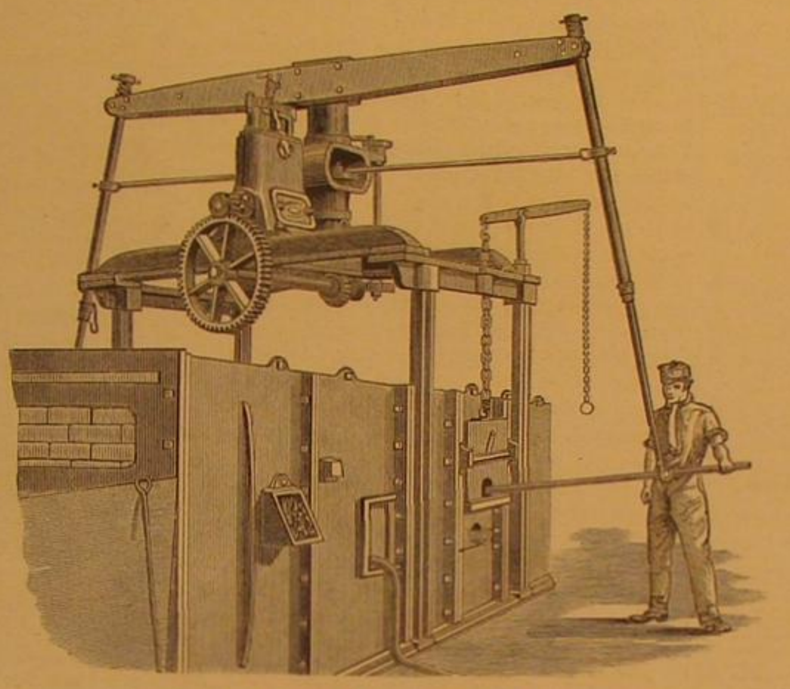
Vol. XXXVI.--No. 2. [NEW SERIES.] | NEW YORK, JANUARY 13, 1877. | $3.20 per Annum. [POSTAGE PREPAID.]

### PUDDLING MACHINERY.

We illustrate herewith a rabbling machine for puddling iron, which can be used in conjunction with any of the known furnaces in puddling, and is now almost exclusively used in the Cleveland district, in England, being fixed over the ordinary furnaces. The machine and engine [Clough's patent three-cylinder] are attached to a substantial bedplate, supported on four double-headed rails, or by other means, over the furnace, the latter having a door at each side for charging and withdrawing the bloom when puddled. From each end of a wrought iron beam are suspended two tubes, to which are imparted a vibrating motion from a crank plate working in the column of the machine. These tubes have at the lower end a double hook, on which the rabbles hang, and the latter, in addition to receiving the vibrating motion of the tubes, also have imparted to them a radial motion from the ends of the wrought iron beam. The rabbles thus operate in two directions, and puddle the iron over the whole surface of the furnace bed. The usual charge for a furnace is about 14 cwt., but considerably larger charges have been successfully dealt with.

The consumption of coal is about 14 cwt. to the ton of bars made, and much less fettling is required. The men have easier work and get out a much greater weight in less time than by ordinary hand labor. Considerably over one hundred of these machines have been sold during the past year, and they are acknowledged by those whose opinion should carry weight, to solve in a most satisfactory manner the problem of mechanical puddling. Special care has been taken to have all the working parts as far as practicable protected from dust, as it is well known what grinding effects the dust and ashes from puddling furnaces have upon machinery.



CLOUGH & CO.'S PUDDLING MACHINE.

### BRAYTON'S HYDROCARBON MOTOR.

It will be remembered that not long ago we illustrated and described the above-named invention in its then most improved form. Of late, however, the construction of the machine has undergone considerable modifications ; and, as will be seen in the annexed engraving, its construction has been materially simplified. In order to appreciate the nature of this in many respects remarkable motor, which, through its utilization of the gases due to the sudden combustion of oil, may be started or stopped almost immediately, which requires no continuous fire and therefore no furnace, which in brief, costs nothing while not actually in operation, it will be well briefly to review its history as an invention. Thus we shall best exhibit the connection between the present and prior types of machine.

In the first engine made by the inventor, Mr. George B. Brayton, a well known engineer who has devoted a quarter of a century to this especial subject, separate charges of hydrocarbon were exploded, the force acting on a free piston to compress air, which in turn expanded upon the crank piston. Subsequently a rack and reversible catch or pawl held the piston, and the vacuum was used in connection with the air pressure. Five engines were built on this principle, only however, to be abandoned when the idea occurred that an explosive mixture could be burned without explosion by utilizing the principle embodied in the Davy Safety Lamp. On reducing this plan to practice, another difficulty was met in the production of a vapor compound which has a tendency to condense under high pressure ; and the effect of the varying temperatures upon the evaporation was a further trouble. The substitution of coal gas for liquid hydrocarbon obviated the trouble ; and, after nineteen years of labor, the inventor found himself possessed of an efficient gas engine, which he patented in 1872, and which subsequently satisfactorily underwent tests made by eminent engineers in this city.

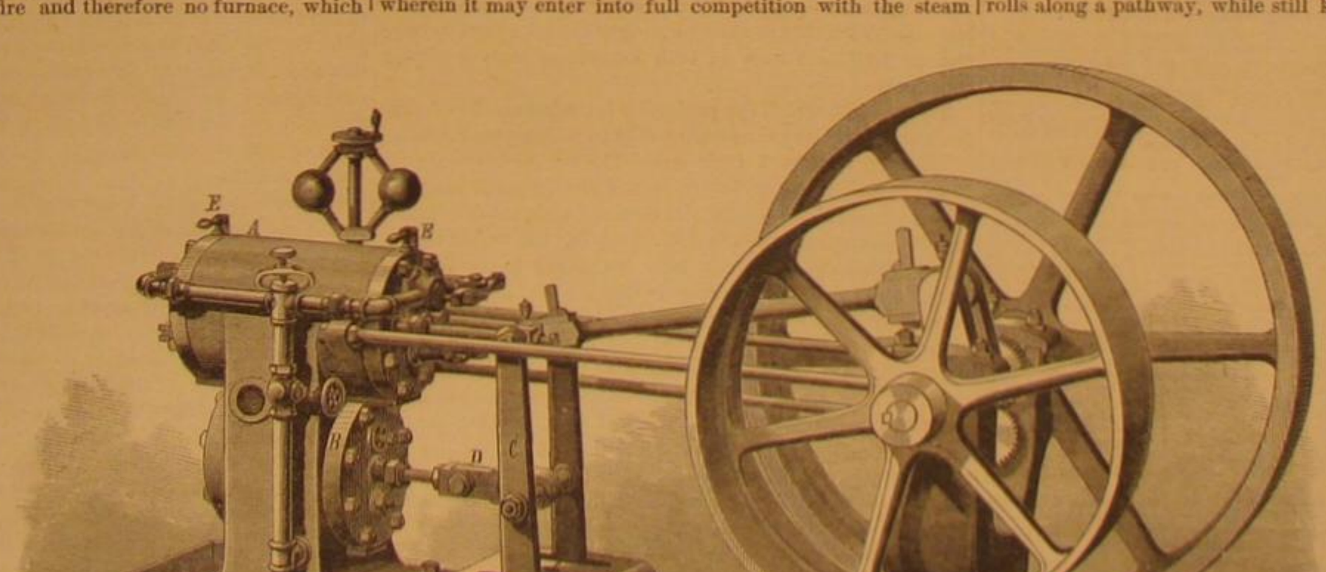
Mr. Brayton now resumed his studies on the oil engine, and after two years he devised a motor wherein a combustible compound is formed by mechanical means, which can (he claims) be used successfully regardless of pressure or temperature. Then followed an improvement in extending the water circulation through the piston, so that the power can be applied to both sides of the same, thus doubling the capacity of the engine. Latterly, the principles have been extended to engines of large dimensions, and thus the oil motor has been developed, so to speak, into a position wherein it may enter into full competition with the steam engine. Although it may never do all that steam has done, it is but just to add that it can do that which never has been accomplished while using steam, namely, that, through the invention, a hundred horse power engine may be almost instantly set in motion by igniting a small burner with a match.

The principles upon which the engine operates are as follows : A small pump feeds the necessary quantity of petroleum into a chamber containing a fibrous substance. An air pump forces through the fibrous compound, which is situated close to the cylinder, the quantity of compressed air necessary to the combustion of the petroleum. The air, in passing through the fiber saturated with petroleum, becomes mixed with the hydrocarbon; and from the combustion of the compound, the expansive force which operates the engine is generated. A small independent pipe keeps a current of air passing through the fiber, and thus continuous combustion is secured. To prevent the combustion of the fiber and the petroleum therein contained, there is, between them and the cylinder bore, a perforated plate which acts upon the principle of the Davy lamp, and thus completely isolates the combustion which takes place in the cylinder. This combustion can only occur as the hydrocarbon and air enter the cylinder; and since this is accomplished gradually, the combustion is gradual, answering exactly to the admission of so much steam. The engine is so constructed as to cut off the supply of hydrocarbon and air at a definite point of the stroke; and the remainder of the stroke is completed from the expanding force of the products of combustion, thus securing the economy due to working expansively. The action of the engine is, therefore, substantially the same as that of an ordinary cut-off steam engine. To keep an equable ratio between the power of the engine and the amount of its load, a pressure diaphragm is provided; while by a very simple arrangement, the supply of oil can be increased or diminished to suit the demands of the duty.

Instead of having guide bars and crosshead guides to guide the piston rods, a novel and simple device is used, as will be seen by referring to our engraving, in which A is the engine cylinder, B is the air pump, and C is a lever connected to the engine and pump pistons. The bottom of this lever is a section of a circle struck off the centre of the piston-rod crosshead journal. As a consequence, the bottom of the lever, C, rolls along a pathway, while still keeping the center of the top crosshead parallel at every point of the stroke, with the pathway, which, being true with the bore of the cylinder, produces a parallel motion without any of the friction due to a sliding motion. The direction in which the fly-wheel revolves is *from* the cylinder (looking at the top of the fly-wheel); and thus the whole tendency due to the angularity of the connecting rod is to keep the lever down upon the pathway on the bed-plate.

The first double-acting petroleum engine made by Mr. Brayton ran in Machinery Hall during the Centennial Exhibition. It was entered as a 10-horse engine, but proved upon a friction brake test to give 13½ actual horse power. The 10-horse engine here illustrated contains many advantages over, and im-

*Continued on page 20.*




BRAYTON'S HYDROCARBON ENGINE.

# Scientific American.

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VOL. XXXVI., No. 2. [NEW SERIES.] *Thirty-second Year.*

NEW YORK, SATURDAY, JANUARY 13, 1877.


**Contents.**

(Illustrated articles are marked with an asterisk.)



TABLE OF CONTENTS OF
THE SCIENTIFIC AMERICAN SUPPLEMENT,
**No. 54.**
**For the Week ending January 13, 1877.**





## PHYSICIANS AS PATENTEES.

We have seldom seen a prettier illustration of professional prejudice than appears in a late number of the *Medical Record*. Speaking of the ingenuity of American physicians the *Record* remarks that scarcely a day passes without some new design for the alleviation or cure of disease being submitted to the instrument maker, who first takes good care to charge the designer a round sum for making it, and then goes on to manufacture and sell the article at an immense profit to himself.

Against this one-sided arrangement, the *Record* protests mildly, and raises the question whether the profession could not arrange with the trade to allow the inventor some return for his work, while the manufacturer retained the exclusive right of patenting and selling the article invented and adopted. "This plan," the *Record* observes, "would save the dignity of the profession; and though not so remunerative as the holding of a patent, it would nevertheless give a physician some pecuniary recompense for the outlay of his time and means and the labor of his brain."

This solicitude for the dignity of the profession seems to us rather far-fetched. The logic of the *Record's* position appears to be something of this sort:

First: It is the duty of medical men to give the world unreservedly the benefit of all professional inventions and discoveries they may make. Second: To take out a patent is to retain a proprietary interest in the invention patented. Therefore it is an undignified and unprofessional thing to patent a medical or surgical invention. But a physician may surreptitiously derive a pecuniary benefit from such an invention, or rather from the sale of it, provided he can persuade a manufacturer to allow it to him! For our part we think that this indirect way of getting one's due is infinitely less dignified than the straightforward matter-of-fact way provided by the law. The prejudice against retaining a personal interest in anything pertaining to the profession—a pecuniary interest, we mean—no doubt had a highly honorable origin; but when it is allowed to react, as it clearly does, to the injury of the profession, it becomes anything but a virtue.

No physician objects to the copyright of a medical book—nor does any one imagine that the dignity of the profession is in any way lowered by the circumstance that many of its members add largely to their income by such means. On the contrary, it would be easy to show that copyright has greatly helped to raise the profession in usefulness and in the estimation of men. It serves as a powerful inducement for the preparation of medical works, and, when completed, assures their publication. Without the protection which copyright offers to both author and publisher, it would be quite impossible to get the more costly and valuable of such professional contributions printed at all; and without the prospect of printing there would be little encouragement to undertake their preparation. What the dignity of the profession would have been without its literature we need not attempt to say.

What the profession has lost, in refusing to take advantage equally of the privileges and benefits of patent rights, it is impossible to estimate. There is not another line of manufacturing business in so unsatisfactory a condition, all things considered, as the making and selling of medical and surgical appliances not patented. Most admirable work is done, but it is done in the most expensive manner. Articles which might be cheaply made by machinery, and should be widely used, are turned out slowly and dearly by hand; the price reacts upon the demand; patients suffer for lack of mechanical aids which they or their physicians cannot afford to buy; and the profession loses in both usefulness and dignity in consequence.

The free gift which the profession intends to make of professional inventions thus results only in making such articles so costly as to restrict their use. The motive is honorable, but the practice conflicts with the conditions of trade to such a degree that it defeats its own end and purpose. Lacking the protection which a patent gives, the maker of any new medical appliance can have no object in making its merits known, or in spending money on machinery for its cheaper or more rapid production; so he meets the limited absolute demand in his own slow and costly way, and charges a profit which helps still more to lessen the demand. As a further result, the mass of medical practitioners are but poorly equipped with professional aids, and the general efficiency of the profession is less than it might be and should be.

The cure of these grave evils hinges, we believe, on the adoption of more business-like and practical views touching this matter by the profession as a whole. The moment physicians and surgeons abandon their prejudice against patents, and act like other people, the business of the professional instrument maker will take on a much more satisfactory aspect. Protected in his work, he would have some inducement to improve its methods. The first result would be to cheapen the products and so encourage their more general use. Enlarged demand would react upon the price, and that again upon the employment of such professional aids, to the natural increase of the intelligence and efficiency of the profession.

Further, invention begets invention; and whatever is done to increase the use of improved professional means and appliances increases also, the probability of still other improvements. The inventor's royalty steps in to encourage the good work, and to secure the preservation of valuable suggestions and devices now commonly lost to the profession. The benefit that would ultimately accrue to the profession from and through this line of advancement is quite incalculable.

## THE OBLIGATIONS OF SCIENCE TO GOETHE.

The great German poet *Goethe*, is generally more appreciated by students of German literature than by scientists for the simple reason that most of his literary labors were at once understood, while his scientific labors, in which he was half a century in advance of his contemporaries, are only just beginning to be valued; and even now, the large majority of people have no idea of their high importance. He went forward with such great steps that he was soon far ahead of his time, and contemporary philosophers were utterly unable to keep pace with him, a misfortune which he himself felt and acknowledged!

Goethe approached the grand problems of nature not as an unimpassioned investigator, but as an inspired poet, and the wonderful generalizations which he made in metaphysics, in botanical and zoological anatomy, in embryology and comparative anatomy, were the basis of the modern theory of evolution. These theories sprang from his intensely poetical conception of the necessary unity of nature, and have now been generally acknowledged and accepted. Metaphysics he reformed entirely, by proving that in fact there is no such thing as a metaphysical universe, no nature above the visible nature; and therefore, to Goethe, metaphysics proper did not exist. He saw that matter without mind was as unthinkable as mind without matter; and he was the first who attacked the *dualismus* which treated mind and material nature, essence and phenomenon, or whatever else they may be called, as opposing principles. He held that in place of being distinct, they form an inseparable unit. Neither matter nor spirit can exist alone; but everything is both in one; and it is evident that it is just as erroneous to call natural objects materialisms as it would be to call them spiritualisms. Nor can any one call this view of the universe atheism, as it acknowledges a God grander and nearer to man than the hypothetical *deus ex machina* of the ancient creeds.

There was recently published a letter from Goethe to Jacobi, in which the writer says: "Why some good people want a God existing outside of the universe is what I do not understand. Does not God exist in the universe, everywhere in the universe? If he does not exist everywhere, entirely and undivided (because the whole universe is a manifestation of His, to us, visible form) then does He exist nowhere. Outside of the universe, there is no space; space comes only to existence as an abstraction when a universe is evolved. A limited personality does not fit an infinite being, which must be the highest, living, active unit: not *in* all things, as if there could be anything outside of Him, but *by* all things, which appear only as perceptible conceptions to the observing faculties of material beings."

In regard to Goethe's labors in special branches of the natural sciences, we must first consider a principle which he insisted on in all his works, namely: That "a bad hypothesis is better than none at all." Professor Huxley endorses this, and adds: "It forces the mind into lines of thought, in which it is more profitable to go wrong than to stand still." One of Goethe's most celebrated works in the natural sciences is his "Metamorphoses of Plants," first published in 1790. In this work he attempted to prove that there was one fundamental organ, by the infinitely manifold transformation of which the whole world of the vegetable forms was evolved. This fundamental organ he thought he had found in the leaf; but if he had been a microscopist he would have gone farther back, and recognized the cell as the organic cause of the leaf. Applying the same reasoning to the cell development, he would have done as we, enlightened by his example, do now; he would have looked for the primary form or type, or other name by which the originating germ may be called.

Goethe's next great labor was his famous theory of the skulls of man and the other mammalia, that they are only modifications or differentiations of vertebræ of the spinal column, being composed of similar parts. This idea, further developed and applied to other parts, is of the utmost importance, and has effected a reform in comparative anatomy, or, rather, has elevated it to be one of the most solidly founded sciences. To have proved the unity of type of two objects so different in appearance as a vertebra and a skull, and afterwards of other objects, was to have made an immensely progressive step.

Goethe also proved that certain differences between the osseous systems of man and the lower mammalia, which had been insisted on before his time, did not exist in the embryos, and only appeared during and after growth.

It is evident that what Goethe called metamorphosis, is identical with what we call evolution. Witness the following expression: "The triumph of metamorphosis is shown when this theory teaches how simple organization begets families, how families split up into races, and races into various types, with an infinity of individualities. Nature cannot rest, nor preserve what she produces, but her actions go on *ad infinitum*."

## COLOR MUSIC.

A correspondent sends us an essay on the analogies between sound and color, describing a new instrument (which he terms a color organ), which displays lights of various colors, claimed to be harmonious with the music produced. An analogy is traced between arrangement of the colors of the spectrum and that of the notes of the minor scale. Our correspondent thinks that color music might be produced by the arrangement of colored lights, and that such an addition would prove valuable in the presentation of operas, or even in connection with church music.

The analogy that really exists between sound and color is, that both are the products of vibrations which the brain, in accordance with their velocity, translates into one or the other impression. Viewing the physical characteristics, we may proceed a step further, and admit that there exist harmonies and discords between colors, as between sounds; and that in this respect a finely painted picture may be as gratifying as a finely written musical composition. Still further, we may concede that there is such a thing as sound painting; but here the analogy grows weak, for a trained perception is needed to interpret the meaning of sounds which express ideas. Still, it is, and always has been, a motive of composers to make music present pictures or thoughts to the mind's eye, as clearly as a painting conveys ideas to the physical senses. But the composer's motive merely offers the bare idea which the hearer clothes to suit himself; and in no instance can it be urged that any musical writer ever wrote a note to express the sensation of blue or green; although, to listen to early pastoral music is to have the idea of blue sky and green fields brought uppermost in one's mind.

There are, however, the clearest scientific objections to the many repeated attempts to demonstrate the analogy which our correspondent suggests. The deepest musical tone perceptible to the ear is caused by about 30 single vibrations per second, the highest by about 24,000. Beyond the latter limit there is silence, or a sensation of pain to the ear. In music, the range is from 32 to about 4,000 vibrations, or about seven octaves. Comparing these figures with those indicating the vibrations of the color sensation, we shall at once perceive the dissimilarity. Thus, the extreme red of the spectrum shows 407 trillions, and the extreme violet 793 trillions. Now, the upper octave of a given note has just double the number of vibrations; and, therefore, our sensations of color do not correspond to a single octave, else the extreme violet would show 814 instead of 793 trillions. We can, of course, see light showing 814 trillions of vibrations, but the color sensation is exceedingly weak and indefinable.

Again, if several notes are sounded simultaneously, we do not hear a sound of medium pitch, but a chord, which is not easily mistaken for a simple sound. A practised ear can easily analyze this consonance into its components; and a skilled musician can readily follow any instrument or voice even in a full orchestra or chorus. A noise, instead of a musical sound, is only heard when the vibrations take place without any regularity, or when a number of sounds burst upon the ear simultaneously and without any regard to law. But when several colors act on the retina, we see no elementary color, but a hue composed of several simple colors, while several musical tones sounded simultaneously do not blend, but remain perfectly distinct to the ear. No eye is capable of recognizing the elements which compose such a mixed color. The artist may know that such and such colors produce another hue; but he cannot see the components in the mixture. The most practised colorist the world ever saw would be utterly incapable of deciding whether a gray upon a rotating disk were mixed from white and black, from yellow and blue, or from purple and green. If there existed a complete analogy between the two classes of sensation, every mass of sound would resolve itself into a confused noise, and all polyphonous music would be impossible.

There is still another difference (which Professor Von Bezold, whose reasoning we are following, in his admirable work on the "Theory of Color," points out). A tone will be perceived as such when only a few of its component vibrations are executed; but if the number of vibrations which reach the ear is too small, a confused impression is the result. Rapid passages on the bass notes of a pianoforte degenerate to a mere rumble; while there is a crystalline sharpness to quick runs on the high notes. In one case, as each note is struck, but a very few vibrations enter the ear; in the other, the vibrations are received by hundreds. With colors the case is different. The impression of a succession of colors can only be produced when the number of vibrations entering the eye from each color exceeds five trillions, and even then it will be quite imperfect, and little more than a glitter. If we paint a color top half of one color and half of another, the two sensations, rapidly produced alternately, are analogous to those of the trill in music. But if such a trill were executed so that each sound should execute the number of vibrations corresponding to the number of vibrations of light, which must enter the eye to produce the effect of alternating colors, the sounds would have to succeed each other in periods measuring at least years.

Returning to the numbers of vibrations corresponding to each color, and constructing with them a scale in accordance with the spectrum, we shall find the same to be very different for the musical scale. In such a scale we cannot illustrate the intervals which are almost involuntarily indicated by the ear in music. Take the fifth, where the vibration numbers are as two to three. A person having a good ear will at once recognize, as discords, variations on either side of the correct proportion. Yet the numbers of vibration of the red of the Fraunhofer line C, and those of the ultramarine blue, a little on the other side of G, likewise bear the same ratio; but it is absolutely impossible, even for the eye of the best colorist, to determine the exact point at which this proportion is reached. So the difference between the octaves in colors is of extraordinary magnitude; while, in music, a note and its octave may easily be confounded by an unpractised ear.

Mr. John Ruskin, in his "Modern Painters," dwells with great elaboration on the principle of gradation in color. He tells us that Nature never uses a color without grading it; that is, never employs flat tints. And he further claims that Turner, whom he considers only inferior to Nature, probably because of his fallible humanity, never painted a square inch of canvas without grading his tint. If we accept this, we are led, according to the theory of musical analogy, to a ludicrous conclusion. Gradation in color must be analogous to the *portamento* in music. The semitone interval of the chromatic scale is but very sparingly employed in music, because it really produces the howl of some wild animal. Therefore, it would follow that if our correspondent had Turner's "Slave Ship" placed before him, and were told to reverse his theory, and translate color into sound, his instrument or chorus would begin a series of hideous howls and whines. A tiled mosaic pavement, consequently, being destitute of gradation, would be the highest possible translation of a musical composition into a composition of colors.

## MORE REMARKABLE CLOCKS.

In a recent number, we referred to a clock without any apparent works, nothing being visible but a transparent dial and a pair of hands. Such clocks are, we are informed, no great novelties, as several of these "mysterious clocks" have been invented, and two were patented in this country previous to that of M. Robert. An informant saw one in Birmingham in 1856, and he remembers reading in the SCIENTIFIC AMERICAN of a similar clock being on exhibition in San Francisco several years ago.

One of the clocks above referred to (that of C. Schwippl, of this city, patented June 21, 1864), differs from M. Robert's clock in having the works in boxes in the centre of the hands. but the patent of C. King, June 16, 1868, shows a clock with the movement concealed in the counterpoise on the end of the hand, like that of M. Robert.

Another style of clock without apparent works was exhibited in a Broadway store some fifteen years ago. It consisted of a heavy ornamental base on which stood a transparent glass column, having a metallic cap on which rested a light round frame surrounding a transparent glass dial of about five inches in diameter, having the usual figures on it, but only one hand, so that it could only point out the hours, or such fractions thereof as could be indicated in the space between two figures.

The works in this clock were probably concealed in the base, and the connection made with the hand by means of a glass rod or tube passing through the centre of the glass column, which rod or tube moved a glass plate at the back of the dial; which, being of the same shape and size as the dial, and the edges of both being concealed by the frame before mentioned, could not be distinguished from the dial plate, and was supposed to be part of it by the ordinary observer. This plate had the hand firmly attached to it, so as to travel with it, and it probably had a metallic ring around it having teeth gearing with a small pinion on the end of the glass rod or tube before referred to, as there was sufficient room in the frame of the dial and the cap of the column to conceal both teeth and pinion.

As there appeared to be no connection between the base and cap supporting the frame of the dial, excepting the plain transparent glass column, and nothing but the figures and a small, ordinary hand on the equally transparent dial, this was truly a "mysterious clock" to most people, but the above is probably the explanation of the mystery.

A third style of mysterious clock was exhibited in Cortlandt street, in this city, a short time since. This consisted of what appeared to be an ordinary French clock contained in a base, supporting a bronze figure with an outstretched arm, from which hung the pendulum There appeared to be no connection whatever between the pendulum and the works, and the question: How is the pendulum kept in motion? was a puzzle that baffled some of the best mechanicians and horologists in the city. Many different theories were advanced to account for the continued movement, such as the application of a blast of air acting on the ball, electricity, magnetism, etc., all of which were denied by the exhibitor; but the real explanation was probably as follows: The figure itself, instead of being stationary on the base, as it appeared to be, was fixed on the top of a vertical shaft, concealed in the base and connected with the movement in such a manner as to give the figure a turning motion sufficient to swing the pendulum, but so small as to be imperceptible to an ordinary observer.

Among other curious clocks we may mention that patented by T. A. Davis, January 15, 1846, which had neither weight nor springs to drive it. Instead of using the cord to hang a weight on in the usual manner, the clock was suspended by it and the weight of the clock itself became the driving power.

A patent was granted by the Assembly of Connecticut, in 1783, for a clock to wind itself up by means of air, which was probably on the same plan as that patented by C. B. Hoard, April 3, 1860, in which the warm air escaping from a room through a ventilating fan or windwheel wound up a spring or weight.

Several attempts have been made to drive clocks by the expansion and contraction of mercury or metallic rods caused by the variation of temperature between day and night. One was exhibited by Coxe in London, in 1827, driven by the expansion of mercury, and the expansion of metallic rods for the same purpose and by the same means is proposed in the patent of Washburne, July 4, 1865.

A recent patent (E. Stockwell, March 2, 1876), shows a safe with a "time lock," in which the clock work is wound up by the opening and closing of the door of the safe, and the apparatus is provided with a device to prevent overwinding, no matter how many times the door may be opened after the spring is properly wound. This is something on the same principle as a French invention we saw some years since, in which the opening of the door of a wardrobe or bookcase wound up the spring of a clock connected with it, and of the watch which is wound up by the opening of the case to see the time.

Almost every one has heard of the wonders of the great clock at Strasburg, its automaton figures, etc; but few know that it has a sphere showing the precession of the equinoxes. This sphere turns once in 25,920 years! at least, we were informed so, but could not then spare the time required to wait and verify the statement.

## THE RESIGNATION OF THE COMMISSIONER OF PATENTS.

Judge R. H. Duell has resigned the Commissionership of Patents, his resignation taking effect on January 1. He leaves the position through motives similar to those which have influenced many of his predecessors, namely, to engage in the private practice of patent law, having completed arrangements, it is said, whereby he connects himself with a law firm of this city. Judge Duell's administration has been marked by much ability; and in the last annual report of the Secretary of the Interior it is stated that, during the year which he has been in charge, the income of the Patent Office has been greater and the expenses less than in any previous year in the history of the office.

Although Judge Duell explicitly states that he has had his present course in contemplation for several months, his resignation will be by many regarded as untimely, in view of the irregularities recently discovered among his subordinates. In some cases, false names appeared on the pay rolls, which were explained to be those of draughtswomen who objected to being known as Government employees; and in others, drawings given out to be made as piece work were sublet by those to whom they were entrusted to other parties. This was irregular; but, it it stated, in no case did it involve loss to the government. The objectionable practices appear to have been promptly checked by an order from the Commissioner, on his attention being publicly called to them.

Among the names of persons suggested for the Commissionership, are those of Congressman Hoskins, of New York, Mr. W. H. Doolittle, and Mr. R. L. B. Clark, Chairman of the Appeal Board of the Patent Office. It is highly important that the person selected for this very responsible position shall possess considerable legal knowledge, and be well informed on matters pertaining to the present state of the arts and of inventions, and also well versed in the practical workings of the Patent Office itself. These requirements, we think, would all be fulfilled by Mr. Clark, whom we have no doubt would make an excellent Commissioner. He is an old and experienced employee of the Patent Office, where he has attained high rank.

Since the above was in type, we learn that our old friend and former associate on the SCIENTIFIC AMERICAN, Salem H. Wales, Esq., is strongly advocated for the Commissionership. For more than one year Mr. Wales occupied the position of President of the Department of Parks, and subsequently and now for over three years has been the official head of the Department of Docks of this city. In discharging the difficult duties of both of these highly responsible positions, he has exhibited rare executive ability. In both he has been called upon to direct engineering work of magnitude, to govern the expenditure of large sums, to interpret laws, many intricate and perplexing, yet involving interests, both public and private, of the highest importance. Through his extended experience in these varied and onerous requirements, he has acquired a breadth and class of knowledge which render him exceptionally well fitted for filling the Commissionership in a manner acceptable to inventors and to the country at large.

### Osmose Plan for Blisters.

The removal of infilteration of the skin is easily accomplished, according to M. Ungerer, by osmose. He had occasion to prove this lately in having to treat an extensive scald on the hand, which resulted in a large and exceedingly painful swelling without wounds. Cold water treatment for 12 hours did not relieve the swelling in the least, and the pain was almost unbearable when the hand was removed from the water only a few seconds. He, therefore made a diffusion experiment, dipping the hand in a saturated salt solution, and the success was surprising. Though the salt solution had not the temperature of the ice water, the pain diminished almost immediately, and in 4 hours blister and pain were both entirely gone. The hand next day differed from the other only by a very slight swelling and redness.

### Neptune the Most Distant Planet.

After a long continued labor, M. Leverrier has at length, with the theory of Neptune and Uranus, completed the study of all the members of the solar system. The author's chief object was to decide the question whether there is an ultra-Neptunian planet, which might be detected, as Neptune was, by the perturbations produced by it on planets already known. The conclusion is negative; there is nothing indicating the existence of a body outside of Neptune

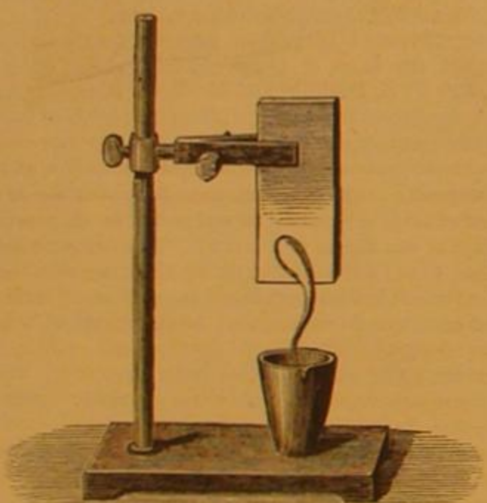
## TEMPERED GLASS.

[Our readers are familiar with the practice of hardening steel to a degree in excess of the requirements, and then reducing it the exact degree of softness which will give the required flexibility and toughness. The latter process is called tempering; and the absence of brittleness and the durability of the steel when in use is properly called its temper. In the following article, however (which we translate from *La Nature*) the noun temper is used as the equivalent of the French noun *trempe*, which properly signifies the hardening and not the reducing process; but it adequately gives the meaning of the word, if this explanation be borne in mind.—EDS.]

Fig. 1.

A substance is said to be tempered when, after having been heated, it is suddenly cooled. Ordinarily this result is obtained by plunging it while hot into a cold liquid; and the degree of temper is proportionate to the heat of the object and also to the rapidity and extent of the cooling. The effects thus produced may be partially or wholly removed by annealing. This operation, the inverse of tempering, consists in reheating the tempered material and then cooling it slowly. If it is reheated to t'e temperature to which it had previously been raised, no trace of temper remains; if it is brought to a lower temperature during a shorter time, the effects of tempering are only lessened. The remarkable properties possessed by tempered steel are well known; but generally, it is not so well understood that other bodies, such as phosphorus, sulphur, certain alloys, etc., experience on being tempered interesting modifications, some of which have been utilized in the arts.

Fig. 2.



The tempering of glass and the curious properties thus acquired by that substance was first studied during the seventeenth century, when "Batavian tears," or "Prince Rupert's drops" were first produced. These objects are now frequently made in glass works, as curiosities, and are retained by allowing melted glass to drop or extend slowly from the end of a rod into a vessel of cold water. The piece

Fig. 3.

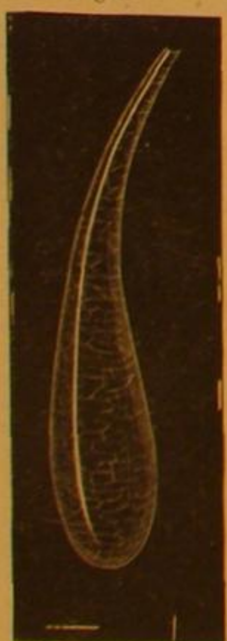


Fig. 4.

which assumes a tear or drop shape, as shown in Fig. 1, is, on cooling, broken from the rod. The curious feature about these tears is that, while they will resist the blow of a hammer on their thick portion, the breaking off of a small piece of the tail causes them at once to fly into a myriad of fragments. It has hitherto been supposed, in order to account for the above, that the exterior of the glass cooled first, and solidified, while the material within, cooling more slowly,

Fig. 5.

Fig. 6.

was prevented by its rigid envelope from contracting, and hence remained in a state of fixed dilatation. Consequently, according to this theory, on breaking the outer envelope, the

Fig. 7.

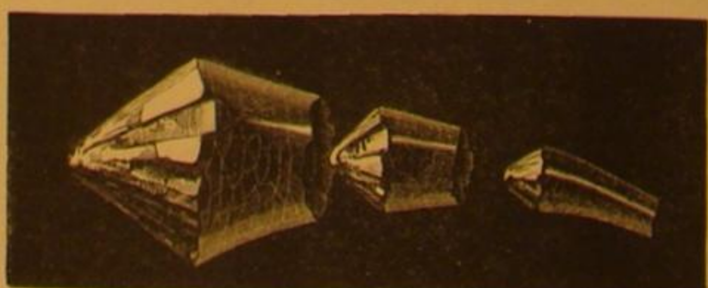
unstable equilibrium of the interior molecules would result in their disaggregation.

The investigations of M. Victor de Luynes, however, tend

Fig. 8.

Fig. 9.

Fig. 10.



to show that the effects noted are due principally to a particular state of the exterior layers of the tears, and that the interior of the mass plays only a secondary part in the phenomenon. The experimental proofs are as follows: A tear is so suspended above a platinum vase of hydrofluoric acid that only the extremity of the tail enters the liquid. As the latter eats away the glass, the drop is lowered, and in this way it is found that it is possible entirely to dissolve away the tail without determining an explosion; but when the neck (that is to say, the point of divergence of the pear-like form) of the tear is reached, equilibrium is always disturbed. Reciprocally, on introducing the large end into the acid, the layers of glass are successively eaten away, and the tear becomes completely dissolved, leaving only the tail and the point of origin, or neck, as before.

These two experiments prove, first, that the stability of the tear depends especially *on* the existence of the parts of the glass which constitute the origin of the neck, and that, as regards these parts, so long as they are kept intact, all the exterior layers of the tear may be removed without determining explosion. Hence it follows that the said layers are not necessary to the maintenence of equilibrium. By gradually destroying the enlarged portion by hydrofluoric acid the tear is reduced to a nucleus. If several rather large tears be thus treated, and if the action of the acid be arrested at different periods for each, nuclei of different sizes are obtained, of which the explosive properties vary

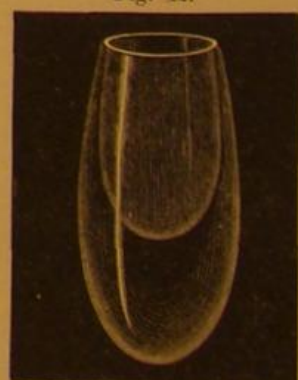
Fig. 11.

in intensity. When the tear is thick enough an inert nucleus is reached, which breaks under a shock like ordinary glass.

The tear made in the manner above described may be considered as formed by the superposition of unequally tempered and hence unequally dilated layers of glass. This dilatation of the exterior layers by the temper produces a bending or flexure analogous to that obtained by compressing the tear in the direction of its axis so as to expand it transversely. Supposing a section to be made in the tear in a plane passing through the axis, the glass in the exterior layers, which M. de Luynes terms the active ones, would be in the same state as in a plate of glass submitted to flexure; the exterior parts being dilated, the interior parts compressed, and the two being separated by a neutral stratum where the glass remains in its natural state. In the tear, the flexion would be carried to its maximum, or, in other words, the conditions would be the same as if the plate of glass were bent so that its extremities touched. All the layers extended or compressed by flexion unite at the neck of the tear; and for this reason it will be seen that, upon the unimpaired existence of the neck depends the stability of the tear; and also that, on destroying the said neck, the active layers, by virtue of the elasticity developed by the flexure are free to exercise their spring-like action to regain equilibrium, and in so doing to destroy the whole tear. If, on the contrary, the exterior layers are slowly dissolved, the neck being preserved, the layers which remain are maintained by the resistance of the interior layers, and equilibrium is not upset.

If the unequal flexions, due to the inequal-

Fig. 12.

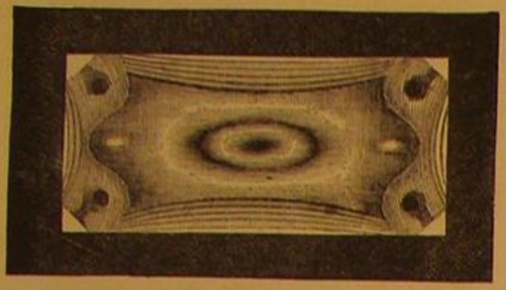


ity of temper of the exterior layers, determine rupture by their elasticity when permitted to detach themselves the molecules of glass of each layer should be displaced in inverse direction, according as the rupture takes place from the tail or from the large end; and hence there should result a difference in the arrangement of said molecules after the rupture. The central portions of a transverse section which belong to slightly tempered layers should not become displaced, while, with the molecules of the outer highly tempered strata, the reverse should be true. Hence after rupture, a trundcate cone should be produced, the summit of which should be directed either to the tail or to the large end, according as the empered layers had been set at liberty from one or the other other extremity.

In order to verify this, a tear was half inclosed in plaster, as in Fig. 2. The tail was attacked with hydrofluoric acid, and the large end was cut with a saw. After rupture, the fragments were held in place by the plaster, and their position and form could thus be conveniently studied. The tear usually remains as in Fig. 3, and on separating the fragments it is found to be composed of numerous truncated cones mutually imbedded. Fig. 4 shows a tear, the tail of which has been destroyed by acid. The summits of the cones are turned in the direction of the tail. In Fig. 5 the tear has been cut at the large end, and the summits are turned in the opposite direction to that noted in the preceding case. Finally, in Fig. 6 is shown a tear sawn through the middle, in which the summits are directed in opposite directions on each side of the point of division.

There are various other facts which tend to confirm the mode of structure already attributed to the Batavian tears

Fig. 13.



Thus, when the tear is partially attacked by the acid, the tail sometimes disaggregates simultaneously with the layers near the surface. A tear is then obtained having the form shown in Fig. 7. This is due to the manner in which the drop is produced, the tail being the prolongation of the exterior layers. In this way also perfectly inert nuclei may be obtained.

Cylindrical rods of tempered glass present phenomena similar to those shown by the tears. On heating a rod at one end it often breaks along its entire length, exhibiting a conical needle-like fracture. If more or less thick threads of molten glass be dropped in water, after the manner described for making tears, they solidify in spirals sometimes very long, sometimes greatly twisted. These threads possess very high tension, due to the temper of the superficial strata, so that, by attacking the spirals or twisted tubes with acid at one portion of their thickness, they explode like Batavian tears. On imbedding the tubes in plaster and cutting them in the middle, to the right and left of the cut will be observed the conical disposition of scales, placed in contrary directions, as shown in Figs. 8 and 9.

When the tempered threads are very fine, they are then very strongly twisted; and it suffices to plunge one extremity in hydrochloric acid to determine immediate explosion. When masses of glass are drawn out to produce cylindrical rods, there remain at the extremities pear-shaped pieces, resembling large tears and weighing perhaps 2 lbs. each. When separated from the blowpipe these fragments break on cooling, like tears cut at the large end, and present the conical fracture with the summits directed to the large extremity, as shown in Fig. 10. A piece of one of these huge tears, which had accidentally become broken, showed a curious phenomenon. On being pressed between the fingers, it became suddenly heated to about 80° Fah., the heat being probably disengaged at the moment of rupture. In Fig. 11 is represented

Fig. 14.

a tear of crown glass, broken partially at the moment of solidification. It shows the lamellar structure described very clearly.

The properties of tempered glass may be noted in any glass object which, after being highly heated, is rapidly cooled in the air. The "philosophic phial," which glass blowers often make at the extremity of their blowpipes, in order to test the quality of the glass, is an instance in point. After examination, the object, Fig. 12, is carelessly thrown on the ground, and left to cool. It will bear quite a strong blow delivered on its outside, but the dropping of any hard body into it causes it to burst into countless pieces.

The properties hitherto noted in Batavian tears, may be found in tempered glass, and they are present in degree proportional to the temper. If, however, the glass is but partially tempered, it is no longer possible to determine the degree thereof by rupture. Recourse must then be had to another characteristic presented by all tempered glass, without regard to the intensity of temper; namely, the action of the glass upon polarized light. The tempering process, by producing in the glass changes of elasticity in various directions, causes phenomena of double refraction which may be determined by the coloration manifested with polarized light. If a rectangular plate of glass, tempered by cooling in the air, is placed between two nicol prisms (turned to extinction), there are obtained, by causing the parallel rays to traverse the glass, very brilliant colorations, disposed as represented in Fig. 13. The form of these colored figures depends on that of the plate.

When objects in tempered glass are not cut with parallel faces, the direct observation of the figures under polarized light becomes more difficult. The following elegant method of observation has, however, been proposed by M. Mascart. As ordinary glass and liquid carbolic acid have very nearly the same degrees of refrangibility and dispersion, a glass rod plunged in the acid becomes almost invisible. M. Mascart puts the masses of tempered glass which he desires to observe into glass vessels with parallel sides, filled with carbolic-acid. The conditions are then the same as if the vessel and its contents were one solid block of glass with parallel sides, and the observation may be made exactly as if such were the case.

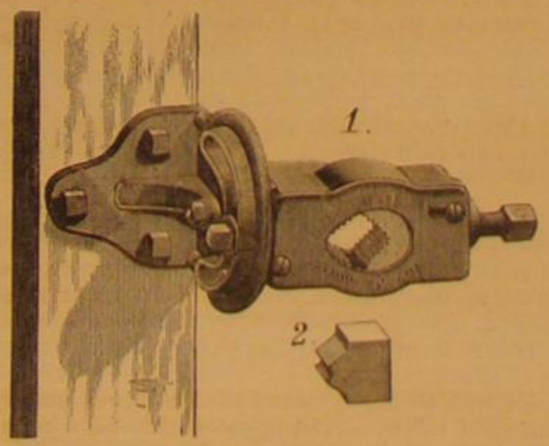
We may now subject the Batavian tear to the test of polarized light; but in order to interpret the indications which we shall obtain, another experiment will be necessary. A flat, rule-shaped piece of glass is inserted in a vise. When placed between two nicol prisms, it produces no phenomenon. Now the screw is turned down, and the glass is bent. As the flexion proceeds under the influence of the polarized light, a black band is first seen in the middle of the rule; then the edges become colored, and then numerous colored bands appear. Relax the screw; these phenomena disappear, and the normal state is regained.

We next place a Batavian tear in carbolic acid in a vessel having parallel faces. When the whole is subjected to polarized light, Fig. 14, colored bands are seen around the contour of the tear, similar to those which we previously obtained by bending the glass rule.

Thus optics prove that temper produces analogous effects to those due to mechanical action, such as flexions; with this difference, that the effects due to temper are permanent, while those which result from flexion disappear as soon as the producing cause ceases to act. Hence the study of the optical properties of tempered glass shows that it is in the same state as glass submitted to bending; and thus we reach a similar conclusion to that already based on the fracture of the glass.

### THE CENTENNIAL PIPE VISE.

The principal novel features in the new pipe vise herewith illustrated are the jaws, which are made of chilled cast iron, instead of steel, as is usually the case. The appliance is not only rendered less costly by this substitution, but, it is claimed, is much more durable.




The jaws, 2, having corrugated or fluted surfaces which come in contact with the pipe or other object held, are placed loose in the box or jaw holder, 1; and a cover which swings as upon a hinge, keeps them in position. The bench plate and the box are connected by means of two bolts, one of which is a center or swivel bolt, and the other, at a suitable distance from the said center, traverses the circular slot in the bench plate. This, when tightened, secures the vise and the object held at any desired angle.

Among the other advantages claimed is the trifling expense of repair, the cost of a new set of jaws being less than one third that of repairing steel ones. By simply opening the box cover, one or both of the jaws may be removed and new ones substituted. This is the work of a moment, and the vise is rendered as good as new. The simplicity of construction is obvious from the illustration.

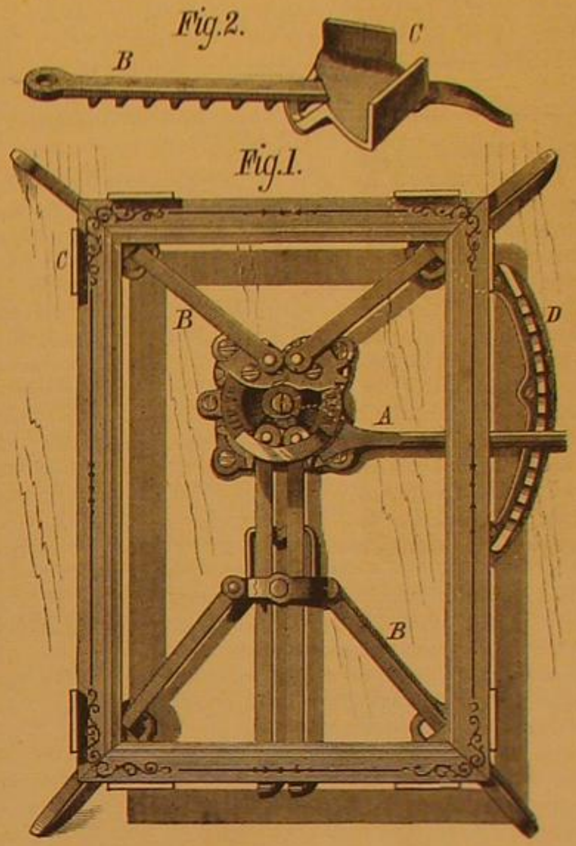
For further particulars address the Exeter Machine Works, William Burlingame, agent, Exeter, N. H., or 140 Congress street, Boston, Mass.

A NEW water and grease proof paper is obtained by saturating paper with a liquid prepared by dissolving shellac at a moderate heat in a saturated solution of borax.

### WIETING'S IMPROVED FRAME CLAMP.

We illustrate herewith a new and convenient device for clamping picture and looking-glass frames, sashes, boxes, and other work secured together at the corners by glue or nails, etc. It may also be used for holding pieces of joinery of different shape during the setting of the glue or cement.

To the bench or bedpiece is attached a metal plate, on which four lugs are cast. One lug serves as a bearing for a toothed segmental lever, A, and the others form pivots for cog-wheels, which intermesh with the segment on the lever and with each other, so as to form a connected train of gearing. On the upper sides of each of the wheels and the lever are pins, which serve as pivots for the clamping rods or stretchers, B, Fig. 2. Lastly, over the wheel a cap (broken away in Fig. 1) is secured.




The stretchers, B, are formed with lugs on their under faces, and their outer ends are bent down so as to keep the rods horizontal. On these stretchers are placed shoes, C, which are readily adjustable thereupon by the engagement of the loops on said shoes with the lugs on the stretchers. These shoes are formed with ears at right angles to each other, with an intermediate space so as to allow the ends of the corners of the frame to project beyond them. The ears are covered with leather, felt, or paper, to prevent marring the frame.

To operate the machinery, it is simply necessary to adjust the shoes, C, on the stretchers in accordance with the size of the frame, each shoe being set in relatively the same position, so as to secure a perfect square or rectangular frame. The pieces composing the frame, having glue put on their ends, are laid in their relative positions; the lever is slightly drawn, when the corners can be properly adjusted, and the lever drawn as tight as may be, and locked by the rack, D, when the frame may be nailed without danger of displacement.

Patented May 16, 1876. Machines or territory can be had by applying to A. Wieting, Fort Plain, N. Y.

### To Distinguish Bitter Almond Oil from Nitro-Benzol.

When benzol from coal tar is treated with strong nitric acid, it is converted into, nitro-benzol, a substance closely resembling in odor the oil of bitter almonds. Several methods have been proposed for distinguishing the two, one of which depends on its reduction with nascent hydrogen. The result in case of the nitro-benzol is aniline, but the test is an exceedingly difficult one to perform, except by experienced chemists.

An easier one is suggested in Wittner's *Seifenfabrikation*. A small quantity of the oil is dissolved in 8 or 10 parts of strong alcohol, adding a solution of caustic potassa equal in volume to that of the oil used, and then evaporating the mass to one half. Genuine bitter almond oil, when treated thus, forms a clear yellowish liquid, while nitro benzol is converted into a hard brown mass, over which is a clear liquid.

If an adulteration of the genuine oil with some artificial kind is suspected, this test will not suffice; but the adulteration is detected by determining the boiling point. Oil of bitter almond boils at 180° C. (356° Fah.,) and nitro-benzol at 213° C. (415° Fah.). If the oil to be tested boils at a higher temperature than 180° C., or 356° Fah., it indicates an adulteration with nitro-benzol.

This test will not of course, distinguish the new artificial oil of bitter almonds, which has the same composition as the natural, nor is there any necessity for distinguishing it.

DYEING BLUE GREY ON GAUZE.—For 22 lbs. stuff, take through a water containing 17 ozs. sulphuric acid, and rinse well; and then, at 176° Fah., through a fresh beck of $3\frac{1}{4}$ ozs. nigrosin and 2 lbs. 3 ozs. alum, and dry.

*Continued from first page.*

provements upon, the one exhibited. It has been stated that the chemical constitution of petroleum shows it to be, as a fuel, 25 per cent. superior to all other fuels. In the Brayton engine the whole products of combustion are contained in the working cylinder, thus, it is claimed, utilizing to the utmost extent the theoretical value of the fuel. In this connection, however, it may be said that, since petroleum, if consumed to practical completion, leaves a mineral residue, the combustion in this case not carried to its final limit, there remaining in the cylinder a comparatively heavy oil, which prevents the formation of a solid deposit, and which serves at the same time for lubrication. The engine is substantially and well built, and has, as will be seen, but few parts, the working parts being accessible and all under the eye of the engineer.

For further particulars address the Pennsylvania Ready Motor Company, 132 North Third street, Philadelphia, Pa.

## Communications.

### Binocular Vision.

*To the Editor of the Scientific American:*

In the SCIENTIFIC AMERICAN of November 25, I notice an article giving the history of the stereoscope; and having never seen in print any other theory of binocular vision than that contained in the article, I conclude that scientific men accept these ideas as correct. Until it can be ascertained that a person who never saw with but one eye does not see things in relief, the theory of Sir Charles Wheatstone, that a superposition of one image on another is necessary, cannot be proven. If any one closes one eye, the relief view of objects is not affected. But in this case it may be said that it is caused by the experience of previous observations. In viewing objects at a distance there is a convergence of the vision, which allows only one focussed point to be seen at a time, but each eye sees a different image as the object is viewed from two different points about two and a half inches apart, yet only one object is seen. When I was a boy I often amused myself in observing objects passing by the corn crib. If the slats are two and a half inches wide and nailed vertically, leaving spaces about one and a half inches, an object (such as a man plowing, passing in front at some distance, say a quarter of a mile) will present a very amusing and instructive spectacle to any one placed inside the crib at about eight or ten feet from the slats. The width of the slat prevents him from converging his vision. Sometimes the horses will be a great distance ahead of the plowman; in a moment the man will be at the horses' tails, then the horses will appear to have very long bodies. It is not necessary that the lenses be prismatic.

More than twenty years ago I made two stereoscopes with common lenses of six inches focus, placed two and a half inches apart from center to center, with their axes parallel. The images were pasted on the cards so that any two corresponding points were exactly two and a half inches distant. The effect was equal to, if not better than, that produced by prismatic lenses. I think the parallel vision is nearer the truth, as the rays of vision, from a base line of only two and a half inches (the distance of the eyes apart), are very nearly parallel. It seems that the small difference in the images has much to do with the unity and relief.

As this subject has been handled by men of great acumen, I feel diffidence in approaching it, but never having seen or heard of a steorscope made with ordinary lenses placed with parallel axes, this may be the means of further investigations by persons having more time, and being more competent, than your correspondent. JOHN H. HEYSER.

Hagerstown, Md.

### A Cigar Box Telegraph.

*To the Editor of the Scientific American:*

Having seen a description of Bailey's system of sea telegraphy in your SUPPLEMENT, No. 7, I recalled some experiments in that line made by myself some years ago. The manner of making the signals, though not new perhaps, was entirely original with me, and would probably interest many of your readers. The system was used at night only, and was managed in this way: A small kerosene lamp was inclosed in an ordinary cigar box, which had an opening cut through the top for the lamp chimney, and several small holes through the bottom to admit air. On the side of the box, just at the height of the flame, was cut a round opening, about four inches in diameter, and covered with glass, to keep out the wind. A shutter of suitable size to cover this opening, was then fastened to the box, by a single screw at the bottom, so that the shutter could be vibrated to or from the opening, like an inverted pendulum. A small stop was put on one side to prevent the shutter from passing the opening; while a knob near the screw served as a handle to vibrate the shutter. A light spring kept the shutter closed, so that no light was visible. My brother, who lived just one mile distant, possessed a similar box and lamp, which we used almost every night. The usual Morse code was used, and the dots and dashes were distinguished from each other by the duration of the flash. To open the shutter and close it immediately represented a dot; to open and close slowly, —say to keep it open about half a second—represented a dash.

A little practice soon enabled any one to read or transmit a message almost as rapidly as by the electro-magnetic system. At the distance of a mile the light of the small lamp, seen through the opening of the cigar box, looked like a tiny spark, but was distinct and certain. With an instrument on this principle, having a powerful lamp and reflector, I believe that messages could be easily transmitted a distance of ten miles in clear weather. Any boy can easily make and use a contrivance of this sort to amuse and instruct himself during the long winter evenings. T. C. HARRIS.

Sassafras Fork, N. C.

### Solid-Ended Connecting Rods.

*To the Editor of the Scientific American:*

It would seem that a connecting rod forged in one piece, with simply an opening in its ends for the reception of its brasses, would commend itself both for locomotive and stationary engines wherever it could be applied, as superior to the complex and costly combination of strap, gibs, and keys usually employed.

I am not aware of a single instance in our American practice where such a rod is used for the main connection of a locomotive; but solid-ended rods are used occasionally for parallel rods, and stationary engine builders are beginning to appreciate them. A good sample of such a rod was seen on the Brown engine in the saw mill at the Centennial Fair. This engine, by the way, was one of the finest on exhibition; its design, proportion, fit, and finish being excellent.

A, Fig. 1, is a side and end view of the crank end of the rod, slightly modified to adapt it to locomotive use, the one on the Brown Engine having semi-circular ends. The opening for the reception of the brasses, B, must, of course be wide enough to let the collar of the wrist, C, through it as shown; the brasses have flanges only on their inner ends, so that the rod, A, may be slipped upon them after they are placed upon the wrist. The wedge, D, may then be put in, and the steel binding plate, E, slid in to place, as shown at E, in the end view. Fig. 2 shows this plate detached from the side view; a small binder is applied at $x$, to keep the plate in its place. The wear of the brasses is followed up by the screw, F, and wedge, D; and when the wedge has reached the extent of its range, it may be returned to the position shown, and a thin steel backer inserted behind one or both brasses as the cese may require; this process of adjustment may of course be repeated until the brasses are worn out.

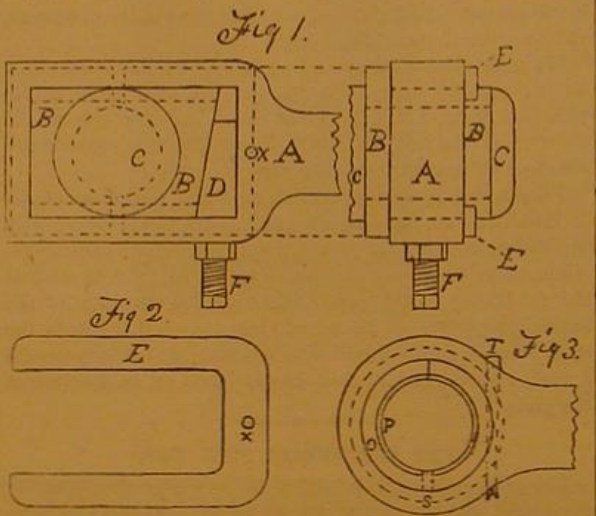



Fig. 3 shows a good substantial form for the ends of parallel rods; the outer ring, O, must be large enough to let the collar of the wrist pass easily through the eye in the rod; the ring, P, is simply a lining of hard composition, to take the wear of the wrist and to be renewed occasionally when worn out; the outer ring being secured by a taper pin, T, split at its lower end as shown. The inner ring is kept from turning by a dowel, S. The rings, being in halves, may be first placed upon the wrist, and then the rod slipped upon them, as explained above. F. G. WOODWARD.

Worcester, Mass.

### Boiler Explosions.

*To the Editor of the Scientific American:*

It is very generally conceded by scientific and practical men that the most common, if not the sole cause of boiler explosions is the allowing the water to become so low that the boiler is overheated, and then while it is in this condition introducing a large amount of water, which, coming in contact with the highly heated iron, is almost instantly transformed into steam, thereby straining the boiler to the bursting point.

Attention should be directed to the other side of the question: the prevention of boiler explosions. Lack of water being the cause of explosions, it is self-evident that a sufficiency of that element would prevent them. The care of keeping up this supply of water rests upon the engineer in charge of the boiler; and engineers are, as a rule, men who have just sufficient education to feed their vanity. They are not educated men, but are a little better informed than their fellows. Their employers, almost invariably, place a large amount of confidence in them. This confidence, taken in connection with their limited education, leads them to feel a superiority to those with whom they come into contact. In many cases it is impossible to tell them anything, for they know all things, as they think, and their evidence is the fact of their employers asking their advice. If an explosion occurs, and you ask the engineer his opinion of the cause, he does not know, he has no theory; but one thing he is positive of: The boiler was full of water a few minutes before the catastrophe occurred; and here he is at variance with all scientific men and the public generally. Such are the men by whom boiler explosions are to be prevented.

The Government has made several attempts to suppress these calamities. On the rivers, it is necessary for all boats to carry a low-water alarm connected with each boiler; and this precaution has reduced the number of explosions to a considerable extent. On land, there has been established in several places a system of inspection. Scientific practical men, who thoroughly understand this business, are employed to examine all boilers, and, in case they prove good, to give certificates to that effect; if otherwise, to have them repaired. This system of inspection has been of great advantage, especially as a means of arriving at the true cause of explosions. It has proved that the bursting of a defective boiler will produce little or no damage; that it is the exploding, the tearing asunder of a sound, well-made boiler, that sends forth the terror and destruction. It has also proved that the inspection of a boiler will not prevent it from exploding, and that such a process will not prevent the engineer from allowing the water to become dangerously low in the boiler. Some other course will therefore have to be taken, and I suggest the use of automatic water regulators and low-water alarms. I will venture to say, that there are over fifteen thousand boilers in Pennsylvania alone, yet, without a doubt, not the one-tenth part of them are using either of these safety arrangements. This is not caused by the expense, for very few owners of boilers would complain against the expense of any thing to secure safety. A very significant fact is that the greater part of the safety arrangements in use in this State are in the oil regions, and this is because there, very frequently, the owners themselves have charge of the boilers. The difficulty is that you go to the proprietor to get permission to attach an alarm to his boiler, he will very likely, in fact almost always, direct you to the engineer, or he will consult that dignitary of himself in regard to it. Of course the engineer gives a decided refusal to have anything to do with it. He knows what the machine is for, and condemns it without an examination. He would not be carrying out human nature, if he did otherwise. You insult him; you wound his vanity, by proposing such a thing as putting up an apparatus to perform the work better than he has been doing it; a machine to give out an alarm and inform against him, when not tending to his duties. You imply a probability of the boiler exploding, which, he thinks, so long as he has charge of it, there is not the least possible danger of. He gives his opinion to the proprietor, and it is taken as correct. The engineer's excuse for disliking these appliances, is that they get out of order. If any one will examine them, and their principle, he will find that they are exceedingly simple, and there is no likelihood of their getting out of order.

Are we to be subjected to the dangers of these explosions and the terrible risk of life incurred on account of the ignorance and vanity of the men who have charge of the boilers? Is is not criminal to neglect any means for the prevention of such disasters? This is a question of public interest, and should be decided by the people, or their representatives. I should like to see something done in this direction, and I am certain that there are hundreds of others who would like to see the same. E. G. A.

Monticello, Pa.

### The First Steamboat on the Mississippi.

*To the Editor of the Scientific American:*

Happening to stop at a bookstall in New York city some years ago, I picked up a tattered duodecimo volume entitled "The Navigator," printed for Cramer, Spear and Eichbaum, by Robert Ferguson & Co., of Pittsburgh, Pa., *anno* 1814. It purported to be "an accurate guide, containing directions for navigating the Monongahela, Alleghaney, Ohio, and Mississippi rivers, with an ample account of these much admired waters, from the head of the former to the mouth of the latter; and a concise description of their towns, villages, harbors, settlements, etc., with maps of the Ohio and Mississippi." The quaintness of the title, and a desire to see what was known at that day of the great Father of Waters, upon whose banks I was preparing to fix my home, induced me to invest a half dollar in the book.

"There is," says the author, or editor (whom I take to be Mr. Zadoc Cramer, as his name appears as the "proprietor of the enterprise,") "now on foot a new mode of navigating our western waters, particularly the Ohio and Mississippi rivers. This is with boats propelled by the power of steam. The plan has been carried into successful operation on the Hudson river, at New York, and on the Deleware, between Newcastle and Burlington. It has been stated that the boat on the Hudson goes at the rate of four miles an hour against wind and tide, on her route between New York and Albany, and frequently with 500 passengers on board. From these successful experiments, there can be but little doubt of the plan succeeding on our Western waters, and proving of immense advantage to the commerse of our country. A Mr. Roosewalt, a gentleman of enterprise, who is acting, it is said, in conjunction with Messrs. Fulton and Livingston of New York, has a boat of this kind now (1810) on the stocks at Pittsburgh, cf 138 feet keel, calculated for 300 or 400 tons burthen. And there is one building at Frankfort, Kentucky, by citizens who will no doubt push the enterprise. It will be indeed a novel sight, and pleasing as novel, to see a huge boat working her way up the windings of the Ohio without the appearance of sail, oar, pole, or any manual labor about her—moving within the secrets of her own wonderful mechanism, and propelled by power undiscoverable."

Whether the citizens cf Frankfort, Ky., ever "pushed their enterprise" to a successful completion, and sent their boat out to astonish the natives, is not related by our author:

but in a foot note to the edition of 1814, he says: "This steamboat (the one built by Roosewalt, in connection with Fulton and Livingston), called the New Orleans, was launched in March, 1811, descended the Ohio and Mississippi, and landed at Natchez in December, 1811, where she took in loading and passengers for the first time, and passed on to New Orleans, in which route she has been successfully employed ever since. Her accommodations are good and her passengers numerous—seldom less from Natches than from 10 to 20 at $18 per head; and when she starts from New Orleans, generally from 30 to 50, and sometimes as many as 80 passengers, at $25 each to Natchez."

The writer further states that the New Orleans had up to that time (1814) cleared over $20,000, over and above all expenses, the interest on the investment included! The cost of building is not stated; but the owners are said to have estimated the value of their "experiment" at $40,000. The writer of the note goes on to say: "The steamboat goes up in from seven to eight days from New Orleans to Natchez, and descends in two or three, stopping several times for freight and passengers. She stays at the extreme of her journey (New Orleans and Natchez), from four to five days, to discharge and take in loading. It is thought, however, by pushing her, she is capable and ought to make the trip every three weeks throughout the year, in which case her gains would be considerable more than stated; 3 weeks to each trip being 17 trips a year, four more than she performed last year."

In those days, Americans were nothing if not patriotic, and consequently we are not surprised at finding our author commenting thus upon the achievement: "When we reflect that England has had the use of steam power for upwards of one hundred years, and that it was left to Americans to apply its force to the propelling of boats against wind, tide, and the most powerful currents of our rivers, we cannot but rejoice and believe that America possesses that happy kind of superior genius, willing to embrace all the better parts of the old, and capacitated to invent new, principles."

There are other extracts that I might make which would astonish and instruct your readers. Captain Eads' plan of jetties is here proposed and urged by our author, years before Eads was born, as the only way to deepen the mouth of the river. In advance of the bulk of geologists, he boldly throws away the antiquated notions of the age of the world, and declares: "When I survey this immense work performed by the hand of Nature, I cannot accord with the views of the philosophers who are pleased to figure out the infantile state of our world. * * * On the contrary, we must grant it an incalculable antiquity!" Pretty well said for 1814! F. L. J.

Osceola, Ark.

### Aeronautics.

*To the Editor of the Scientific American:*

Your comprehensive editorial article published under date of December 2, 1876, seems to embody the latest suggestions in regard to the subject of aeronautics. The substitution of a machine sustained by mechanical force, instead of by a buoyant gas, is a mark of progress, since a car sustained by gas is, from its large size, in proportion to its carrying capacity, necessarily unwieldy, and at the mercy of the element it is proposed to navigate. That a heavy body can be sustained by mechanical force is evidenced by the flight of birds. That a heavy body can be sustained by continual circular fan motion is evidenced by the toy tin fan, which, when a certain velocity is given it, overcomes the pressure of its weight, rises, and continues to rise as long as that circular motion is, through its own momentum, kept up; and could the velocity with which it starts be maintained by some power within itself, it would be clearly self-sustaining.

The results of the experiments of the Aeronautical Society of Great Britain, noticed in the above mentioned article, afford a very satisfactory starting point from which to calculate the amount of nominal horse-power required to raise and keep supported a certain number of pounds weight. These experiments show that a plane, whose surface measures one square foot, held at an angle of 15°, against a current of air having a velocity of twenty-five miles per hour, will sustain a weight of 1¼ lbs., while the direct pressure, necessary to hold the plate against the current, is ¼ of a lb.

Assuming the result to be sufficiently accurate for purposes of experiment, the number of lbs. weight a nominal horse-power will sustain can be readily calculated. A plane at rest, and a wind velocity of twenty-five miles per hour, is equivalent to forcing a plane against still air at a speed of twenty-five miles per hour. The horse-power required to maintain a pressure of ¼ lb., at a speed of twenty-five miles per hour, would be equal to that number of lbs. (¼), multiplied by the number of feet a minute which it moves (2,200), and the result divided by 33,000, which will give a result of $\frac{1}{60}$ horse-power as the power required to sustain 1¼ lbs., or $\frac{1}{67\frac{1}{2}}$ horse-power to the pound, which is one (1) nominal horse-power to every 67½ lbs., of weight sustained.

Twenty horse-power would sustain theoretically a weight of 1,350 lbs., but, practically, probably only about 1,000 lbs., and would require two fans each 33⅓ feet in diameter, moving at a speed of 35 revolutions a minute, which, with the faces at an angle 15°, would represent a wind velocity of twenty-five miles per hour. As a proof of the power required to drive two such fans at the speed named, we have only to reverse the process and call them wind wheels and calculate the power to be derived from them, with a wind velocity equal to that produced by their motion, twenty-five miles per hour, the result will be very close to twenty horse-power.

From these figures can be seen the enormous amount of power required to be developed by apparatus which must not weigh complete—with supplies for keeping up the power driver for managing the craft, and passengers or freight—a greater number of lbs. than 67½ lbs., (practically 50 lbs.) to every horse-power such apparatus is capable of developing and maintaining. This proportion of power to weight is largely in excess of that which can be produced by any motor at present manufactured, although the steam fire engine boiler comes nearest, for furnishing the most power with the least weight. Until a motor can be devised which shall cover the required demands aerial navigation will probably remain a practical impossibility, but, given these requirements, there is every reason to believe this seemingly difficult problem can be successfully solved. In the past twenty years manufacturers of steam engines and boilers have been, each year, getting more steaming capacity and power within less space and with less weight. It is not particularly visionary to suggest that it may be in the range of possibility to make such advances in future as have been made in the past and produce a motor which shall fulfil the requirements of aerial travel.

Meriden, Conn. Charles E. Dayton.

### A Renewal of the Lactometer War.

As a general rule, when learned doctors disagree, they fight out their differences in ponderous pamphlets and periodicals, and occasionally in the lecture room, among their compeers in learning. The general public rarely pays much attention to such warfare; first, because it believes that truth is mighty and will prevail; and secondly, because the subject matter of the controversy too often soars far above the average intellect. Recently, however, a great battle, wherein the public is materially interested, has been waged in a court room; and for several days two sets of learned chemists, armed with lactometers, retorts, flasks, and libraries of authorities, have each endeavored to impress one weary judge and twelve tired jurymen with the profundity of the ignorance of their respective opponents, and the accuracy of their own views.

The case was the People against Schrumpf. Schrumpf soid milk which the Board of Health's lactometer said was watered. Scrhumpf was indicted, convicted, fined, and committed to durance vile for ten days. Such, we should explain, was the proceeding which cloaked the real case of Doremus against Lactometer, which was but a repetition of the conflict waged in the courts last spring, wherein the above much abused instrument came off, as it did this time, victorious. President Chandler appeared, as before, as champion of the lactometer, and his opinions were corroborated by many other of our most prominent chemists who have made milk an especial study. Dr. Doremus prosecuted the instrument as of old, and he also had a very respectable support.

We cannot spare space to review the enormous mass of conflicting evidence presented, nor shall we attempt to reconcile the faults or frauds alleged by one side to exist in the instruments of the other. The gist of the whole business is more easily stated. It is a fact, which we have often explained, that the specific gravity of milk may be lowered by adding either water or cream, and its density may be increased by removing the cream. Although cream is lighter than milk, it is heavier than water; and hence the addition of cream has much less effect than that of an equal amount of water; so that although the lactometer does not detect skimmed milk, it does detect the admixture of any considerable quantity of water. Now, after the most careful experiments, the Board of Health has placed the standard of pure milk at the lowest possible point, namely, specific gravity 1·029; in order that honest dealers may have every protection, and in milk of that specific gravity the lactometer is made to float at the 100° mark. If, therefore, a greater density is shown, then the milk may have been skimmed or slightly watered; if a less density is exhibited, then either water or cream has been added; and it becomes a question of probability, which no one will think much over before deciding, whether the dealer has added water or cream. The lactometer, therefore, does not and is not claimed to decide the actual value of the milk, but it does serve to indicate any considerable amount of dilution; and this view, in which the best experts agree, is now reinforced by opinions of intelligent parties. The lactometer will therefore continue to be, as it has been all along in this city, a terror to dishonest milkmen and a valuable safeguard for the community.

### Enamels for Culinary Vessels.

For enamelling cast and wrought iron vessels, the following is the method and materials most generally employed: 100 lbs. calcined and ground flints, and 50 lbs. borax, calcined and finely ground, are intimately mixed, fused, and gradually cooled. Of this 40 lbs. are mixed with 5 lbs. of potter's clay, and ground in water to a pasty mass. The vessel, first thoroughly cleansed by means of very dilute sulphuric acid and scouring with sand, is lined with a coating of this about ⅙ of an inch thick, and left for it to harden in a warm room. A new coating is next added, prepared from 125 lbs. of white glass, free from lead; 25 lbs. borax; 20 lbs. soda in crystals, which have been pulverized and fused together; ground, cooled in water, and dried. To 45 lbs. of this, 1 lb. of soda is added, the whole mixed in hot water, dried and finely powdered. A portion of this is sifted over the other coating while it is still moist, and the vessel is then dried in an oven at the temperature of boiling water, (212° Fah.) The vessel is then heated in a stove or muffler till the glaze appears. It is then taken out and more glaze powder is dusted on the glazed surface already in fusion. This enamel resists perfectly the action of dilute mineral and vegetable acids and alkalies, and does not crack or scale off from the metal.

In Germany and France the following process has lately came into use—more especially for enamelling copper culinary vessels: 12 parts (by weight) white flor spar; 12 parts gypsum, and 1 part borax, are finely powdered, ground together and fused perfectly in a crucible; when cold, this mass is again carefully ground to powder, made into a uniform paste with water, laid upon the clean metallic surfaces, dried and fused. This also gives a beautiful alabaster surface for ornamental purposes.

### Moses Refuted.

The subjoined ludicrous production, from the New York *Times*, is one of the best burlesques on the "scientific method" that have come under our notice. The hit at geologists who construct elaborate theories on exceedingly frail suppositions might well be extended to some learned professors in other branches of science, who have reared wonderful but unsubstantial fabrics of apparent fact solely from the "scientific (?) uses of their imaginations."

"A new and violent blow has just been struck at the Mosaic account of creation by the discovery of an extremely important fossil in a coffee sack at Baltimore. In the center of this sack was found the skull of a monkey. There can be no doubt as to the facts. The coffee was of the variety called Rio, and the skull was perfectly preserved. Let us dwell for a little upon the meaning of this discovery as interpreted by the principles of geology. The coffee sack was 12 (say 12½) inches in diameter, and 4 feet in height. The skull, which lay in the middle of it, was therefore 2 feet below the surface. To suppose that it was violently forced into the sack, after the latter was full, would be eminently unscientific. No one imagines that the fossil birds of the Old Red Sandstone dug down into that locality through the superincumbent strata. Nothing is more universally conceded than that fossils are always found where they belong. The animals whose remains we find in the rocks of the paleozoic, the meso-Gothic, and the Syro-Phœnician strata, belong, respectively, to those several systems. The fossil monkey skull was, therefore, deposited in the coffee sack when the latter was half full, and the 2 feet of coffee which rested upon it was a subsequent deposit. Now, it follows from this premise that monkeys existed during the early part of the Rio coffee period. It is the opinion of most geologists that the Rio coffee period succeeded the tertiary period, and immediately preceded the present period. Now, no tertiary monkeys have yet been found; but the Baltimore discovery shows that monkeys existed as early as the middle of the Rio coffee period, a date far earlier than any which has hitherto been assigned to them.

"We are now in a position to inquire what is the least period of time which must have elapsed since the skull of the Baltimore monkey was the property of a live and active simian. The answer to this question must be sought by ascertaining the rate at which coffee is deposited. It is the opinion of Mr. Huxley, based upon a long and careful examination of over three hundred garbage boxes, that coffee is deposited in a ground condition at the rate of an inch in a thousand centuries, but the deposition of unground coffee is almost infinitely slower. He has placed bags, coffee-mills, and other receptacles in secluded places, and left them for months at a time, without finding the slightest traces of coffee in them. Although Huxley does not hazard a guess at the rate of deposition of unground Rio coffee, Professor Tyndall does not hesitate to say that it is at least as slow as the rate of deposition of tomato cans. Let us suppose, as we are abundantly justified in doing, that 30,000,000 of years would be required to bring about the deposition of a stratum of tomato cans one foot thick all over the surface of the globe, an equally long period must certainly have elapsed while a foot of underground coffee was accumulating over the skull of the Baltimore monkey. We thus ascertain that the monkey in question yielded up his particular variety of ghosts and became a fossil fully 30,000,000 of years ago. Probably even this enormous period of time is much less than the actual period which has elapsed since that monkey's decease; and we may consider ourselves safe in assigning to his skull the age of 50,000,000 years, besides a few odd months.

"In the light of this amazing revelation, what becomes of Moses and his 6,000 years? It will hardly escape notice that he nowhere mentions Rio coffee. Obviously, this omission is due to the fact that he knew nothing of it. But if he was unacquainted with one of the most recent formations, how can we suppose that he knew anything about the elder rocks—the metamorphic and stereoscopic strata? And yet it is this man, ignorant of the plainest facts of geology, and of its very simplest strata, who boldly assumes to tell us all about the creation!"

### A Sinister Result of the Centennial.

While it is much more agreeable to believe that our Centennial Exposition has been attended with none but beneficial results, the fact cannot be ignored that one unfortunate consequence is just now strongly obtruding itself. To the unsettled state of politics is undoubtedly owing the check which all have remarked in the rapid recovery of business from the stagnation of the past three years; but to that cause alone cannot be laid the unusual financial stringency which prevails at the present time, most especially in agricultural districts. Reports from many sections of the country state that failures to meet obligations, among the farmers, were never so frequent; while business with that usually thrifty class of the population has rarely been more dull. It looks very much as if the people, possibly relying on the favorable indications (which appeared during the summer) of a brisk fall and winter trade, had invested their savings in Centennial excursions, and now find themselves compelled to retrench, or, in many cases, driven to the worse result of failing in their payments. There is one consolation in the fact that the money has not gone out of the country; and although the movement may remain sluggish till the new Administration is settled upon, a general revival of business will undoubtedly come in the spring.

### Stearin from Fats.

Much attention has been attracted by our recent articles on the manufacture of artificial butter, and many of our correspondents have experimented on the separation of the constituents of fatty matters. The entire separation of the stearin from the fats is, however, a difficulty with some of them, and for their benefit, and that of others, we will give descriptions of the several methods in use.

The first is the saponification of the neutral fat with lime-water and steam, or with aluminate of soda, sold under the name of *natrona* or refined saponifier. Another method is by treatment with dilute and strong sulphuric acid and steam, at a high temperature. The third method is by chloride of zinc, and by dry decomposition and distillation with superheated steam alone. Perhaps the process most commonly employed on a small scale is that of the saponification with lime or aluminate of soda. Heat (in a large, lead-lined wooden vat or tub) the fat and water in the proportion of about 10 lbs. fat to 2 gallons water, by means of steam circulating through a coil of leaden pipes in the bottom of the vat. When all the tallow is melted, add 1¼ gallons lime water containing 1¼ lbs. of lime (about 14 per cent. of the weight of tallow). Heat constantly nearly to the boiling point, with constant stirring, for from 6 to 8 hours. Run off the yellow glycerin solution, add 1¾ gallons dilute sulphuric acid at 12° Baumé (=1.086 specific gravity, containing 30 per cent. of sulphuric acid, $H_2SO_4$) to the lime soap; stir, and heat as before until the reaction is complete, shut off steam, let the whole stand to settle, draw off the fatty acids from the top into similar smaller vats, add diluted sulphuric acid and heat, draw off the fatty acids, and wash repeatedly with hot water. The quantity of fatty acids obtainable from 100 lbs. good tallow are about 94.8 lbs. The average of solid fatty acids is about 45.9 per cent.

Let the washed acids stand for some time in a fused state to eliminate all mechanically adhering water, then allow to solidify by cooling. Press out the liquid oleic acid in an hydraulic press; then put the cake in a more powerful press, and subject to pressure again; after this, it is pressed again, as before, but between warm plates. It is then fused, cast in large porcelain-lined iron moulds, of about 5 lbs. capacity each, and set by to crystallize. This is accomplished in 12 hours in winter; but in summer it requires twice the time. The crystallized cakes are placed in bags of horsehair, between plates of iron or zinc, in a hydraulic press capable of exerting immense pressure. The cakes are once more subjected to pressure in a press placed horizontally, the plates inclosing the cake being heated in this case by steam; this removes the last trace of oleic acid. The stearic acid is then melted together with dilute oil of vitriol (3° Baumé, 1.02 specific gravity), washed with water containing oxalic acid, and cast into slabs for the candle maker.

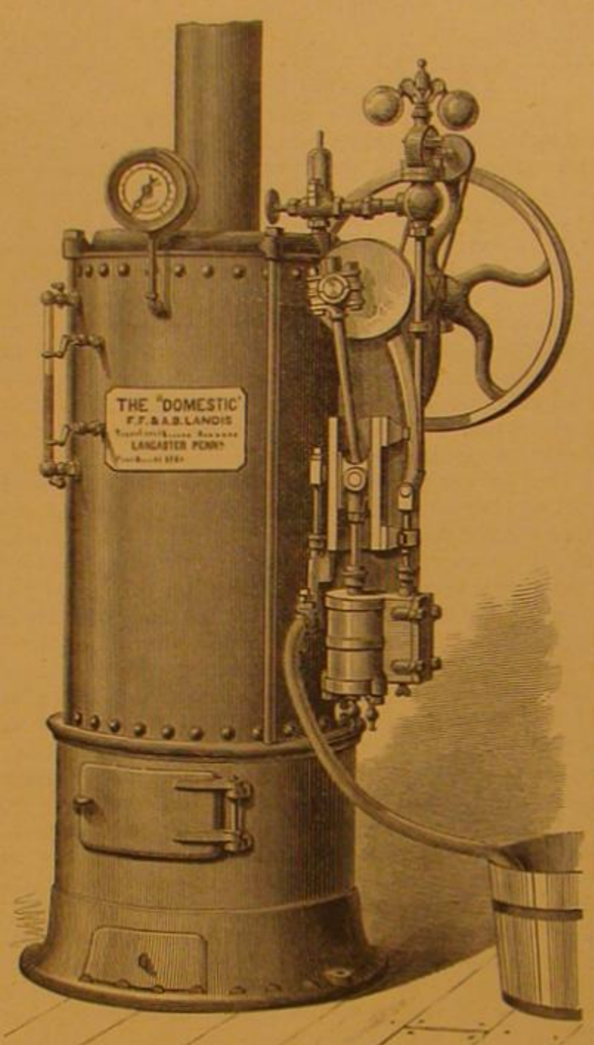
### THE TANITE COMPANY'S NEW PLANER KNIFE AND STOVE PLATE GRINDERS.

The Tanite Company's "Automatic Planer Knife Grinder," illustrated in Fig. 1, is made in three sizes: No. 1 for 24 inch, No. 2 for 36 inch, and No. 3 for 48 inch knives. This company claims to be the first to conceive and bring into use the cup wheel, by which the unequal concave grinding, caused by the wear of wheel when used on its face or edge, is avoided. In this machine, the knife is ground with a straight bevel with no change until the wheel is worn out. This apparatus stands about 2 feet 11 inches high to top of wheel, and is 3 feet wide, No. 1 being 3 feet 3 inches, and No. 3, 5 feet 8 inches, long. It has a 1½ inches steel arbor fitted with self-oiling boxes, with 3½ inches bearings; and it runs, we are informed, perfectly steadily when the wheel is making 1,500 revolutions per minute. It grinds smoothly, leaving no chatter marks upon the knife. Owing to their peculiar process of manufacture, the Tanite Company are enabled to furnish wheels that cut rapidly and with a very small degree of heat. The stove plate machine, which is represented in Fig. 2 is designed to meet the needs of stove manufacturers. It weighs about 720 lbs. The top of table, when horizontal, is 2 feet 9 inches from floor, and in area measures 24½ by 41½ inches; the front end of table can be elevated by means of a hand wheel and screw, so as to obtain, in combination with a cone wheel, any desired angle. The arbor is made of 1¾ inches steel, and has two bearings, one 6 inches, the other 8½ inches, long; and by means of the rack, pinion, and lever, it can be raised 6 inches if desired. The overhead work is very complete, the hangers having adjustable self-oiling boxes.

Both of these machines are of excellent workmanship, and of strong and durable material. For further particulars address the Tanite Company, Stroudsburg, Pa.

### THE DOMESTIC STEAM ENGINE.

A new domestic steam engine of 3 horse-power, which is furnished at a very low price, is illustrated in the engraving




herewith given. In construction, this machine embodies many advantageous features. The bed, cylinder, steam-chest, both crank shaft bearings, and the guide lug are all cast in a single piece. The bed is oval in form and hollow, and the portion on which the cylinder is made serves as a feed water heater, wherein the exhaust steam is utilized. In order to protect the crank bearings from heating, due to their proximity to the boiler, they are made of the best Babbitt metal; and a chamber is provided beneath them into which the cold feed water is forced prior to its entering the heater. The chamber also tends to keep the other parts of the engine (except the cylinder, steam chest and heater, which should of course be as hot as possible) in a cool state. The crosshead, connecting rod, eccentric strap, and rod are constructed of cast steel. The crank shaft is of cold rolled iron; the pump barrel, stuffing box, valves, and chambers are of brass, and are disposed so that easy access to the packing may be had. The valves may be reached for repacking and adjustment by slacking one set screw without removing any of the pipes. The tops of the stuffing boxes are cupped so as to prevent water and oil running down over the engine. The piston is a solid casting; and in two grooves in its face are sprung metal rings, turned eccentrically, and larger than the cylinder. This is claimed to form an excellent self-adjusting packing. Lastly, the necessary drain cocks and an efficient governor are provided.

The cylinder diameter is 3 inches; stroke, 4 inches; diameter of fly wheel, 18 inches; and weight, 65 to 70 lbs. At 260 revolutions per minute, and under a pressure of about 100 lbs. of steam, the engine develops (per dynamometer) a little over 3 horse power. It is sold as of 1½ to 2 horse power, with a working speed of 300 revolutions. It may be attached to the boiler by bolts, or to a separate post.

The boiler has a cast iron base, forming fire box and ash pit. There is a fire brick lining which, it is claimed, on becoming heated tends to consume the gas generated. Holes through the smoke bonnet above the tubes are provided, so that the latter can be cleaned without removing the bonnet. Above the bonnet is a circular plate with corresponding apertures, which are, all but one, smaller than those through the smoke bonnet. By turning the plate so that the one large hole is successively brought over the tubes, the latter may be cleaned one at a time. The small holes serve as a damper, admitting cold air into the stack, and so checking the draft, and thus avoiding the necessity of opening the fire door. The boiler has all necessary attachments, and all parts of the engine are duplicated, so that they may be easily replaced.

For further information address the manufacturers, Messrs. F. F. & A. B. Landis, Lancaster, Pa.

### Distance Indicator.

This improvement is by Captain Henry Watkin, R. A., being a hydro-clinometer designed for use in coast batteries, having a height of 90 feet and upwards above the sea level. It consists of a piece of wood about 2 feet 6 inches long, 3 inches deep and 1 inch thick. Imbedded in one side is a tube containing colored spirit, there being above the tube a scale graduated for yards. A small telescope is fixed at the top of the instrument at one end, the telescope having cross hairs similar to those in a theodolite. In using the instrument, the end furthest from the observer rests on the top of the box in which it is carried, the end next the observer, and which carries the telescope, being elevated by means of an adjustable brass arm or support. In taking a range all that is necessary is to sight the object and bring the cross hairs to cut the water line. The exact range is then ascertained by reading the figures on the scale at the level of the spirit, which gives it without any calculation whatever. The time required for the operation is about eight seconds, after which the object, if moving, can be continuously followed. After full trial, both at home and abroad, this instrument has been sealed for adoption in the British service.

Fig 1

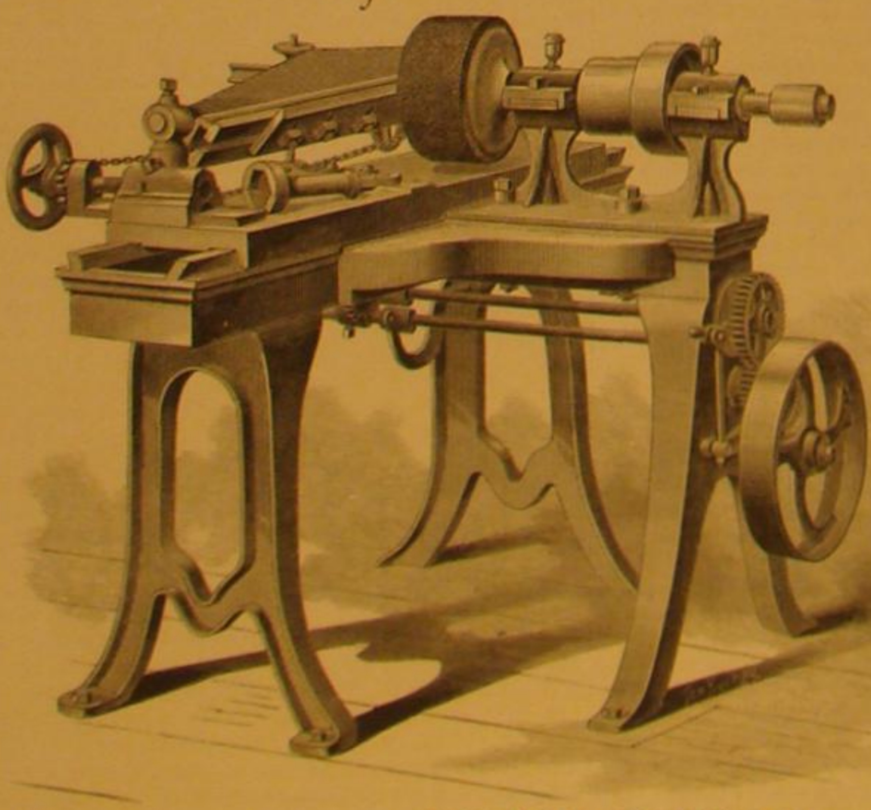
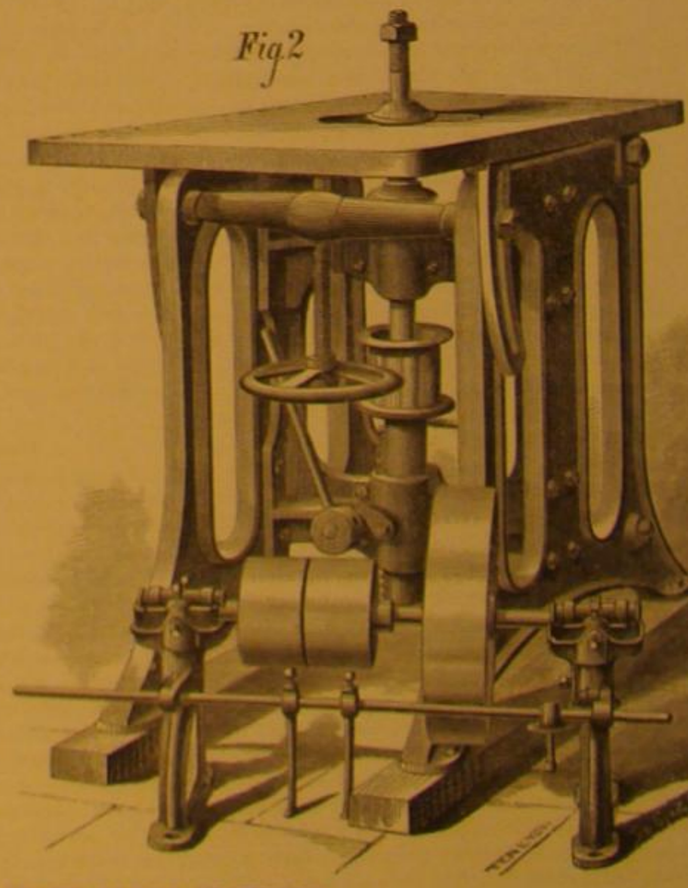


Fig 2



THE TANITE COMPANY'S PLANER KNIFE AND STOVE PLATE GRINDERS

## THE HARE AND HER FOES.

Mr. Wolf has represented in the admirable picture (which we select from his work entitled "The Life and Habits of Wild Animals,") a touching episode in the life of one of the most graceful and harmless creatures in the whole list of Nature's works. The hare (*lepus timidus* of Linnæus) has in all ages been a chosen type of speed and timidity; and from the time of the Roman empire till now, the chasing of hares has been a favorite sport. In the pursuit of these creatures, as generally practised now, called coursing, grayhounds are employed, the dogs being matched against each other in couples, and held by their collars to a catch at the end of a leathern strap. When a hare is found, and leaves her form in the grass where she prefers to make her home, after she has started some distance, the dogs are released simultaneously; and away they go with lightning speed, the devotees of the sport riding after them to enjoy the chase, and to see which favorite dog catches the hare. The pursued creature is overmatched in speed, strength and endurance; but she frequently gives the best grayhounds a long run, as she doubles with remarkable facility, turning back on her course so suddenly as to run between the dogs, who shoot far beyond her, being unable to come to a sudden stop. Hares are also hunted in the usual way, with harriers, hounds of a breed possessing speed and keenness of scent.

The eyes of the hare are large and prominent, and its vision extends in all directions at once; its senses of hearing and smell are very acute. Hares generally remain quiet during the day in the form or seat, as it is called, which is generally a depression in the ground in a meadow. In the evening they chase each other and gambol over the fields, and manage to get food enough for the day's support; and the neutral color of the animals so closely resembles that of the soil that they readily escape observation after sunset.

The hare shown in our illustration has been wounded in the foot, perhaps by a stray pellet from a sportsman's gun; and unable to proceed farther, she crouches under a leafless bush. But the whiteness of the snow soon reveals her whereabouts to the pursuing crows; and a few of these strong *omnivora* will soon peck the poor creature to death. The crows depicted are of the hooded variety (*corvus cornix*, Linnæus); they have black heads, forenecks, wings, and tails, with purplish blue and green reflections; the rest of the plumage is ash gray in color, tinged with purple. This crow occurs in all parts of Europe, being common in the north of Scotland; its favorite food is fish and molluscs; and when unable to break the shells of the latter with its beak, it will carry them to a great height and drop them on a rocky spot. Its ordinary flight is slow and regular, and its gait upon the ground remarkably sedate and dignified.

HUNTED DOWN.

### Simple Apparatus only Necessary.

We hear so much nowadays about the elaborate outfits of scientific apparatus, wherewith this or that college is provided, while so many ingenious devices, with names ending in "graph," "scope," and "meter," are constantly being invented, that we are half inclined to think that more attention is being paid to the tools than to the work which they are designed to accomplish. Apparatus may be divided into two classes; first, that used for purposes of investigation; and second, that employed to demonstrate the laws of science or the results of investigations to others. In either case, the simpler the tools the better; for in the one the investigator wishes little to hamper him in his pathway toward the result he searches for, and in the other the idea is to impress principles on the mind, and not to burden it with unnecessary details.

The student of the lives of the great inventors and discoverers will find that they almost always preferred the most primitive devices for working out their ideas, and for illustrating their meaning in giving explanations. Faraday's first electrical experiments were conducted on a machine which he himself made with a glass phial; and his lectures to children were models of extemporaneous speaking, illustrated by experiments, made with the simplest materials. His discourses on a candle are admirable disquisitions on heat and combustion. Tyndall, from a piece of ice, evolves a wonderful story. The late Professor Graham offered in himself a still more striking example of how genius of the right sort can work with the very simplest means. A recent biographer says that, "with a glass tube and plug of plaster of Paris, Graham discovered and verified the law of diffusion of gases. With a tobacco pipe, he proved indisputably that air is a mechanical mixture of its constituent gases. With a tambourine and a basin of water, he divided bodies into crystalloids and colloids, and obtained rock crystal and red oxide of iron soluble in water. With a child's India rubber balloon filled with carbonic acid, he separated oxygen from atmospheric air, and established points the importance of which, from a physiological point of view, it is impossible to overrate. And finally, by the expansion of a palladium wire, he did much to prove that hydrogen is a white metal."

### Pressing Cotton in Vessels.

A new system has been recently adopted in this city by shippers of cotton which is said to prove thus far successful. The cotton is first pressed in a compressing machine, and bound with iron bands, as is usual with all cotton cargoes. The bales are then put into the ship, side by side, and pressed longitudinally into their places by a patent hydraulic machine. They thus get a pressure both ways, and it is this second pressure that makes the saving of room. The entire cotton cargo thus forms a compact mass in the hold, and its weight is proportionately so much greater than ordinary cotton cargoes that the necessity for ballasting the ship is obviated. It is claimed that about one-fourth more cotton can be packed in vessels' holds by this means than formerly.

### Ingenious Advertising.

Visitors to the Centennial will doubtless remember that one of the sewing machine exhibitors in Machinery Hall, whose display occupied a very prominent position on a principal aisle, kept posted, during the continuance of the Exposition, a large sign, inviting all comers, and especially those who owned sewing machines, to inscribe their names in a handsome register. The inducement offered was that, after the close of the Exhibition an elegant sewing machine would be presented to some one of the signers, and all would have equal chances in drawing for the prize. Of course the effect of this was to attract hundreds of people toward this particular exhibitor's display; and thus his goods were brought into especial prominence. But that was merely a secondary object. A very large percentage of those who stopped to read the sign wrote their names, and told the kind of sewing machine they were using. Then a neat certificate was presented in return, which established the signer's claim to one share in the drawing. In this way thousands—perhaps tens of thousands—of names of sewing machine users were obtained. We always found a crowd about the book, often large enough to partially block the passage.

Now that the Centennial is over, the shrewd sewing machine concern is reaping its rich reward, and at the same time is firing hot shot into its competitors. To every individual on that register circulars are sent in which each person is informed that No. 20,561 drew the prize, and that the fair winner is of course "delighted with her good fortune." Then the reader is told that to him or her, and to all other signers on the book, and to them only (there is an air of severe justice and unrelenting discrimination about this), the so-and-so machine will be sold at half price, and in addition the purchaser will be presented with a "Centennial souvenir," in the shape of a set of lithographed figures of the buildings. He is also advised: "If you have an old machine, it will be to your advantage to sell it now, and get the so-and-so." Of course, the recipient of this wise counsel is impressed with the inestimable advantages, which are his merely through his fortunately happening to sign his name during his Centennial visit.

There is a furniture dealer somewhere out West to whom it would be unfair not to give credit while on this subject of ingenious advertising. He issues circulars to all the church sextons, requesting them to send to him, just as soon as they learn of a marriage, the names of the happy pair. On receipt of this information, the agents of the furniture man are hurled upon the innocent and defenceless couple; and on sales being effected a neat percentage goes to the sexton. The same enterprising person prints business cards across marriage licenses, and furnishes them to town clerks; and among the names of other household furniture, the words "cradles" and "children's chairs" are prominently displayed. Some years ago, there was (and probably still is) a custom in some New England towns of tombstone agents appearing at the house of mourning within a few hours after a funeral; and they would, tearfully and in a sympathetic manner, solicit an order for a memorial marble to the "dear departed." While some of the above-described methods of increasing business are perhaps objectionable, they lack the promptitude and persistency of the lightning rod man, who starts when the storm commences, and pervades the whole town before the clouds have dispersed.

A NEW plan for protecting safes is to enclose them in wire netting, so connected with a battery and bell that the division of any portion of the wire ruptures a circuit, and the bell gives the alarm.

### HOW TO ADJUST LINE SHAFTING.

A correspondent asks us for some accurate method of lining shafting, and says that for want of knowledge upon the subject, his shafting runs out of true; and as results, the belts have an unequal tension upon them, the bearing boxes get heated, and the couplings get loose, giving him constant trouble. As we have from time to time received a number of similar communications, we give the following information upon the matter.

There are several methods of lining line shafting, and some of them are found to be decidedly defective in practice. One of the most common of these is that of hanging plumb lines over the shaft, and then streching a line, parallel with the line shaft, but near the floor, and then adjusting the line shaft until the plumb lines are all equidistant from, or have precise and equal contact with, the stretched line, thus accomplishing the horizontal adjustment. This is a crude and troublesome operation for several reasons, among which may be mentioned the fact that it is difficult to measure between such lines when they are long, and that, as the line shaft is moved during adjustment, the plumb lines sway about, involving the necessity of some one to steady them. They are furthermore in the way; and the contact by swaying of a single one with the stretched line interferes with the whole operation. For the vertical adjustment a spirit level alone

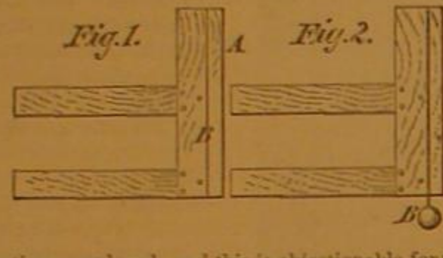


Fig. 1. Fig. 2.

is sometimes employed; and this is objectionable for the reasons, among others, that there is nothing to guide the operator as to whether the part he begins at, and which we will suppose requires to be adjusted, should be lifted at the one end or lowered at the other, in order to make an adjustment suitable to the general line of the shafts. He may it is true first test the whole line of shaft, and make a note of the result arrived at at each testing place, using the notes as a guide to the readiest method of adjustment. It is better, however, in every respect, to adopt the plan here recommended, which is as follows: First prepare a number of rude wooden frames, such as are shown in Fig. 1. They are called targets, and are pieces of wood nailed together, with the outer edge face, A, planed true, and having a line marked parallel with the planed edge and about ¾ inch inside of it. This is intended for use as a guide, in conjunction with the plumb line shown in Fig. 2, attached at B. The next proceeding is to stretch a line parallel with, but vertically below the line of shafting, sufficiently to clear the largest hub upon any of the pulleys on the line of shafting, as shown in Fig. 3, in which A, represents the shafting, B the largest pulley hub, and C the stretched line. In adjusting this line, we have, however, the following considerations: If the whole line of shafting is parallel in diameter, we set the line equidistant from the shafting at each end. If one end of the shafting is of larger diameter, we set the line further from the surface of the shafting, at the small end, to an amount equal to one half of the difference in the two diameters; and since the line is sufficiently far from the shafting to clear the largest hub thereon, it makes, so far as stretching the line is

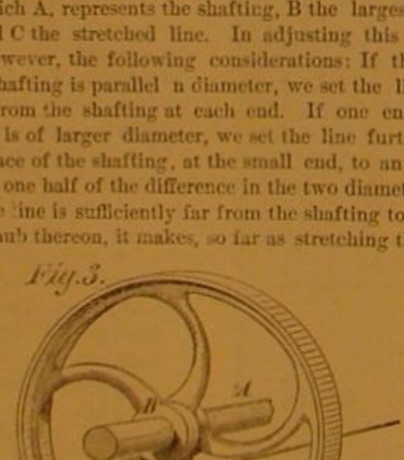


Fig. 3.

concerned, no difference of what diameter the middle sections of shafting may be. The line should, however, be set true as indicated by a spirit level.

We may now proceed to erect the targets as follows: The planed edge, A, in Fig. 1, is brought true with the stretched line and is adjusted so that the plumb line, B, in Fig. 2, will stand true with the line or mark, B, in Fig. 1. When so adjusted, the target is nailed to the post carrying the shafting hanger. In performing this nailing, two nails may be slightly inserted so as to sustain the target, and the adjustment being made by tapping the target with the hammer, the nails may be driven home, the operator taking care that driving the nails does not alter the adjustment. In Fig. 4, A A represents the line of shafting, B B, two of the hanger posts, and C C, two of the adjusted targets.

Having adjusted and fixed in the manner above described a target to each of the posts supporting a shafting hanger, we may remove the horizontal stretched line, and take a wooden straight edge long enough to reach from one post to another. Then beginning at one end of the shafting, we place the flat side of the straight edge against the planed edge of two targets at a distance of about 15 inches below the top of shafting; and after leveling the straight edge with a spirit level, we mark (even with the edge of the straight edge) a line on the planed edge of each target; and we then move the straight edge to the next pair of targets, and place edge even with the mark already made on the second target. We then level the straight edge with a spirit level, and mark a line on the third target, combining until we have marked a straight and horizontally level line across all the targets, the operation being shown in Fig. 5, in which A A represents the line of shafting, B B, the hangers, and C C, the targets. D represents the line on the first target, and E, the line on second. F is the straight edge, levelled ready to form a guide whereby the line, D, or target, may be carried forward, level and straight, to target 3, and so on across all the targets. The line thus marked is the standard whereby the shafting is to be adjusted vertically; and for the purpose of this adjustment, we must take a piece of wood or a square such as is shown in Fig. 6, the edges, A and B, being true and at a right angle to each other. The line D, in Fig. 5, marked across the targets being 15 inches below the center line of the shaft at the end from which it was started, we make a mark upon our piece of wood the line C, in Fig. 6, 15 inches from the edge, A (as denoted by the dotted line in Fig. 6); and it is evident that we have only to adjust our shaft for vertical

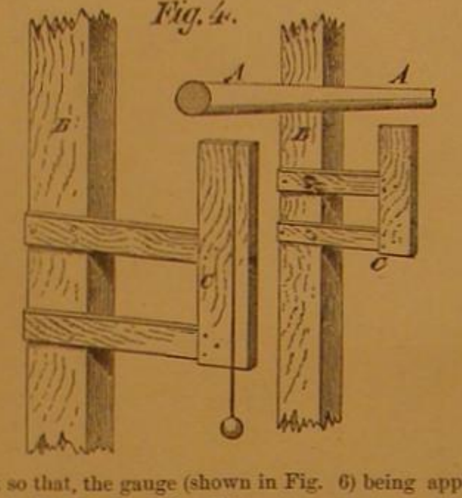


Fig. 4.

height so that, the gauge (shown in Fig. 6) being applied as shown in Fig. 7, the shaft will be set exactly true, when the mark, C, on the piece of wood comes exactly fair with the lines, D, marked on the targets.

For horizontal adjustment, all we have to do is to place a straight edge along the planed face of the target, and adjust the shaft equidistant from the straight edge, as shown in Fig. 8, in which A is the shaft, B the target, C the straight edge referred to, and D a gauge. If, then, we apply the straight edge and wood gauge at every target, and make the above described adjustment, the whole line of shafting will be set level and true.

There are several points, however, during the latter part of the process at which consideration is required. Thus, after the horizontal line, marked on the targets by the straight edge and used for the vertical adjustment, has been struck on all the targets, the distance from the center of the shafting to that line should be measured at each end of the shafting; and if it is found to be equal, we may proceed with the adjustment; but if, on the other hand, it is not found to be equal, we must determine whether it will be well to lift one end of the shaft and lower the other, or make the whole adjustment at one end by lifting or lowering it as the case may be. In coming to this determination we must bear

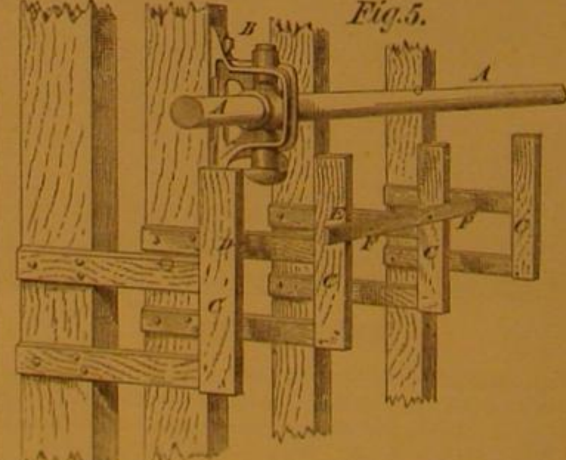


Fig. 5.

in mind what effect it will have on the various belts, in making them too long or too short; and when a decision is reached, we must mark the line, C, in Fig. 6, on the gauge accordingly, and not at the distance represented in our example by the 15 inches.

The method of adjustment thus pursued possesses the advantage that it shows how much the whole line of shafting is out of true before any adjustment is made and that without entailing any great trouble in ascertaining it; so that, in making the adjustment, the operator acts intelligently and does not commence at one end utterly ignorant of where the adjustment is going to lead him to when he arrives at the other. Then, again, it is a very correct method, nor does it make any difference if the shafting has sections of different diameters or not; for in that case, we have but to measure the diameter of the shafting, and mark the adjusting line, represented in our example by C, in Fig. 6, accordingly, and when the adjustment is completed, the center line of the whole length of the line of shafting will be true and level. This is not necessarily the case, if the diameter of the shafting varies and a spirit level if used directly upon the shafting itself. In further explanation, however, it may be well to illustrate the method of applying the gauge shown in Fig. 6, and the straight edge, C, and gauge, D, shown in Fig. 8, in cases where there are in the same line sections of shafting of different diameters. Suppose, then, that the line of shafting in our example has a mid section of 2¼ inches diameter, and is 2 inches at one, and 2½ inches in diameter at the other end. All we have to do is mark on the guage, shown in Fig. 6, two extra lines, denoted in Fig. 6 by D and E. If the line, C, was at the proper distance from A, for the section of 2¼ diameter, then the line, D, will be at the proper distance for the section of 2 inches, and E at the proper distance for the section of 2½ inches diameter: the distance between C and D,

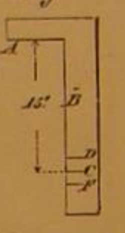
Fig. 6.



Fig. 7.

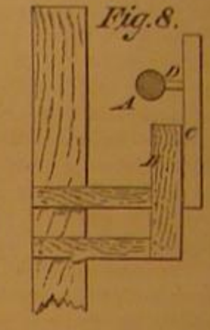


Fig. 8.

and also between C and E, being ⅛ inch, in other words, hale the amount of the difference in diameters. In like manner for the horizontal adjustment, the gauge piece shown at D in Fig. 8, would require when measuring the 2¼ inches section, to be ⅛ inch shorter than for the 2 inches section, while for the 2½ inches section would require to be ⅛ inch shorter than that used for the 2¼ inches section, the difference again being one half the amount of the variation in the respective diameters. Thus the whole process is simple, easy of accomplishment, and very accurate.

If the line of shafting is suspended from the posts of a ceiling instead of from uprights, the method of procedure is the same, the forms of the targets being varied to suit the conditions. The process only requires that the faced edges of the targets shall all stand plumb and true with the stretched line. It will be noted that the plumb lines (shown on the target in Fig. 2, at B) are provided simply as guides whereby to set the targets, and are put at about ¾ inch inside of the planed edge so as to be out of the way of the stretched line. It is of no consequence how long the stretched line is since its sag does not in any manner disturb the correct adjustment

### Bewitched Engineers.

It is luckily not often that we learn of such an exhibition of silly superstition as the performance of one Latimer has lately evoked from the Civil Engineers' Club of the Northwest, in Chicago. Latimer is not an every-day seventh son of a seventh son, born under an eclipse, who restores lost articles and predicts marriages (with photograph of future spouse), and who invites you to send one dollar and a lock of your hair—ladies half price. He is a specialist in the business, and devotes himself exclusively to the divining rod branch. The club recently had a collective interview with him. After working himself into a proper clairvoyant state, he lucidly explained that "from every substance in nature, there are thrown out emanations at an angle of 45°, and that according to the affinity between such emanations and a substance on the rod, so will the latter be more or less influenced." With a perspicuity unusual in oracular utterances, he added that "the moving force is magnetism;" and that when he insulates himself, there is no movement in the rod.

So vastly was the club impressed with the superhuman information it had received (doubtless free, in consideration of the advertising of the *séance* in the club's organ, the Chicago *Engineering News*, whence we quote *verbatim*) that the members "became so absorbed in the fascinating occupation of wandering gravely about the room with forked twigs in their hands, sometimes advancing, and sometimes retreating; but always with eyes closely fixed on the mysterious rod which each clutched with all the strength of his fingers, that a formal adjournment was forgotten, and the meeting finally broke up as train time approached. A committee, however, was appointed to arrange for a series of complete tests by which the most skeptical might be convinced that a new and valuable scientific fact awaited only investigation to become recognized and utilized."

There is evidently a good opening for sane civil engineers in Chicago.

### A Toad-Eating Fly.

Nature, among those occasional odd freaks wherein she seems to overturn her own laws, often reverses in the strangest manner the conditions of destroyer and prey. Toads, it is well known, live on insects, and for this reason are valuable aids to gardeners and farmers in protecting their crops. Lately there has been discovered an insect which lives on toads, and which afflicts those reptiles in a way that suggests the concentrated revenge of the whole insect class. It deposits its eggs on the eyes of the toads; and the *larvæ*, in the form of minute white worms, devour not only these organs, but the nose and jaws of the unfortunate batrachian. Curiously enough, the toads do not seem to suffer, but continue their usual habits apparently undisturbed. The name *lucilia bufonivora* has been given the fly.

## THE LOUISVILLE WATER WORKS.

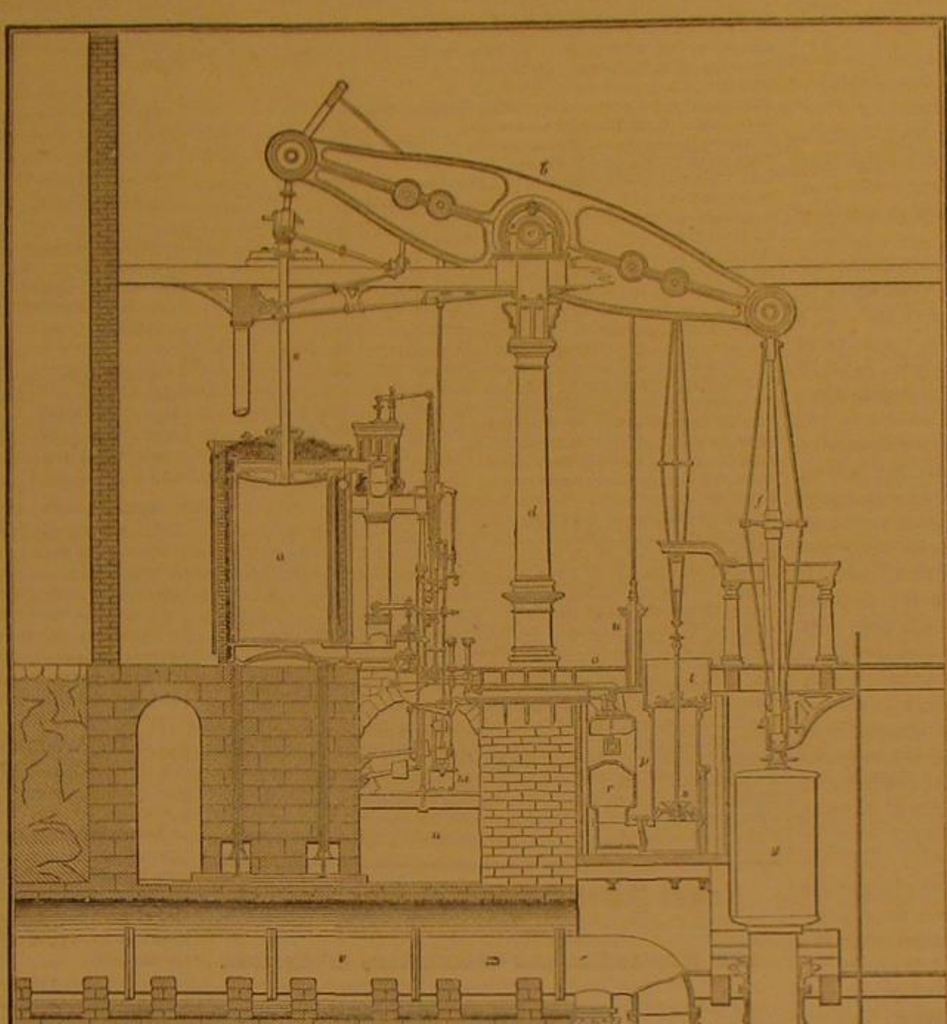
The large pumping engines of the city water works of Louisville, Ky., are on the Cornish plan. They are exactly alike, each working a single-acting lift and force plunger pump. The dimensions of the principal parts of the engines and pumps are as follows, namely: Steam cylinder, *a*, 70 inches diameter, stroke of steam piston 10 feet. The beam, *b*, for each engine is double; the two members, 3 feet 5 inches apart from center to center, are each 31 feet 10 inches long between end centers, 6 feet 9 inches deep in the middle, with 3 inch thickness of web, and 9 inches width of center rib and outside flanges; the cylinder and pump ends of the beam are equal in length; each pair of beams weighs 42 tuns. The beam vibrates on a main center or shaft, *c*, 20 inches diameter, 9 feet 8 inches long, with journals 15 inches diameter, and 19½ inches bearing. The plummer blocks, for the beam center of both engines, rest in pedestals bolted to a massive cast iron entablature, which (extending transversely across the house and into the brick walls) is supported by four Tuscan columns, *d*, of cast iron, standing on and anchored to the beam wall, by means of arched cast iron bedplates, built in the masonry. The piston rods are guided by parallel motions, and the pump connecting rods by cross-heads and slides; piston rods, *e*, 6½ inches diameter and 16 feet long each; pump connecting rods, *f*, 8 inches diameter and 28 feet long each.

The pump barrels are 36 inches in diameter each, plungers 36 inches diameter, with stroke same as steam piston, 10 feet. The extreme lift of the pumps, when the river is at its lowest stage, is 21 feet 10 inches. The pumps are connected with the standpipe by two lines of 40 inch flanged pipes, provided each with a stop gate near the standpipe. The pump valves, *h h*, are of the kind known as Harvey and West's double belt valve. The pumps and pump mains to the standpipe have a circular water way of 40 inches diameter throughout, thus admitting the introduction of pump barrels 40 inches in diameter, and increasing the present pump capacity 23 per cent whenever the consumption of water will demand a greater supply than at present provided for.

The metal (cast iron) of the pumps and pump mains is from 2 to 3 inches in thickness, varying as the forms vary from the cylindrical to the oval or rectangular. All the joints are made with lead by means of flanges and bolts; the flanges are from 2½ to 3 inches thick, and from 4 to 6 inches wide, with 1¼ inch bolts.

Each engine is provided with a battery of three single flue Cornish boilers. The performance of the engines has been very satisfactory. The highest daily duty (calculated by the Cornish method) was 48,363,344 lbs. of water raised 1 foot high per 100 lbs. coal; the highest monthly average was 35,957,629 lbs., and the yearly average duty 30,217,865 lbs. Cost of the engines and connections complete, $117,753.64.

The cataract, *m*, is in the vault, *n*; the condenser and air pump are in the well below the main floor, *o*, of the engine house, *p* is the cistern, *r* condenser, *s* bucket of air pump, *t* hot well. *w* is the induction waterpipe at the foot of the pump stock, *v* the eduction main, *u* the feed pump.



PUMPING-ENGINE, LOUISVILLE WATER-WORKS.

(*Theodore R. Scowden, Engineer.*)

## Constructive Use of Wood.

The main stay of constructive woodwork is the mortise and tenon. A piece of woodwork which can be put together without glue, nails, or screws, and serves its purpose, is an ideal work of construction; but this is not always possible. Another principle of construction is that every piece of wood should be so placed that it can swell or shrink without injuring itself, or displacing any other piece. This is maintained in an ordinary panelled door, provided no mouldings are inserted. Still another principle is that mitre-joints should be avoided, whether for moulded work or not, for the reason that shrinkage causes all mitres to open. No piece of wood should be used unless the straight grain of the wood can be seen through its full length in one place. Inserted mouldings should be avoided as far as possible; and all mouldings for panel-work should be worked on the styles and rails. It is a general principle, observed in the best mediæval joinery, that all mouldings on rails which are horizontal should butt against the styles; and that styles should be either plain, or should have mouldings stopped before reaching the joints with the rails. In practice all rail mouldings may be worked the whole length of the stuff used; and, if muntins (which are the middle styles) are used, the mouldings may be cut away to the square wood before the mortise is cut which is to receive the tenon of the muntin. Thus the mouldings will butt against the square sides of the muntin. All the parts for a door thus made can now be got out by machinery, and the door will be fully constructive in every sense of the word. There is no obstacle to this in the way of cost. The dovetail is a constructive device; and the dowel is admissible in places as a substitute for the mortise and tenon. Tongue and grooving is a legitimate device, both for ends and sides of boards. Bevelling the edges of the pieces thus joined is better than beading. The best way to construct large panels is to make them of narrow strips, tongue and grooved, and bevelled at the joining edges. Such panels will never "draw." The shrinkage will be divided between all the joints. Solid table-tops should never be fastened with glue or screws, but should be secured with buttons fastened to the under side of the top, which travel in grooves cut in the framework to allow for expansion and shrinkage. These are but few of the principles to be observed in doing the best woodwork.

In all kinds of lumber, the heart should be rejected. All boards cut on a radius from the center to the periphery of a tree will remain true, while all others have a tendency to warp or check. The first are called "quarter-sawn." It is a peculiarity of oak that the best grain is found in quarter-sawn boards. It is only in these that the "silver-grain" is seen. This consists of a ribbon of very hard substance which grows out from the center of the tree. It is for this reason that oak is the most enduring wood: it has a grain two ways. All woods check in the direction of a radius from the center. Quarter-sawn oak cannot check.—*Andrews' Guide to Church-Furnishing.*

To MAKE a good varnish for gun barrels, take shellac 1 1-2 ozs., dragon's blood 3 drachms, rectified spirit 1 quart. Apply after the barrels are browned.

## NEW YORK ACADEMY OF SCIENCES.

The regular monthly meeting of the chemical section of this society was held at their rooms, 64 Madison avenue, on December 11, Dr. J. S. Newberry, President, in the chair. Professor A. R. Leeds, of the Stevens Institute of Technology, read a paper entitled

A NEW TEST REACTION OF ZINC.

While testing before the blowpipe a new mineral from the Franklin zinc mines of New Jersey, Professor Leeds discovered that the reaction for zinc, when this metal is present in silicates in minute quantities, is much more easily obtained by the use of fused sodic chloride of sodium than with sodic carbonate. This is due to the greater volatility of zinc chloride over the oxide. The green color with cobalt was not readily obtained unless the assay itself were moistened with cobalt instead of the coating. It will be noticed that the number of blowpipe reagents is gradually increasing, and the tests are becoming more satisfactory and delicate.

NOTES ON THE ULTIMATE ANALYSIS OF CRUDE PETROLEUM

was the title of a paper by Professor S. F. Peckham, read by Professor Leeds, Chairman of the chemical section. The author stated his troubles in obtaining satisfactory results by combustion of crude petroleum with oxygen and oxide of copper, and how he overcame them. Instead of using the ordinary bulb for holding and weighing the liquid, he used a glass tube drawn out into capillary tubes at both ends, so that the liquid could be drawn up into it without being heated. The oil was placed in a platinum boat, and over it a brush of asbestos, which had been soaked in nitrate of copper and ignited, and thus covered with oxide of copper. Oxygen gas was employed in the combustion. Care is necessary to avoid violent explosions.

INDIUM IN AMERICAN BLENDES.

A paper on this subject, by Professor H. B. Cornwall, of Princeton, was also read by the Chairman of the section. The author has devoted much attention to the spectroscopic examination of American blendes for indium, and in several cases his labors have been crowned with success. In the *American Chemist* for January, 1873, he mentions several blendes then examined, in one of which, that from Roxbury, he found a considerable quantity of this new metal. In the present paper, he mentions several others in which traces of it have been detected, especially some from the far west

Professor A. R. Leeds read a paper on the

CHEMICAL LITHOLOGY OF THE ADIRONDACKS,

and exhibited polished specimens of rock brought from the summit of Mount Marcy. The chemical study of the composition of rocks is a tedious and laborious one and Dr. Leeds and his assistants deserve great credit for their persevering labors, although the details are not such as to be of popular interest. Among other analyses reported was a quantitative one of basalt, in which eleven constituents were determined, including titanium.

The following papers were read by title: "Descriptions of New Noctuæ, with remarks on the variations of larval forms in the group," by A. R. Grote, of Buffalo, and "An Index to the Literature of Titanium, from 1789 to 1876," by E. J. Hallock, of Columbia College.

The section on mineralogy met at the School of Mines, in 49th street, on December 18. Professor T. Egleston read a paper on the

SMELTING OF NATIVE COPPER

at Lake Superior. Dr. Bolton and Mr. Julian gave a sketch of a mineralogical tour in Western North Carolina, accompanied by the exhibition of a great number of specimens.

ON December 29 ult., a terrible accident happened on the Lake Shore and Michigan Southern Railroad. The train fell through an iron bridge near Ashtabula, Ohio, the cars falling 75 feet. There were 175 persons on the train, of whom between 30 and 40 were killed outright. The wrecked train, as usual, caught fire, and the cars, etc., were totally destroyed.

FOR a cement for fixing metal letters to glass windows, take copal varnish 15, drying oil 5, turpentine 3, oil of turpentine 2, liquefied glue 5 parts. Melt in a water bath, and add dry slaked lime 10 parts.

### Salicylic Acid in the Household.

Dr. Von Heyden gives the following directions for using this newly introduced antiseptic in the preservation of food, and for other purposes in domestic economy:

1. Raw meat: It frequently happens, especially in the warm season, that meat which is otherwise faultless emits an unpleasant smell on boiling. This is often the case with certain kinds of meat, like tongues, etc., which contain readily decomposing particles of fat and blood. This is easily remedied by laying the meat, before cooking, in warm water which contains from half to one teaspoonful of salicylic acid to the quart; or by putting a little acid in the water in which it is boiled.

To protect meat from spoiling for a few days either of the following methods may be employed: Place it in water containing from ½ to 1 teaspoonful of acid in a quart of water; or rub it with dry salicylic acid, especially near the bone and fat. The manner of keeping it, as well as the previous cleansing, is as usual. Although raw meat, when treated with salicylic acid, loses its fine red color on the surface, it suffers no change within. The meat also cooks soft in a short time. It is also advantageous to add 1½ teaspoonful of the acid to a quart of brine used in pickling meats.

2. Pure cow's milk: The addition of ½ to 1 teaspoonful to a quart (or about ½ to 1 gramme *per liter*) of dry crystallized acid—not in aqueous solution—prevents curdling for 36 hours longer than otherwise, and yet it retains the property of yielding cream and butter perfectly.

3. Butter: If butter be worked with water containing one teaspoonful of acid to the quart, and kept in such water, or packed in cloths soaked in an aqueous solution of the acid, it keeps much longer. Even butter which has began to be rancid can be improved by carefully washing with salicylic water, 2 or 3 teaspoonfuls to the quart, and washing in clean water.

4. Preserved fruits: Cherries, currants, raspberries, plums, apricots, and peaches may, as experience has proved, be very advantageously treated in the following manner: The fruit is placed in a preserve jar, with not a very wide mouth, layers of fruit alternating with layers of sugar, but no water; and strewing over it a pinch of salicylic acid (½ gramme to the kilogramme, or 3½ grains to the lb.), and covering the jar with parchment paper which has been softened in salicylic acid solution, and then boiling as usual in a water bath. Bilberries, or blueberries, are better boiled without sugar, allowed to cool, and put into narrow-mouthed bottles (some crystals of salicylic acid being strewed over them), corked and sealed. Fruit preserved in this way has kept well for two seasons. Others have recommended covering the fruit in the jar with a close-fitting strip of blotting paper, which has been saturated with a solution of salicylic acid in rum.

For cucumber pickles, and those put up with vinegar and sugar, a corresponding process is recommended; the acid being boiled in the vinegar, and when cold poured over the pickles. For salted cucumbers, salicylic acid is put in the water during the boiling (½ to 1 teaspoonful to 1 quart), and otherwise treated as usual. It is also recommended to sprinkle salicylic acid in the barrel on the surface of the pickles.

5. Boiled vegetables: An equally small amount of dry salicylic acid may be added to these to prevent their spoiling.

6. For disinfecting and purifying the air and walls of closed rooms, salicylic acid may be evaporated on a hot sheet of iron or tin.

7. Vessels, corks, etc., which have a disagreeable odor or taste, will be rendered perfectly sweet by washing with a solution of salicylic acid, a fact that deserves special attention.

The best method of preparing these salicylic acid solutions is to put 2 or 3 teaspoonfuls of acid in a quart of water, heat rapidly to boiling, and let cool. What separates on cooling is an excess of pure acid, which may be kept for subsequent use, or it may be well stirred up and used in suspension when more of the acid is wanted than will go into solution.

In this connection we may add that the purest form of salicylic acid is that obtained by dialysis, as it is impossible to remove all the tarry and resinous matter by recrystallization.

### What's in a Name?

We recently published a description of an ingenious lantern improvement by President Henry Morton, of the Stevens Institute, which was reproduced by the *English Mechanic* as the discovery of Mr. Henry Norton. We also described the new resonant alloy invented by Professor Silliman, of Yale College, which our cotemporary also publishes, but credits the invention to Mr. Lilliman, of New Haven, Conn.

### An Improved Indian Ink.

Most of the black Indian ink met with in commerce possess this disadvantage, that it blots when a damp is brush passed over it; or, as draughtsmen say, "it does not stand." The addition of alum does but little good; but G. Reisenbichler states that bichromate of potash accomplishes the object by rendering insoluble the glue which the ink contains, and thus making the ink permanent. Such an ink Reisenbichler calls "Harttusche," or "hard Indian ink." The bichromate of potash is not colorless; on the contrary, it possesses a deep yellow (almost red) color, but does not at all injure the shade of the ink, as 1 per cent. of it in a very fine powder, intimately mixed with the ink, which has already been mixed with glue and dried again, is sufficient. The salt must always be mixed with the ink in a dry state; otherwise the ink might lose its friability in water.

A drawing which has been made with this ink in the dark, or by artificial light, must be exposed to sunlight for a few minutes, which renders the bichromated glue insoluble in water. Draughtsmen who cannot provide themselves with such ink make use of a dilute solution of bichromate of potash in rubbing up the ink. There is no danger of the yellow salt penetrating the paper, if the ink is thick enough.

DYEING DEEP ROSE.—This color is dyed in the beck in which cochineal reds have been dyed, adding, for 22 lbs. material, 10½ ozs. oxalic acid, 5½ ozs. tin crystals, and 3½ ozs. cochineal. Boil up, cool, and dye boiling for 30 minutes.

### Inventions Patented in England by Americans.

From October 24 to November 20, 1876, inclusive.

ATTACHING GEAR WHEELS.—B. T. Taylor *et al.*, Fall River, Mass.
BALE TIE, ETC.—W. B. Hayden, Columbus, Ohio.
CAR COUPLING.—G. H. Awes, Adrian, Mich.
CAR LAMP.—A. H. Phillippi *et al.*, Reading, Pa.
CASTOR.—L. P. Lawrence, Port Morris, N. J.
EGG BOX.—A. H. Lucas *et al.*, St. Louis, Mo.
ELECTRIC LIGHT BUOY.—P. E. Smith, Scotland Neck, N. C.
ELEVATOR.—B. H. Davis, Foxcroft, Me.
FEEDING PAPER TO PRESSES, ETC.—H. W. Covert, New York city.
FIRE EXTINGUISHER.—H. Conant, Pawtucket, R. I.
GRAIN SCOURER.—The Barnard and Leas Company, Moline, Ill.
IRONING TABLE.—L. P. Lawrence, Port Morris, N. J.
JAR, ETC.—A. Montgomery, New York city.
LAYING PIPES, ETC.—A. O'Neill, Baltimore, Md.
MAGNETIC ENGINE.—E. Weston, Newark, N. J.
MAKING GAS, ETC.—R. D. Bradley, Preston, Md.
MATCH FRAME.—E. B. Beecher, New Haven, Conn.
MOWER AND REAPER.—S. Sweet, Dansville, N. Y.
NAIL FEEDING MACHINE.—J. C. Gould, N. J.
OPENING CANS, ETC.—Meyer *et al.*, New York city.
OPENING CANS, ETC.—S. Poole, Boston, Mass.
PACKING BAGS, ETC.—H. L. Mattison, Oswego, N. Y.
PAPER BAG MACHINE.—E. Stanley *et al.*, Brooklyn.
PERFORATING PAPER.—W. Braidwood *et al.*, Mount Vernon, N. Y.
PIPE JOINT.—A. O'Neill, Baltimore, Md.
PIPE MACHINERY.—J. B. Root, New York city. Three patents.
POTATO DIGGER.—L. A. Aspinwall (of Albany, N. Y.), London, England.
PREPARING WOOD.—N. Wheeler, Bridgeport, Conn.
PRESSING SUGAR.—T. L. Wadsworth, San Francisco, Cal.
PULLEY, ETC.—A. A. Hall *et al.*, Nashville, Tenn.
RAILWAY RAIL.—J. T. Clark, Augusta, Ga.
RAISING WATER.—J. A. Ayres, Hartford, Conn.
RIBBON WIRE, ETC.—J. Fettis, New York city.
SCREW CUTTING.—S. W. Martin, Springfield, Ohio.
SETTING SPRINGS, ETC.—J. S. Passenger *et al.*, Birmingham, Conn.
SHEET METAL PIPES, ETC.—F. Hoeltge *et al.*, Cincinnati, Ohio.
SHOVEL.—H. W. Shepard *et al.*, Brooklyn, N. Y.
SMOKE CONSUMING FURNACE.—C. B. Bryant, *et al.*, Stoneham, Mass.
SPEED GOVERNOR.—G. Westinghouse, Jr., Pittsburgh, Pa.
SPRAY APPARATUS.—M. A. Lake *et al.*, Chicago, Ill.
STEAM BOILER, ETC.—J. B. Herreshoff *et al.*, Bristol, R. I.
STORING FUEL, ETC.—E. R. Kerr, Kewanee, Ill.
SUGAR MAKING, ETC.—E. A. Corbin *et al.*, Philadelphia, Pa.
TREATING EXTRACTS, ETC.—W. Adamson, Philadelphia, Pa.
WIRE FENCE, ETC.—W. D. Hunt, Scott, N. Y.
WORKING HIDES, ETC.—A. Fitzhenry, Somerville, Mass.

## Recent American and Foreign Patents.

### NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED COTTON GIN FEEDER AND PICKER.

William T. Adams, Rienzi, Miss.—Cotton to be operated upon is placed on an apron, when it is carried forward to the picker, the apron being moved by a crank. The picker being revolved by a belt from the gin, acts upon the cotton as it comes over the roller and delivers it to the gin. The rapidity with which the cotton is fed into the machine may be varied. The picker cylinder has forked and curved teeth.

IMPROVED TIRE UPSETTER.

Morris W. Griffiths, Middle Granville, N. Y.—In using the machine the part of the tire to be upset is heated and is bent inward over the horn of an anvil, more or less, according as the tire is to be shortened. The bent part is then placed upon a plate, and is clamped by rough faced eccentrics. The bend is then hammered out of the tire, when the latter will be shortened.

PULVERIZED FUEL FEEDER FOR SMELTING FURNACES.

William West, of Golden City, assignor of one half his right to Ira S. Elkins, of Denver, Col. Ter.—This is a contrivance for feeding smelting furnaces with coal dust by means of the air blast. A screw conveyer feeds the dust into tubes, from which it drops through the funnel-mouthed pipes into the large blast pipes upon nozzles through which the blasts escape and force it into the furnace.

IMPROVED BOOT AND SHOE CRIMPING APPARATUS.

Henry Lampus, Enon Valley, Pa.—The leather to be crimped is placed under a plate, and it is forced down between other plates by a screw, the distance between the plates being adjustable. The form of the plates not only causes the leather to crimp smoothly and evenly without wrinkles, but the boot made of an upper crimped on this machine is claimed to be not liable to wrinkle in the instep, and is more comfortable to wear than those crimped in the usual way.

IMPROVED LABELING MACHINE.

Jonathan Bigelow, Boston, Mass.—This invention is an improvement in that class of labelling machines or apparatus in which the paste and label are applied to the can as it rolls down an inclined plane, of which the paste bed and label holder form a part. The invention relates to several features for improvement, for which reference must be made to the patent.

### NEW MISCELLANEOUS INVENTIONS.

IMPROVED FIRE EXTINGUISHER.

Amzi S. Dodd and Isaac C. Andrews, New York city, assignors to Home Fire Extinguisher Company, of same place.—A bottle containing part of the gas generating ingredients is held in a cage in the upper part of the can, and so disposed that, by screwing down a stem which is attached to a bell which rests above the bottle, the latter is forced down on a projection on the bottom of the cage and broken. The construction is such that it is impossible to break a charged bottle when adjusting it, from forgetting to raise the breaking devices. The second invention consists in ribs formed upon the inner sides of the bars of the cage to receive the ring rib formed upon the outer surface of the bottle, and support said bottle; and in the combination of a stopper with the stem and the bell in such a way that the bottle may drop away from said stopper when forced down through the cage.

IMPROVED PACKAGE BAND.

Owen L. Taylor and Thomas H. Patterson, Saginaw, Mich.—This package band consists of a connecting plate, with two elastic bands attached to it at right angles to each other. The bands hook to the connecting plate after passing around the package in opposite directions.

IMPROVED APPARATUS FOR HANDLING HORSES.

William W. Winegar, Chambersburg, Ill.—This consists of a couple of upright crotches, together with cords and a tightening device therefor, mounted on a cranked axle of a pair of wheels, in such manner that, by adjusting the axle fore and aft under the body and between the legs of the animal, the cords may be arranged so as to confine him in a web in which he can be turned over on side or back, and can be moved about readily on the wheels.

IMPROVED PEW HAT HOLDER.

William H. Hampton, Luray, Va.—This invention consists in applying to the back of pews a wire holder that is capable, by a rotary movement, of placing a gentleman's hat under the seat in front, the hat being thus both out of the way and not at all liable to become soiled or injured. Patented April 18, 1876. See advertisement on another page.

IMPROVED PEA-NUT HEATER.

Jean Espito, New York city.—This consists of a top receptacle with a hinged cover, surrounded at the sides and bottom with a water chamber that is heated by a charcoal furnace in the base or supporting chamber. The charcoal furnace provides the steady heat required for heating the water bath, which again imparts the required heat to the pea-nuts without wilting, browning, or parching the same. They may thereby be kept in the heater for considerable time, and be sold at any moment in a fresh and heated state.

IMPROVED PROCESS OF MAKING BIRCH BEER.

Harvey Decker, Jersey City, N. J.—This process is for making beer from ground birch bark, and it consists in first extracting the strength thereof in hops and water without boiling; secondly, fermenting the liquor obtained with yeast; and, thirdly, in adding malt and sugar, the latter having been previously made to absorb oil of wintergreen.

IMPROVED LIQUID FILTER.

William Maynard, New York city.—This is a combination of the partitions and the screens with each other, and with a case to form a series of filtering and conducting spaces for the passage of the liquid. The construction is such as to enable the apparatus to be quickly and thoroughly cleaned.

IMPROVED STONE PAVEMENT.

John Murphy, Columbus, O.—This consists in laying blocks of stone with interspaces, filled with a composition consisting of pulverized slag, coal tar, fresh lime, sand, and pitch. A pavement laid in this manner is said to be impervious to water and is not acted upon by frost. The composition, being in a measure elastic, renders the pavement easy to travel on, and it also deadens the sound of vehicles passing over it.

COMBINED PENCIL SHARPENER, PROTECTOR AND ERASER.

Andrew Wilson, Providence, R. I.—This is a casting which resembles a human hand grasping a cone, and having the index finger extended. The cone is hollow, and has a section removed from one side. In one edge a knife is secured, for the purpose of sharpening the pencil. The lower end of the cone holds a rounded rubber eraser. The index finger is widened, and in it is secured a knife. The portion of the blade near the cone is made concave for cutting twine. The outer end is intended for cutting paper of different thicknesses. The arm of the casting is bored and threaded for receiving the point of the pencil, which it protects.

### NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED SPRING HINGE.

Lorenz Bommer, Brooklyn, N. Y.—A flange or wing plate is cast in one piece with the ornamental top and bottom buttons of the hinge, and has a fixed pintle socket and detachable top socket, both provided with annular recesses. This dispenses with the separate casting, finishing, and attaching of the buttons, and imparts, by the greater bearing surface on the pintle, a more rigid connection with less friction on the faces or bearings of the seats.

IMPROVED WAGON BRAKE LEVER.

David McGuire, New Gordon, Mo.—This consists in the arrangement of a jointed lever for operating the brake connected with a pawl, that engages with rounded ratchet teeth on a curved bar attached to the side of the wagon. The pull of the brake rod on one part of the lever locks the pawl in the curved bar. The lever automatically unlocks the pawl when it is moved to relieve the brakes.

### NEW AGRICULTURAL INVENTIONS.

IMPROVED GATE.

William G. Hughes, Columbia City, Ind.—When the gate is closed its forward end enters the space between the two posts. The latch is placed across this space so that it may engage upon a catch and fasten the gate. By operating a lever a latch may be raised to unfasten the gate.

IMPROVED FEED TROUGH.

James H. Grundy and Thomas H. Carter, Bremen, Ky.—This trough is so constructed as to prevent fowls or other animals than those being fed from having access to the grain, and to prevent the animals being fed from wasting their food by throwing it out of the trough. It is provided with a cover sliding longitudinally, in which is a hole to receive the animal's nose. The cover is provided with suitable stops to limit its movements.

### NEW HOUSEHOLD INVENTIONS.

IMPROVED WEATHER STRIP.

John C. Fiester, Reading, Pa., assignor to himself and Jacob Schaaber, of same place.—This weather strip is made from two pieces of wood, one of which is fixed to the door and the other joined to it by a rule joint. Hinge plates are provided at each end and also springs for throwing the removable part down on the door sill. A spring bolt catches and retains the strip as it is raised by passing over the threshold, and is tripped by contact with the door casing as the door is closed.

IMPROVED PADLOCK.

Anthon O. Kruger, Rock Harbor, Mich.—This consists of a pawl connected to the bolt and so held by a spring that it must be pushed by a thumb piece into the path of the key before the latter will engage it, so as to throw back the bolt. The thumb piece is locked by a spring pin inside of the lock, so that it cannot be moved until the spring pin is drawn out b the key. The invention also consists of a secondary bolt, to be worked by a key hole plate and a stud on it, which engages the bolt by a pawl, so as to swing into and out of the position to be engaged with the keyhole plate stud, which must itself be adjusted to a certain position to receive the pawl.

IMPROVED SCREW TAP.

Josiah W. Melvin, Houston, Texas.—This is an expanding tap or reamer having cutters placed in slots in the tapering portion of a mandrel, in which they are capable of being moved longitudinally. They are clamped by a thimble and nut upon the outer side, and a clamping bolt running through the mandrel.

IMPROVED SCREW PROPELLER.

Frank Maynard, North Dorset, Vt.—This is a motor for the propulsion of canal boats. It consists in arranging upon radial arms screw blades that extend inward from the circumrerence of the wheel through one half or less of the distance from the periphery of the shaft, and in making them of the same pitch at the inner and outer edges. The hoop that surrounds the wheel, as well as the peculiar construction of the hull, it is claimed to throw the water in a line parallel with the shaft.

### Artificial Butter.

*To the Editor of the Scientific American:*

Owing to the receipt of much correspondence concerning my article on artificial butter, which appeared in the SCIENTIFIC AMERICAN SUPPLEMENT, N. Y., Nos. 48 and 49, I wish to state that I own no patent on the process. The only patent held is Mege's, which is owned by the United States Dairy Company, 6 New Church street. All letters, therefore, should be forwarded to that address. The process I described in my article is simply an elaboration of that patented by Mege, and cannot be used without infringing on the United States Dairy Company's patent. HENRY A. MOTT, Jr., E. M., PH. D.
New York City.



## Notes & Queries

A. F. will find a recipe for a cement for china on p. 346, vol. 24.—N. T. will find directions for making silicate of soda on p. 225, vol. 23.—F. N. will find directions for getting rid of flesh worms on p. 233, vol. 31.—J. C. will find directions for making laundry bluing on p. 219, vol. 31.—H. T., J. K., B. L., J. H., T. W., J. D., W. R., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) F. W. C. says: I wish to convey hot water 1,000 feet from the heater through an iron pipe. Must the return or circulation pipe be as large as the supply, in order to keep the water hot at the terminus of supply? A. Yes.

1. I notice that in the vacuum chamber of a cold water pump, the water does not fill the chamber. What is it above the water, air or vacuum? A. It is air, and the pump does not draw it off because it is at a higher level. 2. Will the vacuum gauge work as well attached to the bottom? A. The gauge may be placed in any desired position.

(2) F. McL. asks: Is there any instrument by the aid of which a person can see the interior of his own eye? A. We know of none.

(3) C. H. H. asks: In regard to the water wheels at Fairmount Water Works, Philadelphia, does the water, or part of it, after being forced up, run back and act as power to raise more water? A. No.

(4) R. S. says: I have a floor made of alternate strips of black walnut and ash. I have great trouble in keeping it clean; in fact, it never really looks clean except immediately after washing. I have oiled it several times with boiled linseed oil, but it collects and holds the dust too much wherever any one walks. Under pianofortes, etc., it retains its brightness and beauty. What is the best substance or oil for me to use? A. Procure a liquid wax at your house painters; this is often applied for this purpose.

(5) A. says: Given a cast iron tank bolted together watertight, and intended to hold pure water. With what shall the inside be painted or covered, in order to effectually prevent rust? The required preparation must be inexpensive and be applied in liquid form. Nothing that will contaminate the water or dissolve, even slowly, will answer, a perfectly waterproof and innocuous preparation is the desideratum. A. Asbestos paint would probably fill most of the conditions required.

(6) A. M. H. says: The four chimneys of my three story brick dwelling did not draw well. This I attributed to the surrounding trees and houses, both of which are considerably higher than my dwelling, and although I had the chimneys well cleaned out to satisfy myself that there was no obstruction in them, I found a good and sufficient remedy only in placing upon each an iron pipe 8 feet high by 7½ inches in diameter. I had the pipes made of galvanized sheet iron and strongly fastened with ⅜ inch iron rods. But a little while ago, after a two years' use of the pipes, the whole four pipes were swept away by the wind and broken into pieces as if they were pasteboard. Upon examination the pipes appeared to have been almost entirely rusted or eaten away from the inside, while upon the outside they were but a little discolored with rust. Why did they first go from the inside, and is there not some kind of durable paint or covering, not too brittle, that will prevent this? A. The soot upon the inside of the pipes developes an acid which assists in corroding the iron. The only satisfactory remedy is the extension of the brick chimney itself to the height required, and securing the same with iron braces.

(7) J. H. L. says: I claim that water is elastic and can be compressed. A friend claims that water is not elastic. A. Water is slightly compressible.

(8) N. A. asks: Will a fan, such as is used to make blast for melting iron, make more blast by having eight arms or wings than if there are but four? A. It would not necessarily be more effective with eight arms. It would be quite possible to build a fan of four vanes which was more effective than one having eight, and *vice versa*, on account of other considerations.

(9) E. L. asks: Can we change our mill, now driven by three wheels with direct gear, by transmitting power from wheels to one main shaft with quarter twist, and from this shaft with quarter twist to spindles? If the wheels will drive steadily, without any reaction, shall we lose any power by the indirect transmission? A. We think there will be no difficulty in making this change. As, however, you will have two belts and shafts to drive, in addition to the other gearing, the useful effect of your engine will be somewhat diminished.

(10) W. A. C. asks: Do you know of any steam boiler in this country built expressly to use salt water, and if so, has it proved a success? A. All marine boilers may properly be classed under this head. Such boilers are successful as long as they are kept reasonably free from scale. For land boilers, those of the cylindrical form have many advantages, when salt water is to be used, as they can be easily and quickly cleaned.

(11) F. G. asks: How much power will it take to force an inch stream of water through iron pipe 75 rods up a gradual rise of 75 feet, and what kind of pump would you recommend? A. Your question is rather indefinite, for almost any amount of power might be required to force water through the pipe, according to the velocity. We never recommend special manufactures in these columns.

(12) R. S. M. says: I want to run a cotton gin and press at a distance of 200 feet from my mill. Which is best, a shaft on ground, or wire rope? A. Either plan will answer very well, and we advise you to employ the one that you can arrange most cheaply.

(13) G. & B. ask: Has the ocean tide ever been used as a motor for driving machinery, otherwise than by water wheels driven by currents, or by the aid of dams and floodgates? A. We have read of propositions to this effect, but do not know of any that have been carried into practice.

(14) J. F. J. asks: How is the level of the sea (I mean the point a surveyor takes in saying that such a place is so far above the level of the sea) obtained? A. Just by taking it. For instance, if the surveyor notes that, at mean low tide, a given reference mark is at a certain elevation above the surface of the water, that becomes fixed, and all elevations can then be referred to mean sea level at any time—without a direct observation—by referring them to the fixed mark, and making the necessary correction.

(15) D. S. says: I am getting a small vertical steam boiler made from No. 20 galvanized sheet iron, I intend to put it on top of a box stove over the pipe hole with a 6 inch flue (that being the size of the pipe). The size of the boiler is 14 x 24 inches, and there will be 4 inches space for water between flue and shell. How much pressure will such a boiler stand? Will the flue stand as much as the shell, or will it collapse? A. The flue is somewhat weaker than the shell. You can carry about 15 lbs. steam. 2. Is there not a way to find the pressure of steam with the safety valve? A. If you buy a safety valve from a reliable maker, you will find it graduated with tolerable accuracy, so that the fall can be adjusted without any calculation. It is not a bad plan, however, to verify the graduation. You will find the manner of doing this fully explained in "Wrinkles and Recipes."

(16) T. M. says: You give Dr. Ferrier's remedy for cold in the head. How often should it be used as snuff? A. If the ailment is really a cold, one application of the preparation will be all that is necessary. It is not advisable to use it constantly for every ache or where neuralgia is suspected.

(17) S. W. asks: Can you tell me how to separate gold from iron when the two are mixed? A. Dissolve the gold in warm *aqua regia* (1 part nitric to 3 parts hydrochloric acid), evaprate nearly to dryness, redissolve in water, and add an excess of strong aqueous solution of sulphate of iron. Boil the liquid and allow to stand in a warm place for an hour. Then decant the clear liquid, gather the precipitate on a filter, wash with hot water, dry, and fuse in a small black lead crucible with a small quantity of anhydrous carbonate of soda. If the directions are closely followed, this will give you a button of the pure metal.

(18) D. asks: What will give a new appearance to old zinc? A. The structure and properties of zinc do not alter by age. You can remove the superficial coating of oxide by means of a little dilute acid and the scratch brush.

(19) W. T. B. asks: Can you give me a recipe for dissolving gutta percha, which is not combustible, and will not cost more than sulphuret of carbon? A. We do not know of such a solvent.

(20) C. E. A. asks: Are wood ashes a benefit to the growth of currant bushes or trees? A. Yes, if not used in excess.

(21) J. P. H. L. says: I have some fine specimens of copper ore. Is there anything that I can put on them that will not change the colors and will prevent their turning green? A. Varnish them with a little purified shellac in alcohol.

(22) W. P. T. says: In answer to H. G. you say that the change of color in hair is due to the loss of the iron salts which are the basis of the dark color. Can the dark brown hair of a young person be prevented from turning white? A. The only remedy that we can suggest is the reinvigoration of the blood by the proper use of animal nourishment and iron tonics. Avoid alcoholic stimulants and do not deprive yourself of needful sleep.

(23) H. L. G. asks: In electroplating, does a current that vibrates do better work than one which does not? A. No.

(24) C. W. W. asks: Of what size and thickness should a boiler be for an engine of 2⅜ inches diameter of cylinders, and 4 inches length of stroke? A. Make a vertical one, 20 or 24 inches in diameter, and 3 feet high.

(25) G. A. W. says: I wish to build a propeller launch. I am making an engine 5 x 6 inches; how big a boat will it run at 8 miles an hour? How large should the boiler be, and how large a screw will it require? A. You can have a boat 30 feet long, with a boiler 3 feet in diameter and 4½ feet high. Propeller should be 30 inches in diameter and of 3½ to 4 feet pitch.

(26) F. D. W. asks: Is the following proposition correct? "It is a principle of mechanics that a force acting at right angles to the direction in which a body is moving, does no work, although it may continually and continuously alter the direction in which the body moves. No power, no energy is required to deflect a bullet from its path, provided the deflecting force acts always at right angles to that path." A. It might be true, if the conditions stated were possible; but it is evident that, when the body is deflected, its motion will not be at right angles to the deflecting force.

(27) N. asks: What is a good pickle or dip for copper-plated zinc work, to be used before gilding? A. Use very dilute oil of vitriol.

(28) J. G. W. asks: If the true meridian may not be obtained from the sun? A. Not unless you have true time, and know how much the sun is slow or fast.

(29) J. J. G. asks: Does a side wheel steamboat or propeller draw more water when running than when still? A. Frequently when the boat is in motion the bow is elevated and the stern depressed.

(30) F. C. R. asks: 1. What size of boiler will be large enough to furnish steam for an engine 3 x 4 inches? A. One 30 inches in diameter and 3 feet high. 2. How large a boat will such an engine run at 3 or 4 miles an hour? A. One 18 feet long. 3. What size and pitch of screw will be necessary? A. Use one 18 to 20 inches in diameter and of 3 feet pitch.

(31) H. W. says: In a recent issue of your paper I see that S. N. W. asks who first applied steam power to the propulsion of boats, and is the inventor of steam navigation. You reply "that the Marquis de Jouffroy of France built a steamship some years before Fulton." But Dionis Papin (born August 22, 1647) of Paris, being a Protestant, fled from France after the repeal of the Edict of Nantes and went to England, and from there to Germany, where he was professor at the University of Marburg from 1687 to 1707. During this time he made several inventions, of which the most prominent was the steamship which he built and set to work in Hesse Cassel, on the river Fulda. What has become of the ship is not known.

(32) W. B. F. says: 1. I have an engine of 3 inches bore by 3½ inches stroke, and I would like to know what sized three-bladed propeller I should use, and what horse power of boiler will it take to run a boat with a 25 feet keel, and 8 feet beam, drawing 2 feet of water? A. Use a propeller 24 or 26 inches in diameter, and of 3 feet pitch; and a boiler 28 or 30 inches in diameter and 3½ feet high. 2. What speed would be realized? A. Probably 4 or 5 miles an hour in smooth water. 3. Where could I obtain directions for building such a boat? A. See the directions for building various kinds of boats, in back numbers of the SCIENTIFIC AMERICAN SUPPLEMENT.

(33) G. W. A. says: 1. We are running a 12 x 20 inches engine with a 9 flue boiler 48 inches in diameter by 20 feet long. The flues are 6 inches in diameter, and the stack is 23 inches in diameter and 40 feet high. She seems to have draft enough, but we cannot keep steam on her. We run her at 100 or 120 revoluttions per minute, driving two 50-saw gins and two 30-inch burrs. The valve is a common slide valve, set with both ends equal with 1-16 in. lead. What is the matter? A. From your account the boiler should steam well if it is clean. Examine it to see if there is much scale in it, and test the engine to see whether there are any serious leaks. 2. Will a 2 inch shaft 100 feet long run two 50-saw gins and one 80-saw gin? A. It would be better to use a larger shaft. 3. Which runs the lightest, belts or iron cogs for driving burrs? A. More of the power applied is generally utilized by belts than by common gear wheels.

(34) B. S. says: I have made an induction coil (Rhumkorff's method), 6 inches long and 3¼ inches in diameter. I get a spark from the induced current about 1-16 inch in length and a very severe shock. I would like to put on condensers to increase the spark as much as possible. Please tell me the proper number of sheets of tinfoil to use, their shape and size, and also give directions for connecting them in the main circuit from the battery. A. Thirty or forty square feet of foil will be sufficient. The sheets may be of any size and shape. Connect the condenser up so as to bring its opposite sides on each side of the vibrating break, that is, with contact points of break between its two coatings.

(35) J. H. asks: 1. Does nickel-plating cost as much as silver plating? A. Yes. 2. Does it require to be burnished after plating? A. Yes. 3. Does it require a battery as strong as for silver? A. It requires stronger battery power. 4. What is the best work on nickel plating? A. "Electricity; its Theory, Sources, and Applications," gives all the necessary instructions for nickel plating.

(36) J. T. D. says: Three months ago, I could not hold both ends of the wires from a gravity battery of large size (150 cups): now I can hold them for almost any length of time without feeling much current till I have held it for three or four minutes, and then I do not feel enough to make me let them go. The battery was tested with a galvanometer and proved to be as strong as ever. A. Your hands are probably dry and offer very considerable resistance to the current. When the latter has been allowed to flow a short time it starts perspiration and thus reduces the resistance. It is not difficult to take a continuous current from a battery; one can do this easily and retain hold of the terminal, when frequent interruptions of the circuit would be too severe for the majority of persons.

(37) W. T. N. says: I made a battery of three copper plates, 7 x 8 inches, tacked to slats ¾ inch wide; between these plates were placed two 7 x 8 zincs. The two zincs and the three coppers were then connected with copper slips, and to the combined zincs and the combined coppers were attached the positive and negative wires. The plates were then placed in a common two gallon pail, full of sulphate of copper solution, the slats resting on the edges of the pail. I supposed I had a battery of about 200 inches of zinc surface, and I thought that this ought to produce some signs of magnetization in a bundle of wires (¾ inch in diameter) in a coil of 180 feet 25 wire, and 600 feet of 35. But it did not, nor would it decompose water. The only sign of electricity was the strong salty-bitter taste on placing the poles on the tongue. What was the trouble? A. One hundred feet of No 16 copper wire will give better results with such a battery than all your wire together. It will take two such batteries to decompose water, and the decomposition would probably stop in 20 or 30 minutes.

(38) A. C. L. says: I want to lay a small lead pipe to bring water into my buildings, from a spring 1,000 feet distant, through hard rock, digging nearly all the way. How can we lay the pipe without going deep as ordinarily, but yet protecting it against any danger of freezing. Our idea is to dig a ditch 2 feet deep, fill it with 6 inches of sawdust then lay the pipe, then fill in over that with 12 inches more of sawdust, and then with the dirt taken from the ditch. Will that answer? How is the best way to contruct the well at the spring? A. To give absolute security against freezing in our climate it has been found necessary to lay water pipes five feet below the surface of the ground. In one case the pipes of a good sized city being laid at 3 feet in depth, the water froze and the pipes burst in many places, so that the ground had to be opened again and the pipes relaid at 5 feet in depth. During some winters the frost penetrates the ground very little, but the pipe must be so laid as to be secure in the severest seasons. It is doubtful if the sawdust filling would save it.

(39) G. C. says: My furnace has a chimney 40 feet high; the number of tubes in boiler is 52, their diameter is 1¾ inches; the size of chimney is 14 inches square, inside. I can put the exhaust into the chimney or not, as I wish; but I cannot see any difference between the ways. I carry 60 lbs. pressure, but am short of power. The boiler is good all but firebox, and that is very thin in places. Can I carry any more pressure? A. If your firebox is weak, we advise you not to increase the pressure. From the data sent, we cannot help you much about the boiler. It may be that it steams well, and the engine takes too much steam. This could only be settled by experiment.

(40) J. B. asks: What size of screw wheel will an engine of 2½ inches bore by 5 inches stroke drive, and what size of boat would be suitable? A. You can use a wheel from 22 to 24 inches in diameter, and of 3 feet pitch, and a boat 20 feet long, of 4½ feet beam.

(41) P. H. D. asks: How does the method for finding the true meridian, given in No. 9, vol. 35, differ from that given in Davies' and other works on surveying? A. There was a time when they were right. We have examined some of the earlier as well as later works on surveying, and it appears that they have copied from each other. They have not taken into account the retrograde movement of Polaris of twenty seconds a year. At the present time, Alioth, the first star in the handle of the dipper, is about 25 minutes ahead, while Mizar, the second star, is five minutes behind.

(42) J. R. M. asks: Do the government observers at the signal stations report the actual hight of the mercury in the barometer, or are corrections applied? A. The readings are reduced to the sea level and also to a temperature of 32° Fah. by Guyot's tables. The first 900 feet makes about 1 inch fall in the mercury, so that if a person is 900 feet above sea level, his barometer will read about 1 inch below the signal reports, for that place.

(43) M. J. C. asks: 1. Is there any difficulty in using an object glass two or three inches in diameter as described on p. 283, vol. 35? A. No. Make the focus of the three inch lens 25 feet. 2. Would the instrument you describe be free from color? A. Not wholly. 3. Would not better results be obtained by using an achromatic objective? A. Yes; but it would be far more expensive.

(44) W. M. says, in reply to J. L. A., who asks how to destroy a human tooth, in or out of the mouth: Take the tooth (after it has been removed) and immerse it in muriatic acid for about 12 hours, when it will be dissolved.

(45) W. M. says, in answer to T. P. H.'s inquiry as to how to harden and polish dental plates: They are first vulcanized at 320° for a shorter or longer period according to the constituents of the rubber. Then dressed down with file, scraper, and sand paper, and then polished with prepared chalk and a brush wheel.

(46) R. E. H. says: 1. I have a Rhumkorff coil, with an 8 inch bobbin. It is fitted with a tinfoil condenser, which is connected with the pillar by one wire and the vibratory hammer by the other. The coil will not work while this condenser is attached; but gives a brilliant spark at the contact breaker (using two small Bunsens) when the condenser is removed. Can you suggest a remedy? A. The condenser has evidently become defective; substitute a new one or have the old one repaired. 2. Though a brilliant spark is got at the contact breaker, but a very small one can be got by joining the terminals of the secondary circuit, and I cannot succeed in lighting up some small Geissler's tubes. These terminals will induce a spark from a thin insulated wire or from the knuckles, so that the tension seems considerable. A. An eight inch bobbin will not give a very long spark, but should be sufficient, with a good condenser, to illuminate small Geissler tubes. 3. Should I connect the ends of the secondary coil with thick or thin wire? A. It is not material, either will answer for ordinary purposes.

(47) J. M. asks: 1. By what means does working high steam expansively effect a saving in fuel? A. If the steam is used without expansion, when it is discharged from the cylinder it is capable of doing more work. If now we employ some of this energy, before exhausting, by allowing the steam to expand, it is evident that more work will be obtained by the consumption of a given amount of fuel. 2. Would the supply of a greater quantity of atmospheric air to the furnace of a locomotive be a desideratum? A. No.

(48) C. S. A. asks: Has a noiseless steam ever been invented? A. Many well built steam engines run noiselessly.

Does it make any difference if lightning rods are badly rust eaten in the ground, provided they go deep enough to strike the damp earth? A. No.

How is gas pipe made? A. From flat plates of iron, heated red hot, and drawn through plates till the curvature and lap are made. Then the lap is welded.

In your explanation of the Bessemer steel process, you do not say where the blast comes from. Is it from a stone coal or charcoal fire? A. From a coal fire.

Can there be such a thing as two lines approaching each other and never meeting? A. Yes. See p. 138, vol. 31.

Is the work of tunneling the North river progressing? A. No.

(49) H. Z. asks: How can I prepare a lithographic stone for Indian ink drawings? A. Rub it with sand, wash well, and then rub with powdered pumicestone. Then wash again, and polish with a fine piece of pumicestone. The finish thus imparted is unfit for chalk work.

(50) D. S. asks: How is a fine oil finish put on furniture? A. Take boiled linseed oil 1 pint, yellow wax 4 ozs. Melt together, and color with alkanet root to impart a reddish tinge.

(51) J. F. M. asks: Please give me a recipe for a liquid dressing for shoes? A. Take gum arabic 4 ozs., molasses 1½ ozs., good black ink ¾ pint, strong vinegar 3 ozs., spirit of wine 1 oz., sweet oil 1 oz. Dissolve the gum in the ink, add the oil, rub them in a mortar until thoroughly united; then add the vinegar, lastly the spirit.

(52) J. C. B. asks: How can I fasten a thin strip of hard rubber to a similar strip of steel or other metal? A. Make a thin solution of glue, and gradually add pulverized wood ashes till you have a stiff varnish. Use this cement hot.

(53) J. F. G. asks: 1. What proposition in Euclid is known by the name of *pons asinorum*? Some maintain that it was the 5th of book I, namely: The angles at the base of an isosceles triangle are equal, etc., others say that it is the 47th of the same book. "The square on the hypothenuse of a right angled triangle is equal to the sum of the squares on the other two sides." A. The *pons asinorum* is proposition 5, book I; and the name is given to it by schoolboys, and is supposed to be an allusion to its being the first difficult proposition which the beginner encounters. Proposition 47, book I, is called the Pythagorean theorem, it, having been demonstrated by Pythagoras.

(54) F. R. asks: How can I calculate the weight of iron and brass castings from the weight of the wooden patterns? A. Brass castings weigh 17 to 19 times the weight of a pine wood pattern. Iron castings weigh 16 times the same.

(55) A. E. B. asks: How many lbs. to the cubic foot is the maximum that water can float? A. About 62½.

(56) J. B. H. asks Is there a clock made that winds itself while running? A. No. Such a machine would be a perpetual motion, which is impossible.

(57) I. R. & Co. ask: What is the process for making crocus or composition for polishing, used in nickel plating? A. Crocus is made by putting tin, as pure as possible into a glass vessel, and pour in sufficient nitric acid to cover it. Great heat is evolved, and care must be taken not to inhale the fumes, as they are poisonous. When there is nothing left but a white powder, it should be heated by a Hessian crucible, to drive off the nitric acid.

(58) M. G. A. asks: Where does rattan grow? A. The rattan (*ratan*, Webster) is a sprout from the sugar cane after the cane has been cut.

1. What is the length of the Suez canal? A. About 100 miles. 2. How long was it being built? A. About 10 years. 3. How many locks has it? A. None. The fresh water canal, made for supplying water to the laborers, etc., has locks; we do not know how many.

(59) A. J. asks: Can you give me a recipe for making a black composition in imitation of jet? A. The usual substitute for jet is ebonite or vulcanite, a patented preparation of India rubber.

(60) E. J. F. asks: How is the pattern produced on marbled paper? A. Use finely ground pigments, mixed with water to the consistence of paste. Make a square box about 2 inches deep, large enough to hold an open sheet of your paper. Fill it within ½ inch of the top with a solution of ½ lb. gum tragacanth to 6 quarts water. Strain the solution. Take a long water color brush, and put stripes of the desired pigments on the surface of the gum solution; pass a metal comb through the stripes in a zigzag direction, according to taste. Dampen the paper, and take 1 sheet of it by two opposite corners, and lay it evenly on the colors, flatten it gently with the hand, lift carefully off, and hang up to dry. When thoroughly dry, polish with a smooth piece of flint.

(61) G. F. E. asks: How can I impart a crystal-looking finish to brass? A. By using a steel scraper or a stick of wood covered with emery paper over the surface. Work it in a circular direction. A slip of Arkansas oilstone, dipped in oil, gives a good effect.

(62) F. D. asks: How can I strip bark from willow twigs, and how can I split the same for making baskets? A. Osier or willow twigs are peeled by soaking them in water till the bark becomes loose, and then stripping them. We believe they are split with a common knife.

(63) N. S., of St. Petersburgh, Russia, asks: 1. How is the rudder of the non-heeling boat represented on p. 287, vol. 35, fixed, so that the after part of the frame does not interfere with it? A. The rudder is fixed to the stern post in the ordinary way. 2. On what theory is the Ocean Queen, shown in the same illustration, built? A. All the information we have on this subject is in the article and illustration.

(64) J. W. S. asks: Is tragacanth mucilage used for any purpose other than by shoemakers and druggists for pasting on labels? A. Yes. It is employed by water color artists, ink manufacturers, manufacturing chemists, and pharmaceutists, and is used extensively in the preparation of mucilage.

1. Can you give me the specific gravities of wax, paraffin, lard, and tallow, at their melting points? A. No, but they are all considerably less than that of water. 2. How can I cast paraffin in a metal mold? A. Coat the mold with a film of olive oil and the paraffin may be readily removed without heating. We think you will experience no difficulty in removing the cast from the mold as you suggest, but in this case the outlines may possibly not be quite so sharp as when removed, after cooling, from the oiled mold.

(65) A. B. T. says: Please inform me how to prepare picture canvas, so that it shall be pliable? A. The canvas cannot be well prepared by amateurs. The materials employed are whiting and glue size.

(66) H. J. asks: In your issue of December 2 is a recipe for hot waterproof cement, in which soluble acid and chromate of lime is to be used. I have been to several drug stores for the chromate of lime, but no one seems to know what it is. Is there any mistake? A. The chromate of lime is a by-product from the manufacture of the chromates of potassa, lead, etc. It may be formed by dissolving one part of lime (caustic) and four parts of chromic acid (by weight) in the smallest possible quantity of pure hot water, decanting the solution and allowing to cool slowly. Under these circumstances the pure salt will crystallize out; or boil the lime with 5 parts of bichromate of potassa dissolved in water, decant the liquid, and dissolve the residue in two parts of chromic acid in water as before. You can obtain this salt by writing to one of the large dealers in laboratory chemicals and utensils in this, or other large cities. There is no mistake in the recipe.

(67) M. D. asks: Why must a smoothing iron be hot to iron clothes? A. To expel the moisture from the starch and convert it into a stiff glaze.

(68) A. A. M. asks: In what solution can I put a beef tongue for a short time, to peel the skin without cooking, and which is not injurious to the meat or the health? A. This cannot be accomplished.

(69) J. D. says: I have some glass curtain pins or knobs in my room; they are hollow, and coated with mercury in the inside. One of them was exposed to the sun and it has lost its brilliancy and reflective power. Was it the heat of the sun that destroyed it? If so, at what degree of heat did it do it? A. If the air in contact with the amalgam was at all contaminated by the products of combustion, which contain sulphurous acid or the exhalations from drain pipes or sewers, the continued heating of the mercury by the direct sunlight might easily determine the gradual formation of the gray film of suboxide or sulphide as the case might be. 2. If a mirror is placed in the sun will the heat destroy it? A. In pure air, sunlight or heat below 600° Fah. has no effect on pure mercury.

(70) H. Y., Jr., asks: Does chewing tobacco have any effect in reducing the flesh and weight of the human body, or does it otherwise make a man thin and soft? A. Yes, especially if he is of a nervous temperament. Its tendency is to injure the human system in various ways. The injury is developed differently in different individuals.

(71) L. O. asks: 1. How shall I make nitrate of iron? A. Place in a suitable vessel a large quantity of clean iron in small scraps, and just cover it with dilute nitric acid (one of the acid to two of water). Heat nearly to boiling, and maintain at this temperature until there is no further evolution of gaseous nitric oxide. This gas should be conducted into a large chimney filled with fragments of brick moistened constantly with water. If the gas be kept from contact with the air it remains colorless and insoluble in water. It should therefore be mixed with a sufficient quantity of air before it is permitted to enter the condenser. When the evolution of gas has ceased, add a quantity of pure water equal to the volume of the dilute acid originally introduced, heat nearly to boiling and siphon off into suitable evaporating vessels, and concentrate the solution by slow evaporation. When the nitrate of iron begins to separate it should be removed from the solution as fast as formed, placed upon a suitable drain (a large covered funnel will answer very well)—and the superfluous fluid allowed to run off. The solution in the evaporating dish should have fresh portions of the strong iron solution added to it from time to time; the solution should never be allowed to approach dryness. The nitrate of iron may be purified by recrystallization from an aqueous solution, draining and drying. In order to avoid a loss of materials in the first operation, the iron scrap should be in large excess of the acid, and these conditions should be maintained during the process of solution. 2. How shall I make nitric acid? A. Introduce into a large glass or porcelain retort, the neck (beak) of which should fit snugly into the end of a glass condenser, equal weights of strong oil of vitriol and niter (nitrate of potassa) or nitrate of soda. The retort is seated upon a sand bath beneath which heat is applied gradually when the saltpeter is decomposed by the sulphuric acid, with the formation of nitric acid which distils over and sulphate of potassa or soda as the salt may be, which remains behind in the retort. We would advise you before beginning the manufacture of this acid to consult some good work on technical chemistry.

(72) W. H. H. says: 1. I want to construct a telegraph line, ¼ or ½ mile in length. For insulators, can I use rubber loops to hang the wire in? A. Rubber loops will answer if a return wire is used, but the ordinary insulators are preferable. 2. Which is strongest, 6 half gallon Callaud batteries or 3 one gallon? A. The 6 small jars will answer your purpose best. 3. If I order a sounder to be made for a ¼ mile line, will it work equally well on a 250 feet or a 1 mile line, if number of batteries are changed? A. If changed so as to give the same strength of current, yes. 4. On how long a line can I use a simple sounder without relay? A. That will depend on the resistance of the circuit. An ordinary sounder will not work well with the usual battery power if the circuit exceeds 10 or 15 ohms resistance.

(73) S. A. H. asks: 1. How should I set a two flue boiler so as to make steam as fast as possible? A. You will find good methods explained on p. 339, vol. 33. 2. Should the grates be at the center or end of the boiler? A. Grates at the end will be sufficient.

(74) R. S. F. says: I have a magneto-electric machine, but the current is not strong enough. How can I increase it? A. If increased battery power does no good, the coil may be defective. It is difficult to give definite advice without seeing the coil.

(75) H. C. N. asks: Is there any chemical that may be mixed with plaster of Paris before setting (or any dip in which it may be immersed after setting) to cause it to stand heat almost to redness without cracking, warping, or crumbling? Are there any cements (for stone brick) that will stand this test? A. If the plaster be pure it will stand heating to full redness without cracking, provided this is done slowly and uniformly so as to first expel all the water. After once rendering anhydrous by the above treatment, it will withstand a bright red heat. This precaution must, however, be heeded: don't treat the substance suddenly. It is better to mix the plaster with a little lime (1 to 3) and fine sand before baking.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

W. L. M.—They are small quartz crystals, the angles of which have been only partially destroyed by corrosion.—C. K.—Your samples are all iron pyrites—sulphide of iron.—O. P. (of Worcester, Mass.) should send us a large piece of his mineral.—T. K. & Co.—It is braunite, or sesquioxide of manganese.—R. W. Co.—It is an argillaceous and calcareous sediment, containing much organic matters.—C. A. McO.—It is galena—sulphide of lead.—J. W. B.—No. 1 is an impure limestone colored by sesquioxide of chromium and iron. No. 2 is a felspathic rock. No. 3 contains amorphous and crystalline carbonate of lime, clay-slate, and iron pyrites.—R. E. M.—It is asphalt (bitumen), of some value if in large quantities. Its solutions in naphtha or turpentine are largely employed as a protecting varnish for exposed metal and woodwork, particularly the hulls of vessels. Large quantities of it are consumed in the preparation of asphaltum pavements and roofs.—T. K. & Co. (H. J. M.)—It is braunite or sesquioxide of manganese.—The specimens numbered 1, 2, and 3 in large tin box (painted blue) are sulphide of nickel and iron. Valuable if in large quantities. There was no name or address on the package, and the postage stamps were 24 cents short.—H. H.—It is what is known as "spongio-piline," a kind of felting made from sponge. It is used to some extent by medical men.—J. A. S.—It is arsenical iron pyrites. If in large quantity, it may be worked as a source of arsenic.

## COMMUNICATIONS RECEIVED.

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

On Emigration to New South Wales. By A. E. B.
On the Lumber Trade of Pennsylvania. By W. T. L.
On Subjects for Discussion. By J. H. A.

Also inquiries and answers from the following:
R. R.—C. W. T.—J. S. A.—W. G.—J. H. R.—W. H. N.—J. R. Q.—W. T. H.—E. P.—J. K.

## HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells prisms, fit for use in a *camera lucida?* Who sells a small steam engine, suitable for driving one sewing machine? Who sells parts for working models of locomotive engines? Whose is the best surveyor's levelling instrument? Where can phosphor bronze be bought? Who sells mineral specimens for the cabinets of collectors? Whose is the best microscope for scientific investigation? All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

# INDEX OF INVENTIONS

FOR WHICH

**Letters Patent of the United States were Granted in the week Ending**

## November 28, 1876.

**AND EACH BEARING THAT DATE.**

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list, including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

| | |
|---|---|
| Acetic acid, making, E. R. Squibb | 185,141 |
| Animal trap, C. Koons | 185,110 |
| Baling manure, P. C. Ingersoll | 185,106 |
| Bandsawing machine, G. B. Phillips | 185,045 |
| Barrel cover, McClellan & McBride | 184,976 |
| Beer, utilizing waste of, J. J. Suckert | 184,934 |
| Belt shifter, F. B. Miles | 185,120 |
| Belt-shipping mechanism, G. E. Taft | 184,989 |
| Bilge water ejector, R. S. Little | 185,115 |
| Bill file, B. J. Beck | 185,006 |
| Blowing toy, H. J. Green | 185,035 |
| Book sewing machine, G. W. Glazier | 184,961 |
| Book sewing machine, J. C. Smyth | 184,980 |
| Brick and peat machine, D. Woodbury | 185,057 |
| Brick kiln, E. W. Bingham | 185,068 |
| Burglar alarm, J. B. Underwood | 185,148 |
| Calendar clock, A. Phelps | 185,128 |
| Car berth supporter, T. Grant | 185,098 |
| Car coupling, E. M. Parrott | 185,126 |
| Car coupling wedge, W. B. Dunning | 185,087 |
| Car door, G. B. Kiteley | 184,971 |
| Car door hanging device, E. E. Pratt | 184,983 |
| Car spring, J. S. Lash | 184,973 |
| Car starter, A. Whittemore | 185,006 |
| Car truck, prismoidal, E. B. Dorsey | 185,019 |
| Carving fork, E. Cady | 185,074 |
| Case for toilet papers, E. W. Dennison | 185,082 |
| Caster bottle, Weber & Wilhelm | 185,002 |
| Charbon roux, making, G. L. Harrison, Jr. | 184,963 |
| Check rower, J. W. Fawkes | 185,092 |
| Cheese press, T. A. Murphy | 185,124 |
| Churn dasher Duval & Morton | 185,088 |
| Clamp for holding rail pieces, C. Lamb | 185,111 |
| Clamp for quilting frames, I. W. Doeg | 184,957 |
| Clamp for wire rope, H. R. Taylor | 184,906 |
| Clock movement, F. Kroeber | 184,972 |
| Clothes drier, J. R. Rusby | 184,985 |
| Compensating pendulum, E. M. Gorwin | 185,016 |
| Compound engine, R. Bogardus | 184,951 |
| Compound tool, S. B. Mayfield | 185,038 |
| Corn husking machine, J. Lund | 185,036 |
| Corn planter, A. M. Southard | 185,140 |
| Corset, M. P. Bray | 185,071 |
| Cotton bale tightener, C. E. Boardman | 185,070 |
| Cotton sweep, H. C. Buhoup | 185,073 |
| Counting alarm apparatus, F. L. Burns | 184,954 |
| Culinary utensil, Kellogg & Lintner | 185,100 |
| Cultivating plow, McAllister & McDonald | 185,039 |
| Cultivator coupling, H. Feltman | 184,900 |
| Cup and ball toy, G. Schoen | 185,049 |
| Curd mill, J. P. Bellinger | 185,012 |
| Curtain fixture, R. J. Pospisil | 184,992 |
| Cutting stone, I. W. Bradbury | 185,072 |
| Dental plugger, R. B. Donaldson | 185,086 |

| | |
|---|---|
| Desk, E. N. Doring | 185,020 |
| Door check, C. H. Osborn | 185,043 |
| Draft regulator, automatic, J. Fowkes | 185,004 |
| Dredging machine, E. B. Tassey | 184,998 |
| Dumping device, W. Willes | 185,055 |
| Earth auger, McCain & Purinton | 184,977 |
| Electric governor, J. E. Rettig | 185,047 |
| Electro therapeutic bath, J. W. Mollere (r) | 7,415 |
| Elevated railway, J. Johnson | 184,968 |
| Elevated railway, J. Montgomery | 185,122 |
| Envelope, L. J. Henry | 185,103 |
| Envelope, G. F. Taylor | 185,144 |
| Extension table slide, H. G. Porter | 184,981 |
| Fare register, W. Stokes | 185,053 |
| Farm wagon spring, L. Pulliam | 185,129 |
| Fastening for ratchet wheels, J. M. Childs | 185,015 |
| Fence, A. M. Corbit | 185,039 |
| Fence post, H. N. Dunbar (r) | 7,413 |
| Fence post, H. Fitts | 185,022 |
| Fire escape, M. Neville | 184,978 |
| Fluid meter, J. R. Norfolk | 184,979 |
| Fluid regulator, E. F. Rogers | 185,134 |
| Fly brush, D. H. Mowen | 185,042 |
| Folding table, A. Gray | 185,099 |
| Fruit drier, W. H. Wiley | 185,097 |
| Furnace door, J. Ashcroft | 184,949 |
| Furnace for fluid fuel, H. A. Branch | 184,953 |
| Galvanizing terne plates, Jones & Cope | 185,034 |
| Gas retorts, cleaning, N. Jamin | 185,107 |
| Gate, H. W. Goodwin | 185,097 |
| Gig saddle, J. B. Gathright | 185,023 |
| Governor, marine, J. Steele | 185,081 |
| Grain binder, E. R. Whitney | 185,151 |
| Grain drill, J. R. Roe | 185,131 |
| Grain sampler, J. F. Gent | 185,024 |
| Grasshopper catcher, E. Kenworthy | 184,970 |
| Grinding mill, etc., D. C. Ebaugh | 185,089 |
| Grinding mill, Stewart & Dunlap | 185,142 |
| Hand piece for dental engines, E. T. Starr | 184,994 |
| Hanger for shafting, J. Yocom, Jr. | 185,152 |
| Harness hame, O. T. Dozier | 185,086 |
| Harvester, Winans & Vandusen | 185,056 |
| Harvester rake, Underhill & Cooley | 185,000 |
| Holder for ribbon peg wood, B. F. Sturtevant | 185,143 |
| Horse hay fork, J. B. Denning | 185,018 |
| Horse cart, irrigator, etc., E. J. Delaney | 184,956 |
| Inkstand, B. Brower (r) | 7,419 |
| Jacquard loom, T. Halton | 185,027 |
| Journal and bearing, F. B. Miles | 185,121 |
| Lamp burner, J. Curzon (r) | 7,412 |
| Lamp chimneys, E. Blackman (r) | 7,417, 7,418 |
| Lamp chimney cleaner, J. M. & G. N. Schatzel | 185,138 |
| Lamp wick, A. Angell | 185,059 |
| Laundry soap, D. Stanton | 184,991 |
| Lead pipe connection, Clapp & Kenney | 185,075 |
| Leather, stamping, Gathright & Watson | 185,095 |
| Link for chains, connecting, J. Mann | 185,037 |
| Locking nuts, tool for, M. H. Dooly | 185,084 |
| Loom shuttle, O. A. Moore | 185,041 |
| Magneto-electric machine, A. G. Holcombe | 184,966 |
| Match safe, C. G. Mortimer | 185,123 |
| Measuring faucet, R. Wasmansdorff | 185,001 |
| Measuring faucet, J. M. Wheeler | 185,003 |
| Meat chopper, S. E. Hewes | 185,104 |
| Middlings, separator, J. J. Haller | 185,026 |
| Mill pick, E. F. Lemoine | 185,114 |
| Millstone dress, E. N. Roeder | 185,133 |
| Millstones, dressing, Orff *et al.* | 185,125 |
| Mining riffle, A. Mann | 185,116 |
| Molding bricks, etc., J. J. Endres | 185,090 |
| Nut lock, W. H. Young | 185,008 |
| Oiler machine, S. Hutchinson, Jr. (r) | 7,414 |
| Organ action, A. N. Hanna | 185,029 |
| Ornamental glass panel, W. Bleiss | 185,013 |
| Ozone machine, H. Milson | 185,040 |
| Packing rosin, H. Johnson | 184,969 |
| Pannier, E. S. Weldon | 185,150 |
| Paper-cutting machine, A. Wieting | 185,005 |
| Pavement, composition, P. F. Baldauff | 185,064 |
| Picture exhibitor, F. E. Schneider | 185,139 |
| Pipe wrench, D. B. Cook | 185,078 |
| Pipes, stopping leaks in, G. F. Wilson | 185,153 |
| Plow, B. F. Jones | 185,108 |
| Plow, J. E. Wilkinson | 185,152 |
| Pneumatic siphon pump, Skiff & Colt | 184,987 |
| Pocket cutlery, J. W. Ayers | 185,062 |
| Polishing machine, W. H. Goodchild | 184,962 |
| Pottery ware, forming, R. Glenon | 185,096 |
| Propulsion of vessels, E. E. Tassey | 184,997 |
| Pulley block, B. Arnold | 185,060 |
| Pulling piles and posts, R. Hillyer | 184,965 |
| Pump, A. S. Baker | 185,063 |
| Punching metal plates, C. Mason | 185,117 |
| Railroad rail chair, J. Peck | 184,980 |
| Retort furnace, boiler, G. K. Stevenson | 185,052 |
| Revolving harrow, etc., W. J. Atchison | 185,061 |
| Ribbon wire, J. Fettis | 185,093 |
| Roof fender, F. O. Rogers | 185,137 |
| Roofing composition, H. K. Shanck | 185,050 |
| Rotary churn, T. Landt | 185,112 |
| Rotary force pump, C. C. Birum | 185,069 |
| Rotary pump, Boulton & Imray | 184,952 |
| Ruler, C. M. Hays | 185,102 |
| Sad iron, Fancher & Judson | 185,091 |
| Saddle blanket, J. R. McCormick | 184,975 |
| Safety valve, S. Harrison | 185,101 |
| Saponaceous compound, D. Stanton | 184,990 |
| Scissors, A. W. Coates | 185,077 |
| Sediment collector, Adgate & Hickman | 184,948 |
| Seed planter, G. E. Herrick | 184,964 |
| Sewing machine, F. M. Johnson | 185,033 |
| Sewing machine chair, J. H. Dymond | 185,021 |
| Sewing machine hemmer, M. Duff | 184,959 |
| Sewing thread cutter, C. H. Bayley | 184,950 |
| Ships' buttons, cleaning, D. Corning | 185,081 |
| Siphon propeller pump, E. E. Tassey | 184,996 |
| Slate pencil sharpener, W. H. S. Hennaman | 185,030 |
| Sled and truck, S. F. Brooks | 185,014 |
| Sled propeller, G. P. Warner | 185,149 |
| Sliding rowlock, G. W. Isaacs, Jr. | 185,032 |
| Smelting copper, method of, E. E. Sluder | 184,988 |
| Smelting furnace, Reynolds & Sluder | 185,132 |
| Smoke stack and arrester, J. Taylor | 185,145 |
| Sowing fertilizers, W. J. Diltz | 185,083 |
| Spindle for mules, etc., J. H. Sawyer | 184,986 |
| Spittoon bracket, S. S. White | 185,004 |
| Spring bed bottom, A. J. Lattin | 185,113 |
| Stair pad, E. H. Bailey, (r) | 7,411 |
| Steam car, L. Ransom | 185,131 |
| Steam radiator, F. Tudor | 185,146 |
| Stool, portable, C. E. Haynes | 185,028 |
| Stove pipe damper, J. K. Clark | 185,076 |
| Strap joint and oiler, L. Ransom | 185,130 |
| Street car doors, operating, J. McGregor | 185,118 |
| Taper boring attachment, P. L. Rogers | 185,136 |
| Tobacco manufacture, C. A. Pilinsky | 185,046 |
| Tobacco plugs, finishing, Miller & Worley | 185,119 |
| Tool and tool holder, W. S. How | 185,105 |
| Torch and firework holder, A. Tufts | 185,147 |
| Toy pistol, H. M. Du Bois | 184,958 |
| Trap for street sewers, T. Derk | 185,017 |
| Tree protector, Peace & Comstock | 185,044 |
| Tubs and buckets, making, D. H. Wilder | 185,054 |
| Upholsterer's button attachment, E. E. Peck | 185,127 |
| Vapor burner, E. F. Rogers | 185,135 |
| Vapor stove, J. H. Bean | 185,063 |
| Vehicle axles, setting, L. Lindstrom | 184,974 |
| Vehicle seat, F. Oppenheim, (r) | 7,416 |
| Ventilating skylight, etc., D. Condon | 184,955 |
| Washing machine, L. F. Betts | 185,067 |
| Watchman's time detector, W. Imhaeuser | 184,967 |
| Water meter, H. L. Arnold | 185,010 |
| Water motor, H. L. Arnold | 185,011 |
| Waterproofing fabrics process of W. Pugh | 184,984 |
| Wax holding apparatus, S. N. Corthell | 185,080 |
| Wheel felly, E. P. Hood | 185,031 |
| Whiffletree, A. B. Allen | 185,009 |
| Whip socket, A. J. Kidd | 185,035 |
| Window blind, B. Green | 185,100 |
| Wood, preserving, H. Akerhielm | 185,058 |
| Wrench, D. C. Stillson | 184,993 |

DESIGNS PATENTED.

9,661.—GLASS, ETC.—J. E. Heuacker, Newark, N. J.
9,662.—RUBBER SHOES.—C. Meyer, New Brunswick, N. J.
9,663, 9,664.—DRAWER-PULLS.—W. N. Weeden, Waterbury, Conn.
9,665.—TYPES.—R. Smith, Philadelphia, Pa.

SCHEDULE OF PATENT FEES.

| | |
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| On issuing each original Patent | 20 |
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| On appeal to Commissioner of Patents | 20 |
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# SCIENTIFIC AMERICAN

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

Vol. XXXVI.—No. 3. [NEW SERIES.] NEW YORK, JANUARY 20, 1877. [$3.20 per Annum. (POSTAGE PREPAID.)]


## THE BUILDINGS FOR THE FRENCH EXPOSITION.

The preparatory arrangements for the international exposition, to be held in Paris in 1878, are already in a forward condition. The building will, as in 1867, be erected in the Champ de Mars, and will cover the entire extent of that celebrated parade ground, reaching from the Ecole Militaire to the river Seine, at the bridge of Jena. Leaving the main exposition building, and crossing the bridge, we enter the Trocadero, an ornamental garden of great beauty, which forms one of the greatest attractions of the renowned Bois de Boulogne.

Our illustration gives an admirable view of the Trocadero as it will appear in the summer of 1878, the artist having stood on the bridge of Jena while making his sketch. Several subsidiary buildings and offices will be erected in the gardens; and a grand central hall for fêtes, ceremonial occasions, etc., will stand in the middle of the further end, on the higher ground towards the Bois de Boulogne. The two crescent-shaped side structures, which, as will be seen, are to be of great extent, will be devoted to the historical collections of pictures, contemporary paintings being exhibited elsewhere. The fountain and cascade will be very attractive features, and will show how artistically the French arrange the water displays which ornament so many of their parks, gardens, and other public resorts.

The cascade is 160 feet wide, falling in several descents to a lake, from which the different parks and shrubberies will be watered. The palace of the Trocadero is, from one pavilion to the other, about 1,330 feet in length, the pavilions at the extremities being connected with the great central rotunda, from the foot of which flows the cascade, by galleries forming segments of a semicircle. In the great hall of the rotunda, an immense organ is to be placed, and concerts will be given on the grandest scale. It has a large parterre, two rows of boxes, and above all an amphitheater, and will seat 8,000 people. Round the concert room outside, giving access to the boxes, are double galleries, closed from the weather, and affording to promenaders a splendid view of the city. On either side are peristyles opening on the Place du Trocadero on the side of the Bois du Boulogne. Above them are the offices of the managers and committees; they also serve as vestibules to the two great curved galleries that run from the central rotunda to the pavilions. These galleries are in a succession of halls; before each is a light, covered portico, running the whole length.

From all parts of Paris will be visible the two immense towers, 260 feet in height, flanking the Trocadero. A flight of seventeen broad steps conducts to the palace, before the portico of which a wide terrace stretches from one extremity to the other. The principal entrance is at the middle, and at each end are two immense domes in iron and glass, surmounted by lanterns and flagstaffs. The gardens stretch on either side of the façade between the palace and the avenues, and contain a number of small buildings, kiosks, model farms, cottages, *cafés*, greenhouses, and the like. The center is left unoccupied for the better convenience of spectators.

The architects in charge of this important feature of the exposition are MM. Davioud and Bourdais.

This is the first illustration of a series which we intend to publish, showing all the features of this great exposition, which will be the largest that the world has ever seen. Although the opening will not take place for the next sixteen months, the demands for space are already pouring in, and intending exhibitors should at once begin making their arrangements. The rapidly increasing export of American machinery to Europe, notably stationary steam engines, in which manufacture the United States has no competitor, gives additional importance to the Paris Exposition; and we hope that our manufacturers and inventors will sustain the national credit for ingenuity and practical skill. The regulations as to forwarding exhibits were published on page 361 of our volume XXXV.

### A Gigantic Time Piece.

The monster clock by Messrs. E. Dent & Co., London, for the Crystal Palace, which has been in course of erection during the past six months at the south end of the building, is now completed and in working order. This clock is almost a counterpart of the great Westminster clock (which was built by the same firm), with the exception of the striking and chiming apparatus, and the dial is the largest ever yet constructed, being 40 feet in diameter, or nearly 1,300 square feet in area. The diameter of the Westminster clock is but 23 feet. The hands, with their counterpoises, weigh nearly a quarter of a ton; the minute hand measures 19 feet in length, and moves ½ inch at every beat of the pendulum. The distance travelled by the point of the minute hand is nearly four miles a week. During seventeen days of observation the variation was eight seconds only.

### To Obtain the True Meridian.

In all of the recent works on surveying, it will be found that Alioth, the first star in the handle of the Dipper, is designated as being directly opposite the pole from Polaris, the north star. There was a time when such was the case, but now it is far from being correct.

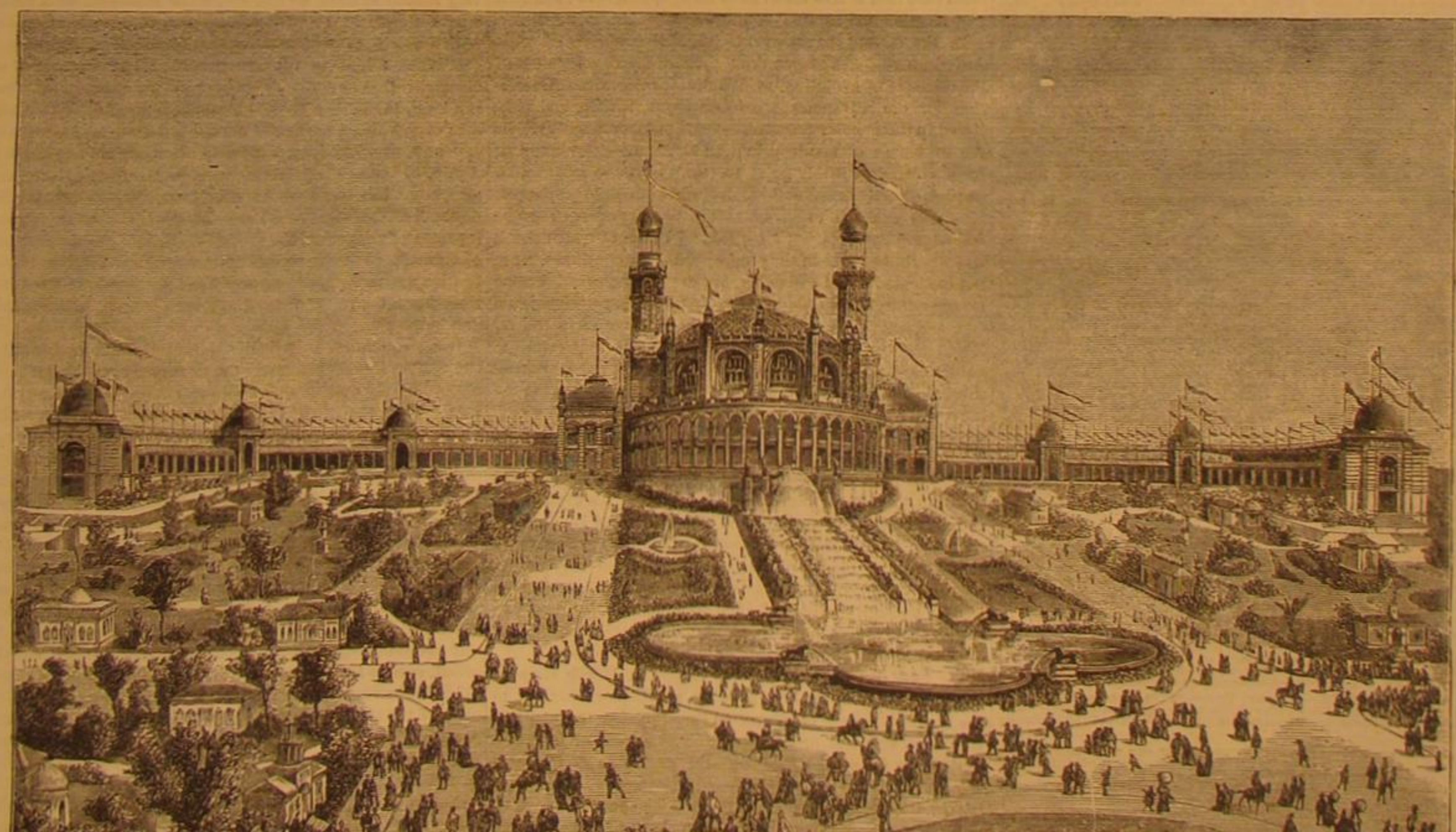
The first published account of this method which we have been able to find is in a revised edition of Abel Flint's work on surveying, published in 1833, which states that this method was communicated to the compiler, with permission to publish, by Moses Warren, of Lyme, Conn. It appears that this mode of reckoning had been in use among surveyors for some time previously; but we have not been able to find by whom or when it originated.

In 1800, Alioth was opposite Polaris; but a retrograde movement of the latter, of about twenty seconds a year, has caused Alioth to be, at the present time, twenty-five minutes ahead, and brings Mizar, the second star in the handle, within five minutes of being opposite; so that, in fifteen years more, Mizar will be exactly opposite. Polaris is on the meridian twenty-five minutes after Alioth has passed the perpendicular, and five minutes before Mizar reaches it. C.

[We republish this article, in consequence of some errors in the previous insertion of it.—EDS.]

### Steam Street Sweeper.

The Third Avenue Railway Company, New York city, has lately put into use a steam sweeping machine which performs the work of removing the snow from the street tracks with much success. The machine resembles in appearance an ordinary box freight car. Under each end of the car is a revolving brush, which extends obliquely across the track, and capable of being raised or lowered as required, by an attendant within. The car is drawn by horses, but the brushes are worked by steam power. As the machine moves along, the horses on a walk, the snow is lifted into the air in large quantities, by the powerful brushes, and falls in graceful cascades upon one side of the track, forming a continuous windrow.



THE FRENCH EXPOSITION OF 1878.—THE TROCADERO.

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**Contents.**

(Illustrated articles are marked with an asterisk.)



TABLE OF CONTENTS OF
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**No. 55.**

**For the Week ending January 20, 1877.**





## THE PREVENTION OF CRIMINAL PROPAGATION.

In discussing the scientific treatment of criminals and kindred topics, the SCIENTIFIC AMERICAN has long insisted that the safety of the social order demands a different treatment of the criminal classes than has hitherto prevailed. The vindictive method, the first resort in all rude communities, has everywhere resulted in failure. The severest punishments, the most threatening of decrees against wrong-doing, have never yet been able to diminish, much less suppress, crime. Indeed, violence has usually been met with violence; so that the prevalence of crime has, as a rule, been in direct ratio to the severity of the law. As a reaction against legal harshness, the sentimental treatment of criminals arose. The reformation of the criminal, not the vindictive punishment of him, became the watchword. Crime was regarded as a purely moral disease, to be cured by moral agencies, with only so much severity and restraint as might be necessary to prepare the subject for the medicine, and secure his continued treatment. This method has succeeded better than the first, wherever it has been thoroughly and consistently carried out; still it has failed utterly wherever the time of treatment has been arbitrarily limited, as it generally is, and in all cases where the criminal tendency is the result of low organization or hereditary taint. And it is open to the very serious objection that it makes the criminal class, as a whole, an unnecessarily heavy burden upon the honest and law-abiding. It puts the State in the attitude of an affectionate but unjust mother, who sacrifices the rights of her well behaved children upon the altar of her morbid affection for the "black sheep" of her little flock. As a possible and more promising third course, our proposition was to sink the idea of vengeance in the treatment of criminals, and all the suggestions of sentimentality as well. The criminal is not a devil-possessed monster to be destroyed, or in any way made the subject of vindictive or warning penalties; no more is he a saint under a cloud, to be coddled and cherished and helped on to heaven. He is simply an ill born or ill bred organization, more or less unfit to enjoy the privileges of civilized society. Society may be really more to blame than the criminal for his criminal condition; nevertheless, the safety of the whole makes it necessary that he should be restrained from the exercise of his evil propensities, and still more that he should not be suffered to transmit his vicious organization to other generations. And in justice to the law-abiding, the means adopted for the securing of these ends should be so simple and direct that the inevitable burden of crime should not be needlessly exaggerated.

How the latter result can best be secured, it is not our purpose to consider here, our attention being just now drawn to the more important element of the problem, the prevention of criminal propagation. We are glad to see that the novel and sufficiently radical position taken by the SCIENTIFIC AMERICAN, in the article entitled "The Generation of the Wicked," is having its effect in the right quarter, that is, among scientific men who will ultimately have this great reform to carry out. The moment the public comes to understand the enormous importance of heredity in this and in other directions, there will be a stop, we fancy, to the suicidal care that is now taken in so many quarters to insure the perpetuation and survival of the worst.

In the closing pages of his instructive survey of what American zoologists have done toward the development of the doctrine of evolution, read before the American Association for the Advancement of Science at Buffalo, and published in the *Popular Science Monthly*, Professor Morse reviews the evidences of man's primitive character—"an array of facts which irresistibly point to man's common origin with animals directly below us"—and remarks that only the densest blindness can fail to recognize the bearing of such grave and suggestive facts. "The dreadful outrages which shock us from time to time in the public prints," he continues, "are not instigated by an evil spirit, but are outbursts of the same savage nature which found more frequent expression years ago, and which are still present in the lower races to-day. When the study of heredity reveals the fact that even the nature of vagabondage is perpetuated, when the surprising revelations of Margaret, mother of criminals, from whose loins nearly a thousand criminals have thus far been traced, are considered, common sense will ultimately recognize that the imprisonment of a criminal for ten or twenty years is not simply to punish him, or relieve the public of his lawless acts, but to restrain him from perpetuating his kind. No sudden revulsion of feelings and amended ways is to purify the taint; but he is to be quarantined in just the same way that a case of plague might be, that his kind may not increase. With these plain facts thoroughly understood, men high in authority must find some other excuse for the exercise of their pardoning power, and other reasons be given for allowing so large a proportion of criminals to go free."

We have discussed this whole matter at length already, and our readers know how little we are disposed to trust to the saving influence of perpetual imprisonment for the prevention of criminal propagation. The stream of tendency that works for unrighteousness—the dark side of Matthew Arnold's divinity—must be stopped at its source, so far as it lies in the power of man to do it. The pestilent flood of criminal entailment must be dried up absolutely: not temporarily suppressed, and left at the mercy of any magistrate to let loose again at any moment. In other words, the surgeon, not the parson or the turnkey, is the proper man to deal with the matter.

If the criminal is in debt to society, let him be confined till the wrong done has been repaired, and the debt paid by hard labor. Then if he be so far reformed in character that the public safety is not endangered by his being at liberty, let him go free—on this sole condition, however, that he has been physically debarred from tainting generations yet to be. This act of justice to the future should be, indeed, the first step taken in the treatment of all criminals, more especially those in which the crime is a symptom of tainted blood. After that, let strict justice to the present unite with sentiment and religion to make the most and best of the perverted organization in hand.

## THE GEOGRAPHICAL DISTRIBUTION OF ANIMALS.

Mr. Alfred Russell Wallace shares with Mr. Darwin the honor of developing the natural selection theory in its present form. He conceived his theory of the origin of species, as he himself says, "before I had the least notion of the scope and nature of Mr. Darwin's labors," and he reached his conclusions simultaneously. He differs, however, from Mr. Darwin in the very important item of the derivation of man, holding that the doctrine of natural selection is not sufficient to explain the transition from the anthropoid ape to man, and that it requires the co-operating agency of some higher cause.

The field of labor of Mr. Wallace, while differing from that of Mr. Darwin, is scarcely of less importance. While the latter naturalist has spent his life studying the hidden characteristics of animal life, and so evolving a history of all living beings *ab initio*, Mr. Wallace has chiefly devoted himself to the investigation of the external part of animal existence; and by dint of personal labor of great magnitude, he has rendered to Science services of inestimable value. It is not our purpose here to enter into Mr. Wallace's biography as a scientist, any further than is necessary to estimate the foundation upon which his latest and greatest work has been reared. From an early period of his life he has been an indefatigable explorer. In the primeval forests of the Amazon and the islands of the Malayan Archipelago, he has spent years; his collections of specimens of birds and insects are remarkably large, and thus his knowledge is not that of the closet naturalist, but has been gained directly from the study of Nature herself. The geographical distribution of animals has been the subject of his researches for several years past, and the results thereof are embodied in the voluminous work which he has lately published. To understand the basis of the investigation, we may briefly follow the author through his introductory summary of his subject: "It is a fact," he says, "within the experience of most persons, that the various species of most animals are not uniformly disposed over the surface of the country." If we wish to find certain birds, or insects even, in our own vicinity, we search for them in particular places; then, as we travel, we constantly meet new species, and lose sight of old ones; and if we progress far enough, we shall find the creatures peculiar to our own district replaced by an entirely new set. We have thus witnessed a double change. First, in our own neighborhood, animals appeared or disappeared according as the soil, vegetation, etc., suited them, or the reverse. But as we got further away, we began to find (second) that localities, very similar to those we had left, were inhabited by a somewhat different set of species, and this difference increased with distance, notwithstanding that almost identical external conditions might be often met with. The first class of changes is that of stations; the second that of habitats. One is a local, the other a geographical phenomenon. The whole area over which a particular animal is found may consist of any number of stations, but rarely of more than one habitat. Again, of the new animals we meet in our travels, some are very much like those we leave at home, others are totally dissimilar. The first series are examples of what are termed representative species, the second of distinct groups or types of animals. The one represents a recent comparative modification and an origin in or near the locality where it occurs; the other is the result of very ancient changes, both organic and inorganic.

It has commonly been believed that the manner in which the various kinds of animals are dispersed over the globe is almost wholly due to diversities of climate and of vegetation. Thus the arctic regions are characterized by white bears, reindeer, walruses, etc., and the tropics by elephants, peacocks, etc.; but it has been found that this explanation is altogether insufficient, and it is now known that countries exceedingly similar in climate and all physical features may yet have very distinct animal populations. Thus the equatorial parts of Africa and South America are similar in climate, and both are covered by luxuriant forests; yet the apes, leopards, and elephants of the one are replaced by prehensile-tailed monkeys, jaguars, and tapirs in the other. Again, if we examine closely the distribution of animals in any extensive region, we find that different, though closely allied, species are often found on opposite sides of any considerable barrier to their migration. Mountain ranges, rivers, arms of the sea, and changes of climate and of vegetation form effective barriers, and the limits of the great forests strictly determine in most parts of the world the range of many species.

Naturalists now believe that, by some slow process of development or transmutation, all animals have been produced from those which preceded them. This modification takes place very slowly, and the changes appear to have accompanied, and perhaps appear to have depended on, changes of climate, vegetation, etc. "If we keep in view these facts," says our author, "that the minor features of the earth are everywhere slowly changing, that the forms and structure and habits of all living things are also slowly changing: while the great features of the earth, the continents and oceans and loftiest mountain ranges, only change after very long intervals and with extreme slowness: we must see that the present distribution of animals upon the several parts of the earth's surface is the final product of all these wonderful revolutions in organic and inorganic nature." Hence the study of animals may reveal to us which are the oldest and most permanent features of the earth's surface, and which the newest; and may show us the existence of continents, now sunk beneath the ocean, which have left no record save the animal and vegetable productions, which have migrated to distant lands.

Mr. Wallace's work is too extended to admit of its complete review within the limits here at our disposal; but the foregoing will convey a general idea of his theory, and prepare the reader for other articles, wherein we shall consider the salient features of the facts and arguments presented.

## MODERN HALLS AND THEATERS.

Sooner or later every theater burns. From the conditions of the case, the chances are that the fire will occur while the building is occupied. Owing to the combustible nature of the stage and its appliances, the fire is certain to be sudden and fierce, and the smoke exceedingly pungent and suffocating. The sharp awakening of the spectators from the unreal life of the play to the real terrors of death by fire takes them at a serious disadvantage. The imagination, excited by the play, leaps at once to the extremity of fear, and the condition of panic is almost inevitable. Nothing short of the conviction that escape is easy and sure, and not always that, will prevent a headlong rush for the door. In such a rush some are sure to fall, thus adding to the unavoidable confusion and delay. Converging streams of excited people, narrow stairways, and sudden turns invariably result in increasing the falls, crushes, and fatal hindrances, whenever haste is important or danger imminent; so that passage ways which would be ample under ordinary circumstances are altogether inadequate in case of panic.

These conditions are as apparent before a disaster comes as after. They are elements of danger in public assembly rooms, which the builder should take into account and provide against as carefully as against unstable walls or insufficient supports. Not to do so is simply criminal. Yet how few are the public halls in New York in which they have been guarded against! How many theaters and concert halls have we in which a disaster, as terrible as the one in Brooklyn, is quite impossible?

Now that public feeling is aroused on this point, it is to be hoped that the discussion will not end until practical measures of precaution have been secured, by legislative action or otherwise.

It is but a few years since a cathedral in South America was a scene of horror as fearful as that in the Brooklyn Theater. In how many of our costly churches would any panic stricken congregation fare any better under like conditions? In how many could the audience escape, in case an explosion of gas or other cause should give rise to a sudden fire in the lobby? Very often there is but one means of exit from the body of the church, and very rarely is there more than one from the galleries. Our theaters and concert halls are, as a rule, still worse in their construction. The new hall on Fifth avenue is perhaps a fair type of such mantraps. From the capacious gallery there is absolutely no outlet except to the front, where two narrow stairways converge in a narrow hall into which the outlets of the main hall open. Thus half a dozen streams of people pour in cross currents into a space which would be packed in case of a rush so that escape from it would be all but impossible, and out of which there is no passage except down other stairways, badly placed and insufficient for easy exit even when there is no pressure from behind. Should a fire break out on that side of the house, the trap would be especially deadly. Those in the galleries would have absolutely no way of escape, while for those in the body of the hall the chances would be anything but cheering. The hall of the Young Men's Christian Association Building and others that might be named are little, if any, better provided with easy outlets.

The ancients did better. They made their theaters of solid earth and masonry, practically fireproof. In course of time we moderns may learn to do likewise, but we fear that such wise and costly precautions for public safety are not to be looked for yet awhile. The most that we can expect is the adoption of simple means already at hand for lessening the danger of fire and for facilitating the escape of audiences when the inevitable time of danger arrives. Among them not the least important are these, and the public should rest with nothing less, namely: That there be provided a sufficient supply of fire extinguishers in all places of popular resort. That the passage ways from every assembly room should be numerous and ample, so that escape may be easy, even should one or more of the ways be blocked by fire or otherwise.

That the outlets of the passage ways be easily opened from within, and so placed as to be readily accessible from every part of the hall.

That each general division of the audience have its independent means of exit.

That an incombustible curtain be hung so that it will drop between the audience and the stage, in any case of fire in that part of the building.

That all stairways leading from galleries or other parts of the auditorium be broad and free from sudden turns.

Perhaps the risk of jams and falls, with their attendant dangers, might be further lessened by dividing the stairways into lanes by means of stout hand rails, which would keep the living currents from side thrusts and general obstruction.

Had these safeguards or anything like them existed in the Brooklyn theater, the disaster there could never have occurred. Its repetition elsewhere should at once be made impossible by their adoption everywhere, so far as may be demanded in each particular case.

## A MUTUAL DISSECTION AND DECAPITATION SOCIETY.

Some time ago, we noted the strange mutual compact, made by a few eccentric physicians of Paris, to the effect that each would provide that his body should be delivered, after death, to his fellow members for purposes of dissection. It now appears that many well known French medical men and scientists have joined in a similar agreement, and a society has been organized, and a constitution has been adopted which is quite a curiosity in its way. The document recites that "the subscribers, convinced that the intellectual future of humanity depends entirely upon the more or less exact notions which are possessed concerning the cerebral functions and the localization of the different faculties," agree upon the following propositions:

The physiological study of psychology, that is to say, the determination of the relation existing between a special function and some corresponding clearly circumscribed portion of the brain, is still very incomplete. Observation, to be fruitful, should be made upon the *encephala* of individuals belonging to the cultivated classes: in other words, of persons who have become well known as savants, literary men, politicians, etc. In such cases, where the life of the person has in part been before the public, it is believed that the comparative study of the healthy convolutions and the faculties in action, will lead to valuable positive knowledge. In the interest of public health and of the longevity of posterity, the society thinks that it is greatly to be desired that the practice of making *post mortem* examinations be rendered more general, and that families should keep records of the results of autopsies of their deceased members, in order to guide their medical advisers in treating the living.

The formal part of the constitution is as follows: "The subscribers, considering that the best way of conquering prejudice is to set the example, organize themselves into a society on the following basis: Article 1. Each member, resolved to contribute to the double object, scientific and humanitarian, above detailed, agrees that his autopsy shall take place. Article 2. In order to remove any obstacle to the execution of his desire, which may be brought forward after death, he will leave (written by himself in duplicate, and confided to responsible persons who 'shall accept the pious duty of respecting it') the following testament: 'I, the undersigned, desire and wish that, after my death, my autopsy may take place, in order that the discovery of vices of conformation, or the hereditary maladies to which they may give rise, may serve as a guide to the proper means for opposing their development in my descendants. I desire especially that my body be utilized to the profit of the scientific idea that I have pursued during my life. To this end I bequeath my corpse, notably my brain and skull, to the laboratory of anthropology, where it will be utilized in any suitable way not opposed to the provisions herein stated. The parts of my body remaining unutilized will be buried or disposed of in the following manner:'" Here a blank occurs for the testator to specify his predilections as regards cremation, burial, etc. Then comes a long list of physicians, and the information that people wishing to join may address Dr. Condercan, 5 rue Marsollier, Paris.

The institution seems to be a new kind of mutual admiration society, or rather an association for the cheap supply of posthumous fame. A person has only to become a member to be assured that after death some inquisitive scientist, mousing around his brain, will probably discover that he might have been a great author or a great general, if his genius had had but the opportunity. Inventors of perpetual motions and Keely motors, scouted during life by an unappreciative world, will, through their *encephala* under the hands of the anatomist, demonstrate that the mental possibilities of vast discovery were in them, even if the sordid and material practical portion of the same were absent. Finely developed convolutions, unimpaired gray matter, and absence of adipose deposit will be all that is necessary to place the Slades and the Homes, and the myriad other victims of the "scoffers and unbelievers," in a high seat in this necrological legion of honor.

## COLORED PHOTO-LITHOGRAPHS BY COLOR-BLIND CAMERAS.

In our recent article on color blindness, we explained the simple expedient of spectacles of colored glass, whereby persons afflicted with the above defect in vision might counteract its deceptive influence. The glass, according to its color, cuts off from the retina certain rays. Thus red glass stops out all but the red and orange rays; yellow glass extinguishes the purple rays, and so on, through the different hues of the medium, the latter in every case being thus opaque to some part of the spectrum. It follows, conversely, that, by the aid of colored glass, our eyes being perfect, we can put ourselves in the same condition as a color-blind person; and in the article referred to, we noted various cases where such temporary color blindness might be beneficially resorted to.

The reader has only to bear in mind the analogy between the photographic camera and the human eye to understand the ingenious application of the foregoing to the practice of colored photo-lithography, as invented by MM. Cros, Du Hauron, and others, and which has of late been successfully experimented upon in Paris. Of the various colors of the spectrum, red, yellow, and blue have been regarded as fundamental, because from them, by mechanical mixtures of pigments, the other colors can all be compounded. The premises are correct, but the conclusion is wrong, as the latest experiments prove that red, green, and violet-blue are the color sensations of the simplest nature. For the purposes of the present explanation, however, it will suffice to regard the colors first mentioned as the bases of all natural hues, and, therefore, by suitable superpositions of tints and shades of red, yellow, and blue, we may reproduce the natural colors of any image, just as they appear on the ground glass screen in the camera. We need only, in fact, supply our camera with colored spectacles to effect this result.

Suppose that, first, a green glass is placed between the lens and object to be photographed. Glass of this color, while allowing blue and yellow rays to pass, stops all the red rays. Hence the image on the ground glass screen in the instrument will be destitute of red, and for the same reason a sensitive plate interposed will be unaffected at wherever the red rays would strike, were the green glass absent; and at such points, therefore, the negative will be transparent. A positive, taken in the ordinary way from this negative, would therefore exhibit in black only the red portions of the object, and it would resemble the proof from a chromo-lithographer's stone used for printing a part of a picture in a certain color.

Similarly, an orange glass would cut off all the blue rays, and a violet glass would annul the yellow rays, and with each of the glasses, the above process being repeated, would yield positives showing respectively only the parts in blue and in yellow on the original. At first sight it is not clear how the actual whites and blacks would, in the above way, be provided for, and made to appear in their relative proportions and values on the final proof. The rays of white light emanating from the white parts of the model traverse, of course, the three colored glasses, each in turn becoming tinted more or less with the hues of the glasses, but keeping, nevertheless, a photogenic action. This action will be indicated on each negative by opacities, which, on the monochromic positive proofs, will be represented by transparent portions. Therefore, when the three monochromic proofs are superposed, as below described, on a sheet of white paper, the latter will show through wherever there is transparence. The blacks, on the other hand, will be indicated on the negatives by transparent places, and hence at such points the color of each positive will appear at maximum intensity. But the superposition of the three colors (those below being seen through those above) will, by their combination form black.

The actual operation of superposing the three positives, as described by M. E. Dumoulin, in *La Nature*, is quite simple. Photo-lithograph may be resorted to to prepare stones for printing from in the usual way on the white sheet. The chief difficulty with which the above described process had to contend was that of shortening the posing period. When the orange glass was before the lens, this period was extremely long, despite the fact that the collodion was strongly bromidized. It has since been found that coralline, mixed with the collodion, greatly diminishes the necessary time of exposure, as this substance possesses the property of communicating to the collodion an especial sensitiveness to red and green rays. Chlorophyll has, however, lately been substituted for coralline, and the alkaline development for the ordinary process, by which means the period of exposure under the orange glass has been shortened from several hours to a few minutes.

### Spirit Lace.

We are greatly indebted to a correspondent for a specimen of lace which, he informs us, was "materialized" at a recent spiritualistic *séance*. We have long desired to examine some of these marvellous productions of the elect, hoping thereby to acquire a knowledge of some of the phenomena not "known to our philosophy." It is with the greater regret, therefore, that we perceive that the spirits have not improved upon the goods manufactured by base mortals, and that the filmy cloud wreaths, out of which this veil was undoubtedly formed, are capable of no better materialization than as a cheap quality of tulle, stiffened with unspiritual British gum. The only thing about the fabric which savors of the spiritualistic is that it is of the variety of lace commonly known as "illusion."

### Alcohol and Cold.

At a meeting given to the Good Templars of the English arctic expedition, Mr. William Malley, of the Alert, in relating his experiences, said that, among the few men who escaped scurvy, and did any sledging worthy of notice, were four teetotallers, who enjoyed perfect immunity from all sickness, establishing beyond the shadow of doubt that the intense cold of the polar regions could be well endured without stimulants.

### Intense Light for Taking Photographs.

A very brilliant, perfectly white, and very actinic light, which may be used for taking photographs, is produced as follows: Place some perfectly dry, powdered nitre in a suitable clay vessel, and in a cavity made in the middle of the powder place a piece of phosphorus and ignite it. While it burns, the nitre melts and a quantity of oxygen gas is given off, producing an intense light.

## THE RECENT ARCTIC EXPEDITION.

We so recently published a description of the achievements of the British Arctic Expedition, under Captain Nares, that any repetition of the account is unnecessary. We are now, however, in possession of the Captain's journal of the voyage, and the following extracts from it will serve to explain why the two ships, provided with every necessary equipment and fully manned, were unable to proceed further toward the pole, and will also show the futility of the open polar sea theory. After fully describing the route taken by the ships, and the geography of the explored region, Captain Nares states that it was found that, "owing to the absence of land trending to the northward, the polar pack not being navigable, no ship could be carried north on either side of Smith's Sound beyond the position we had already attained; and also that from any attainable position in Smith's Sound, it was impossible to advance nearer the pole by sledges. The only object, therefore, to be gained by the expedition remaining in the vicinity for another season would be to extend the exploration of the shores of Grant Land to the southwestward, and Greenland to the northeastward and eastward; but as with the resources of the expedition I could not hope to advance more than about fifty miles beyond the positions already attained on those coasts, and, moreover, although the crew were rapidly recovering from the disease which had attacked them, they would certainly be unfit for employment on extended sledge parties next year, I decided that the expedition should return to England as soon as the ice broke up and released the ships. On July 31, after considerable labor to clear away a passage through the barrier of floe bergs, which had so well protected us during the winter, we succeeded during a strong southwest wind in rounding Cape Rawson and entering Robeson Channel on our return voyage."

CUTTING A WAY THROUGH THE ICE.

Another member of the expedition says: "If we have not yet learned the way to the North Pole, we have at any rate found out for certain what is *not* the way. We have demonstrated the open polar sea to be a myth; we have shown that the Smith Sound route, affording no continuous land to the northward, is not the route by which the highest latitudes will ultimately be gained; and we have traced the real difficulty of arctic exploration to its true and final source, and proved that, until some way can be discovered which opens out a totally different description of ice from that encountered by our present expedition north of latitude 83°, no amount of strength, or skill, or daring will suffice to overpass the barriers which Nature has set up around the pole."

HAULING A SLEDGE OVER THE ICE.

A good idea of the magnitude of the labor and the severity of the climate which lay before the expedition may be formed from the following extract from Captain Nares' journal:

"The long arctic winter, with its unparalleled intensity and duration of darkness, produced by an absence of sunlight for 142 days, was passed on board with much cheerfulness and contentment; the time, in reality, passed with great rapidity; and in January, when the first glimmering increase in the midday twilight began to lengthen sensibly day by day, the want of light was scarcely noticeable by any one; and not until the sun actually returned on the 1st of March, did we in any way realize the intense darkness we must have experienced for so long a period. On five evenings in the week a school, formed on the lower deck, under Commander Markham and several of the officers, was well attended, each Thursday being devoted to lectures, songs in character, and readings, with occasional theatrical representations; the whole so admirably arranged and conducted by Commander Markham as to keep up the pleased interest of all for the whole period. The health of the officers and crew, with only one exception, was most excellent; and the habitable deck as dry as is possible in these regions, in a ship, without an extraordinary expenditure of coal.

"Although we had frequent evidence of strong winds prevailing in Robeson Channel, the weather at our winter quarters was remarkably calm; indeed, we may be said to have wintered on the border of a Pacific Sea. The prevailing wind was from the westward; we never experienced any easterly winds: it always blew off the land. Had it not been for the intervening calms, the persistent westerly winds might have been well called a trade wind. On only two days were we prevented by the wind and accompanying snowdrift from taking exercise outside of the ship. This quiet state of the atmosphere was productive of the severest cold ever experienced in the arctic regions. During February mercury remained frozen for fifteen consecutive days; a southwesterly gale, lasting four days, then brought warmer weather; immediately the wind fell, cold weather returned, and the mercury remained frozen for a further period of fifteen days."

In spite of this most discouraging report, further expeditions are already being talked of; but we think that they will serve more to demonstrate man's endurance and perseverance than to achieve the wished-for result. But that the open polar sea should vanish from our books on geography without any explanation seems incredible; and it is to be hoped that some physicist will show us how a point on the earth's surface, twenty-six miles nearer the center than the equator, can so far escape the effect of the central heat as to be covered with perpetual ice.

We publish three excellent engravings, selected from the London *Graphic*, the first showing the method employed in cutting a way through the ice. In many places, the ice was blasted with gunpowder, and the pieces removed from the ship's course by manual labor, as shown in our engraving. Captain Nares shows that this was a work of some magnitude.

"In Robeson Channel proper, except where the cliffs rise precipitously from the sea, the shore line is fronted at a few paces distance by a nearly continuous ragged-topped ice wall from fifteen to thirty five feet high. But on leaving Robeson Channel the coast line loses its steep character, and the heavy ice is stranded at a distance of 100 to 200 yards from the shore, forming a fringe of detached masses of ice from twenty feet to upwards of sixty feet in height above water. The average measurement of the ice in thickness as it floated is eighty feet."

Our second engraving shows an incident in the sledge travelling which did such good work in achieving the highest known latitudes. "Commander A. H. Markham, with Lieutenants A. A. C. Parr and W. H. May under his orders, started on September 25, 1875, with three sledges, to establish a depot of provisions as far in advance to the northwestward as possible. Lieutenant P. Aldrich left four days previously with two lightly equipped dog sledges to pioneer the road round Cape Joseph Henry for the larger party. He returned on board on October 5, after an absence of thirteen days, having, accompanied by Adam Ayles, on September 27 (from the summit of a mountain 2,000 feet high, situated in latitude 82° 48' north, somewhat further north than the most northern latitude attained by our most gallant predecessor, Sir Edward Parry, in his celebrated boat journey towards the north pole), discovered land extending to the northwestward for a distance of sixty miles, to latitude 83° 7', with lofty mountains in the interior to the southward. No land was sighted to the northward. On October 14, two days after the sun had left us for its long winter's absence, Commander Markham's party returned after a journey of nineteen days, having, with very severe labor, succeeded in placing a depot of provisions in latitude 82° 44' north, and of tracing the coast line nearly two miles further north, thus reaching the exact latitude attained by Sir Edward Parry. I despatched Lieutenant Rawson to again attempt to open communication between the two vessels. He was absent from the 2d to the 12th of October, returning unsuccessful on the latter day, having found his road again stopped by unsafe ice within a distance of nine miles of the ship. During these autumn sledging journeys, with the temperature ranging between 15° above and 22° below zero, the heavy labor, hardships, and discomforts inseparable from arctic travelling were much greater than those usually experienced. Out of the northern party of twenty-one men and three officers, seven men and one officer returned to the ship badly frostbitten, three of these so severely as to render amputation necessary, the patients being confined to their beds for the greater part of the winter."

The engraving gives a view of part of the road southwards towards where the Discovery was lying. The only place where sledges could get along was between the steep, snow-covered cliffs eaten out by sea ice, and the hummocks forced up on the shore. Abrupt declivities of from 20 to 30 feet were common. The sledge shown in the engraving is loaded with pemmican for a depot close to the ship. For a regular sledge party, it would, of course, be laden with tent, bags, cooking gear, etc.

Our third engraving is the most interesting ever published in illustration of the long investigated question of polar geography. It shows the sea of ancient ice lying between the highest attained point and the pole itself, and any investigator who reaches the pole must traverse it. For want of a better name, Captain Nares called this frozen desert the "palæocrystic sea," or sea of old ice, to distinguish it from the sea whose surface is undergoing perpetual change from the breaking up and shifting of the floes in spring, the consequent formation of new "one season's" ice, and the incursions of icebergs broken off from the glaciers. The reader may judge from the engraving how far the existence of an open polar sea may be calculated upon for purposes of navigation. The big block of ice in front is perhaps fifty or sixty feet high; while the frozen mass beyond is by no means as smooth as it looks in the engraving, and may be shortly described as a wilderness of ice rocks, of every variety in form and size, matted together by patches of drifted snow. At a point about two miles south of the Alert's winter quarters, where Robeson Channel begins to widen out and its shores to retreat westward and eastward, the ice was found to assume quite a different character from that which had been observed in lower latitudes. Its massive hummocks and extended floes were clearly the product of a distinct region, and had been formed, not in narrow channels and under comparatively sheltered headlands, but in the broad expanse of the polar ocean.

THE PALÆOCRYSTIC SEA.

## A NEW HYGROMETER.

BY G. P. HACHENBERG, M. D.

A change in the weather is almost always preceded by a change in the humidity of the air, and frequently these changes may occur without materially affecting atmospheric pressure. Consequently, a sensitive hygrometer is more reliable to prognosticate changes in the weather than a barometer. The psychrometer, commonly known as the "dry and wet bulb thermometer," an instrument in use by the Signal Corps, U. S. A., is readily influenced by any changes in the humidity in the air; but practically it is of little use in predicting changes in the weather. From an experiment made on board a Spanish ship of war, many years ago, where a single stem of pine wood, glued to another piece of firm wood, was used in testing the humidity of the air, I was led to invent a hygrometer, which appears to meet all the requirements of an instrument of that kind; for not only by its indications is the degree of humidity in the air accurately given, but we are often able to prognosticate changes in the weather.

The instrument is represented by Fig. 1. *a a a* are three upright strips of wood, $\frac{7}{16}$ by 1 inch, and $2\frac{1}{2}$ feet long. The narrow left hand side of each piece is faced with a thin strip of cedar, $\frac{1}{8}$ of an inch thick, with the grain running lengthwise. Each piece consists of this strip of cedar, glued to thoroughly seasoned white pine, with the grain running transversely to that of the cedar. The middle piece is a few inches longer than the other two, in order to receive the lever, *b*, which is attached to index hand, *c*. *d d* represent the degrees of the instrument, 1 inch to each degree. Zero (0) stands in the middle of the scale, and is the dividing line between wet and dry. Each side is divided into 20 degrees, showing the degree of aridity on the one side and of humidity on the other. The three pieces, *a a a*, are united above with round nails by a brace, *e e*. The nails of the two outer pieces work in slots cut perpendicularly. The pieces, *a a a*, are accurately fitted at the bottom into a piece of plank, with screw holes at the end, *f f*, in order to fasten it against the wall. At *g*, the index hand, *c*, is likewise fastened to the wall in a manner to give free action, both to the hand itself and to the lever, *b*. There is a free joint between the index hand and the lever. J is an apparatus attached to the index hand to register the action of the instrument. K is a blank card fastened against the wall.

L is a part of an ordinary lead pencil, held by an oblong slot attached to the index hand; and a ring to receive the pencil is attached over the opening of the slot. Near the point of the pencil is a notch to receive a small metallic ball, M, suspended by a thread. The end of the pencil is perforated to receive a thread, to which is attached ball N, and it is fastened at *g*. This ball keeps the pencil in contact with the card.

It will be perceived that, by the least motion of the index hand, either way, the pencil will make its mark on the card; and as the pressure on the pencil by the ball, M, is downward, it will not take the same line twice. This part of the register is adjusted, from time to time, as it may be necessary; it may be once a day, or once a week, according to the changes in the weather.

In preparing the wood for the construction of this instrument, both the pine and the cedar must be carefully dried. The pine should be placed in a warm oven, and care taken not to impair the texture of the wood by too great heat. When thus dried, it is dressed and cut crosswise, and the pieces accurately glued to the cedar. The pine will absorb sufficient water out of the glue to warp it considerably. This warp is taken out by another drying process. When the pieces are perfectly straight, they are fastened to a strip of plank, as stated above. The instrument should be fastened against a firm wall in a dry, shady place out of doors, and in the following manner: Draw two perpendicular lines on the wall, one to correspond to the middle line of the middle piece, *a*, and the other to the zero line on the scale. The instrument is fastened to the wall to correspond with these lines. However, if there is any curvature left in the pieces, *a a a*, an allowance on the scale must be made for it. (The representation of the registering part is entirely out of proportion with the rest of the instrument).

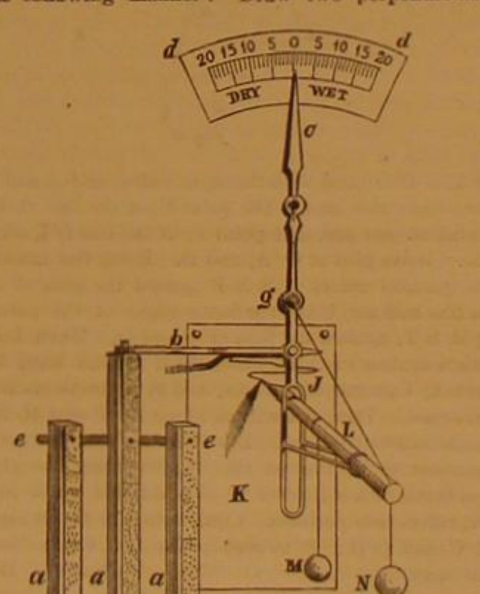



Fig. 1

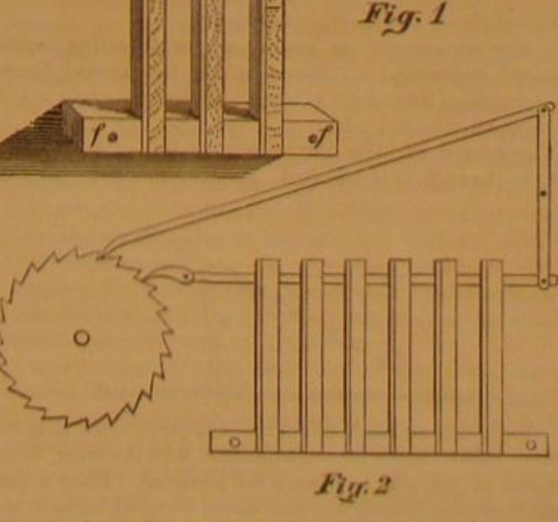


Fig. 2

The immediate operation of this instrument is neither accurate nor satisfactory, owing, in part, to the moisture which the wood absorbs from the glue, and to its not yet having received the hygrometrical temperature, so to speak, of the air. But after it has assumed its normal action, it becomes exceedingly sensitive to any change in the air. Its *modus operandi* is: As the humidity of the air increases, the pine absorbs moisture, which swells it, and causes a curvature of the three pieces; the degree of the curvature gives us, on the scales, the degree of the humidity in the air. When the air becomes arid, the pine expels its moisture and shrinks, throwing its curvature in the opposite direction, in proportion to the degree of the aridity. The reading of the probabilities of the weather by the use of this instrument depends not always upon the degree of the dry and wet on the scales, but on the manner in which the index hand moves, through the period of a day or so. Sometimes there is a tidal wave, either of aridity or humidity, that may influence the instrument for a brief time to several degrees, after which it will take its former position; but if from this, or any other position, it should persistently move either way, to wet or dry, we may conclude as to the probable state of the weather for the coming night or the next day with certainty. This is so invariably the case that it may rain, or be cloudy, and the weather may appear altogether unsettled, and the index hand may point to 15° wet; but should the hand slowly work its way to zero, notwithstanding all the signs unfavorable for clear weather, even those of the barometer itself, we can safely calculate on immediate fair weather.

This instrument might be made much smaller and portable, and utilized for various purposes, such as testing the dampness of rooms, cellars, and public buildings.

In developing my hygrometer, I constructed an instrument partly represented by Fig. 2, where I took advantage of the atomic changes in the wood, and effected an adynamic rotary motion. The force was easily made accumulative to an extent to produce a ceaseless motion. Had I not pointed out the secret of this perpetual motion, and had I befogged the apparatus with a mechanical complication, I might have been amused, for a brief time, with the reception that the solution of this "mechanical impossibility" would have received, for but few would have taken that row of sticks for my source of power. The power created by this instrument is not that of a ceaseless strain, but, as the force is from two opposite directions applied to the wheel, it is interrupted in its nature.

Round Mountain, Texas.

## Sulphur for Scarlet Fever.

Dr. Henry Pigeon writes to the London *Lancet* as follows: "The marvellous success which has attended my treatment of scarlet fever by sulphur induces me to let my medical brethren know of my plan, so that they may be able to apply the same remedy without delay. All the cases in which I used it were very well marked, and the epidermis on the arms in each case came away like the skin of a snake. The following was the exact treatment followed in each case: Thoroughly anoint the patient twice daily with sulphur ointment; give five to ten grains of sulphur in a little jam three times a day. Sufficient sulphur was burned, twice daily (on coals on a shovel), to fill the room with the fumes, and, of course, was thoroughly inhaled by the patient. Under this mode of treatment each case improved immediately, and none were over eight days in making a complete recovery, and I firmly believe in each it was prevented from spreading by the treatment adopted. One case was in a large school. Having had a large experience in scarlet fever last year and this, I feel some confidence in my own judgment, and I am of opinion that the very mildest cases I ever saw do not do half so well as bad cases do by the sulphur treatment and as far as I can judge, sulphur is as near a specific for scarlet fever as possible."

MARSTON'S PORTABLE GANG SAW MILL.—In our illustrated article on the above machine, in No. 1, current volume, an error occurred in the accidental omission of a 0 in the number of feet sawn per day of 10 hours. The figure should be 20,000, and obviously not 2,000, as stated, which would be rather slow sawing.

## Communications.

### Patent Office Requirements in Reissue Cases.

*To the Editor of the Scientific American:*

In last week's *Official Gazette* you will notice a ruling on a motion to rescind that part of rule 63 which requires an applicant for reissue to place on the file, at his own expense, a certified abstract of title. If the Commissioner would append to his decisions even an abstract, showing the points or line of argument pursued by counsel, the decisions themselves would be more intelligible. In this case but little can be gathered from the decision, except the Commissioner's opinion upon the question, the arguments in favor of which are entirely unknown. This imposition of an extra tax in reissue cases is one of those arbitrary exactions which now and then crop out in the administration of the Patent Office, having their origin apparently in a desire to introduce something new, without special regard to its utility or lawfulness. The statute provides that, for certain specified reasons, a patentee may reissue his patent. "The Commissioners *shall*, on the surrender of such patent, and the payment of the duty required by law, cause a new patent * * to be issued," etc., (sec. 4916). The duty required by law is $30, but the Commissioner refuses even to send an application to the Examiner until he has paid into the Patent Office another duty, to wit, the price of a certified abstract of title. This is a subject of importance to patentees, not only because it involves an additional and uncertain expense, but because the same principle will justify possibly greater impositions. I hope this letter may awaken attention to the question.

The points of my argument are as follows:

1. The Examiners are bound to take notice of all the records of the Patent Office, and the record of assignments forms a part of these. There is no more reason why the applicant should furnish the Examiner with copies of these records than of any others: patents, for instance, upon which his claim may be rejected.

2. There is no authority in the Commissioner to make such a rule. He is only permitted to make rules and regulations "not inconsistent with law" (statute, S. 483, title XI).

3. There is no value in the abstract after it is obtained, because it shows nothing as to unrecorded transfers.

4. The applicant is obliged to make oath as to the residence of the title. That is the latest and best evidence of the facts sufficient for every purpose, in a reissue as much as in an original application. As the Commissioner says, if this statement should prove to be untrue, the patent issued under it would be defective. Well, does the Patent Office ever guarantee the validity of the patents issued? The Commissioner further says that certain evidence of title is necessary to show to whom the reissue should go, and that the fee paid for the abstract is the price of this evidence; yet he admits that he cannot be impeached for issuing a patent to an improper party. Now, the rule amounts to just this: The Commissioner rules out the oath of the only competent witness, and requires at his expense a piece of testimony which is of no value as proof, and refuses to forward the application until the coffers of the Patent Office are enriched to an extent beyond the fee prescribed by law. It is easy to see that the patentee knows whether he has made assignments or not. Supposing he swears that he has not, why should not the officers test that statement by the record of the Office as much as his other statement (both under oath), that he was the first to invent the combination, etc.? But suppose the application is made in fraud. He assigns to-day and asks a reissue to-morrow, swearing that he has not assigned. Would a certified abstract help the Office to any information as to that?

This tax is an imposition, pure and simple. It has no purpose, nor any use except to swell the receipts of the Patent Office, which are too large without it; and it ought summarily to be abolished.

S.

### Carbolic Acid for Whooping Cough.

*To the Editor of the Scientific American:*

An item in your issue of December 23, 1876, relating to the application of the vapor of carbolic acid, by Dr. Lee, of London, for whooping cough, recalls a similar application made for my children in the winter and spring of 1873. Two little girls returned from school with hard coughs. During the night following they received small doses of various cough medicines, but without apparent effect; they coughed incessantly. The next day we learned that they had been exposed to whooping cough at school, and that they probably had it. That night, as our usual remedies had failed, it occurred to me that possibly some relief might be obtained by their inhaling the vapor of carbolic acid. So, when the children were in bed, we evaporated, over the gas in their bedroom, a very weak solution of the acid for about fifteen or twenty minutes. The effect was magical. The character of the cough was from that time changed. There was no hard coughing that night. The children had a light cough, which continued during the usual term of whooping cough, but it was without the "whoop," save in one or two instances, and without any special distress, sickness, or discomfort. Three other children took the cough at this time, and were treated in the same way, with the same result.

In these instances a teaspoonful of a strong solution of carbolic acid crytals and glycerin was well mixed in a quart of water. From one to two gills of this weak solution was evaporated slowly over the gas (in the room where the children were asleep or at play), with doors and windows closed, twice daily.

R.

New York city.

### An Instrument for the Mechanical Trisection of an Angle.

*To the Editor of the Scientific American:*

This device consists of a pair of compound compasses of four legs, so connected by levers that in every position of the compasses the second leg will bisect the angle formed by the first and third legs, while at the same time the third leg will bisect the angle formed by the second and fourth; thus the angle formed by the first and fourth legs will be trisected.

In Fig. 1, O G, O H, O I, and O K are the legs of the compasses. A E, C E, B F, and D F are connecting rods or levers, pivoted at A, B, C, and D, united by pivots at E and F, and moving in slots upon the legs O H and O I. In the triangles O A E and O C E, O A = O C, A E = C E, and O E is common. Hence the angle G O H = the angle H O I. In like manner, the angle H O I = the angle I O K. Thus the three angles are equal.

Make the sides, O G and O K, coincide with the given angle. Mark the points, H and I, and H O and I O.

This construction suggests a method of trisecting the angle by means of two pairs of parallel rulers (Fig. 2). Lay off

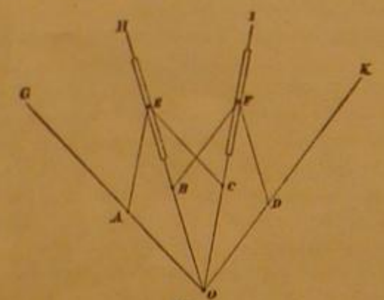



Fig. 1

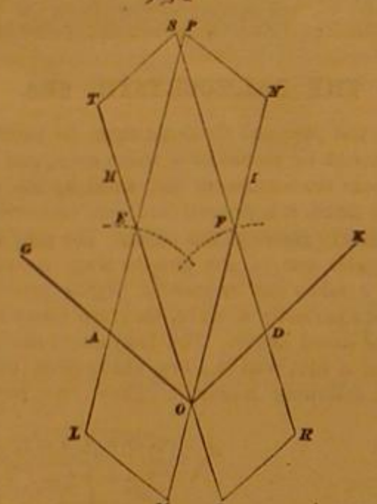



Fig. 2

O A = O D; and with the same radius and A and D as centers, draw two arcs. The point E, of the line O H, will be found on one arc, and point F, of the line O I, on the other arc. Drive pins at O, A, and D. Bring the inner edges of the parallel rulers L M N P against the pins at A and O. In like manner, bring the inner edges of the parallel rulers Q R, S T, against the pins at O and D. Then keeping the rulers against the pins, move them around until L P intersects Q T on one of the arcs, and M N intersects R S on the other arc. Then draw lines along Q T and M N, and the angle will be trisected. It will be seen that L P and R S also intersect each other on the line besecting the given angle—a fact which will serve as an additional guide in bringing the rulers into position. Completing the parallelograms O A E C and O D F B, as seen in the first figure, the proof is the same.

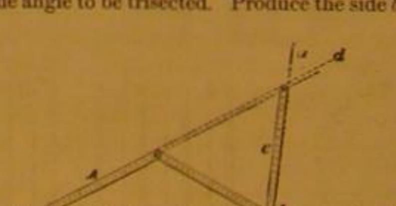
WARREN HOLDEN.

### An Instrument for Trisecting an Angle.

*To the Editor of the Scientific American:*

I have constructed an instrument for trisecting angles. You will understand it at first sight. In the annexed figure, the triangles 1 2 3 and 2 3 4 being isosceles, the angle 2 1 3, or its equal, $d\,o\,c, = \frac{1}{3}\,a\,b\,c$.

The manner of using the instrument is as follows:—Let $a\,b\,c$ be the angle to be trisected. Produce the side $b\,c$ towards




*o*. Apply the side marked C of the instrument to $a\,b$, as in the figure; hold it tight with one hand, and, with the other, bring the end of the side A to touch $b\,c$ produced. Place a rule against the side A, and, the instrument being withdrawn, $d\,o$ may be drawn.

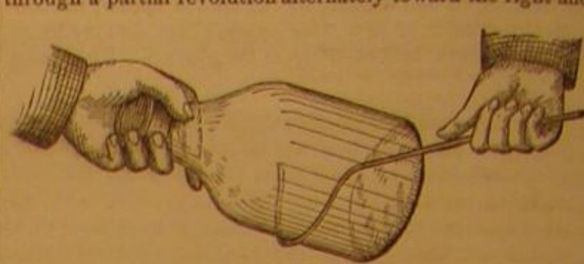
A slight addition to the instrument would transform it into one for finding either the square or the square root of a number.

D. MATTE.

### Cutting Glass Bottles.

*To the Editor of the Scientific American:*

It is often desirable for experimental purposes to cut glass bottles to form jars, or to cut large glass tubes into sections, when diamonds cannot be obtained or are unavailable. To do it readily and neatly, it is only necessary to provide a wire of from ⅛ to $\frac{3}{16}$ inch diameter, and bend it to conform to the curvature of the bottle or tube to be cut, so that it extends over about half the circumference. The bottle or tube is scratched with a file, or otherwise marked; and the wire is heated to a low red or black heat, and placed under it, as shown in the engraving, and the bottle is slowly rotated through a partial revolution alternately toward the right and



left, until the glass cracks along the line of the wire, when the rotary motion is continued, but more in one direction than the other, until the crack makes a complete circuit.

A convenient way of cutting or breaking glass tubes of small diameter, having thick sides, is to make a nick in one side with a file, and place the thumbs close together on the tube opposite the nick, with the nails in contact with each other. Pressure is then exerted on the tube with the thumbs, and at the same time the tube is pulled lengthwise, when it will break with a smooth, square fracture. A single nick is better than a mark around the tube.

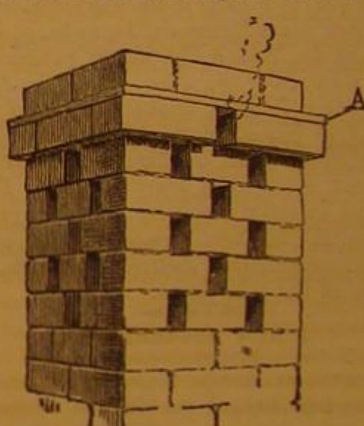
D. M. H.

Brooklyn, N. Y.

### Smoky Chimneys.

*To the Editor of the Scientific American:*

Of the various remedies for smoky chimneys, I have never seen a more satisfactory one than that represented by the engraving. The chimney from which the sketch was taken was an eight inch square flue, straight and vertical from cellar to top, some thirty-two feet in height. The draught had always been sluggish except in brisk weather, and various sheet iron concerns had been tried with indifferent success. The other day a few of the top courses of bricks were removed and relaid as shown in diagram. Instead of the eight




inch square flue out of the top, seven or eight 2x2 inch openings were left in each of the four sides, making an aggregate area of opening laterally of about 120 square inches instead of sixty-four out of the top. A plate of slate, A, with a three inch opening in its center, covers the top, having a course or two of brick above it to keep it down. A single soapstone or cast iron cap with a small opening in the center would probably be preferable to the slate and brick. The draught is now all right.

Worcester, Mass. F. G. WOODWARD.

## THE DEATH OF COMMODORE VANDERBILT.

After a tedious illness of several months, during the greater part of which time his demise was daily, if not hourly, expected, Commodore Vanderbilt died on January 4. He had reached the advanced age of 83 years, retaining a wonderful physical power, the strength of which was clearly shown in his long resistence to the ravages of a wasting and painful disease.

Cornelius H. Vanderbilt was born on Staten Island, N. Y., in 1794. His father was a small farmer, in fair cicumstances; but the family was large, and Cornelius, being the eldest son, found himself compelled to rely upon his own efforts for support before he was fairly seventeen years of age. The elder Vanderbilt, in order to transport his produce to New York, had established a ferry between the city and Staten Island. After his death, Cornelius, having earned sufficient money to buy a boat, became a boatman, and carried passengers over the same route for eighteen cents a trip. By dint of close economy, he saved enough to buy a larger vessel, and finally he possessed the best boat in the harbor. Thus began Vanderbilt's connection with public transportation; and from the owner of the single little craft, he rose to be the controlling power of fleets of magnificent vessels and some of the wealthiest railroads in the country. To one boat, others were soon added; then he bought a schooner, and went into the coasting trade; and finally, in his twenty-third year, he owned several fine sailing craft and some $9,000 in money. In 1818 Thomas Gibbons, a New Jersey capitalist, offered him the command of a small steamboat, at a salary much less than his income at the time. Vanderbilt, however, accepted the offer because, with his natural acumen, he foresaw that steam was destined to supplant sails, and a knowledge of steam navigation was necessary to him. For twelve years he remained in Mr. Gibbons' employ, during which time the litigation between rival steamship companies was bitter and continuous, and he was compelled to resort to expedients of every kind to protect his employer's interests. Finally, in 1829, he deemed his education finished; and refusing command of the whole line of boats owned by Gibbons, on his own terms, he started building vessels of his own. The first one he constructed was the famous Caroline, used by Canadian rioters in 1837, in a disturbance which involved an invasion of American territory, and occasioned a vexatious international dispute between England and this country. During the next twenty years of his life his energy was remarkable.

He built steamboat after steamboat, and established opposition lines on the Hudson and on Long Island Sound. He built handsomer and faster boats than those on the regular lines, and cut down the fares. He took great pains in selecting competent men to work for him, paid them well, and kept them in their places. His vessels were constructed under his immediate supervision and from his own plans. He patronized foundries where machinery could be made in accordance with his own ideas. He never insured a vessel; but used to say: "Good vessels and good commanders are the best kind of insurance; if corporations can make money in the insurance business, I can." During his long experience he never lost a vessel by fire or wreck.

Within a few years after the launch of the Caroline, he built 38 steamboats. Then he organized an opposition line of steamers to California, and another between New Orleans and Galveston. In 1853, he had already become one of the richest men in the country, and in that year he made his famous trip to Europe with his family in his own steamer, the North Star. On his return, he organized a line of steamers between New York and Havre, France, and built the magnificent steamer Vanderbilt, at a cost of $800,000. This vessel he presented to the Government during the war. From first to last, he owned, wholly or in part, 100 steam vessels; and in 1857 he began to sell them and invest in railroad stocks.

Through Commodore Vanderbilt's Wall street operations we cannot follow him. He possessed a genius for combination and organization a tenacity of purpose, which enabled him to hold on to advantage once gained, rather than risk anything for the sake of a possible betterment; and he is said to have understood the art of "watering" stock scientifically better than any man that ever lived. As soon, however, as he became practically master of the New York Central, Hudson River, and Lake Shore and Michigan Southern railroads, he introduced systems of close economy. Trains were added, depots were built, tracks were doubled, and the business of the different roads was developed wherever there was an opportunity. At the same time, judicious retrenchment was everywhere carried on. He erected the great freight depot and the Grand Central depot in this city, built the underground railway on Fourth avenue, and constructed the four-track system on the Hudson River and New York Central railroads. The actual value of the estate which he leaves is variously estimated, but it probably aggregates nearly $60,000,000, the greater proportion of which is invested in railroads.

As a man, Commodore Vanderbilt was remarkable for no characteristics outside those already detailed, or apart from his business life. He was almost destitute of education and of cultivated tastes. His vast wealth, with the single exception of the endowment of the Vanderbilt University, in Nashville, Tenn., was not in any wise devoted to philanthropic projects. It was gained, not like the millions of Stewart, through the successful exercise of mercantile ability, or like that of Astor, through the inevitable accretion of capital produced by time and enhancement of values, but rather through gigantic enterprises involving sharp conflicts with men of scarcely less energy, through audacity, through indomitable perseverance, and through thrift. That the use to which his fortune has been placed has benefited the community, there can be no doubt. Such, however, is but the natural result of the enterprises necessary to the accumulation of a great fortune. Mr. Vanderbilt was frugal in his living, systematic in his business and recreations, and industrious at all times.

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[For the Scientific American.]

## CHEMICAL PROGRESS IN 1876.

The old proverb, that there is nothing new under the sun, seems quite out of date when we look at the scientific records of a year, and especially as we glance over the chemical discoveries that have been made or published in that brief space of time. Rudolph Wagner, one of the German members of the Centennial jury on chemistry, aided by a dozen or more able assistants, publishes annually a brief but careful abstract of all that has been accomplished in chemical technology for the year. These brief notices fill a volume of over eleven hundred pages. The amount of chemical work performed in each year which does not fall under this title would fill another volume of equal size. It is not our intention to undertake the compression into a brief editorial of all the contributions that have been made to chemistry within the year just closed, but only to point out a few interesting facts, omitting in some cases, perhaps, others quite as important for want of time and space. Nor shall we undertake to arrange them in the order of their importance, for it is strangely true that discoveries which seem trifling often prove of immense value, while those which attract most attention at first are soonest forgotten.

### INORGANIC CHEMISTRY.

The discovery of the new metal gallium marks an important epoch in chemical chronology, not alone on account of its peculiar properties, its low melting point, etc., but more as being the first element whose discovery had been predicted, and thus bringing into prominence the almost forgotten laws laid down by Mendelejeff several years previously. This metal, its discovery, its spectrum, and other properties have been fully described in our columns.

Although gallium is the last brilliant triumph of the spectroscope, many of its other achievements have been of great practical value. We described, in our issue of July 17, 1876, the use of the spectroscope on the witness stand, in a case of supposed forgery. Professor H. Vogel, of Berlin, has done a vast amount of valuable work in devising methods of detecting adulteration, especially in wine, by means of the absorption spectra. (See SCIENTIFIC AMERICAN, May 20, 1876.) He even adapted it to the detection of some metals of the iron group, and more recently to the salts of aluminum and magnesium, when in very dilute solutions, bringing to his aid an organic coloring matter, purpurine, the absorption spectrum of which is variously modified by these metals. The subject of the detection of blood, even when old and dry, by means of the spectroscope, has also been studied by Vogel, who points out a certain method of distinguishing it from indigo, with which some have claimed that it may be confounded. It may be here remarked that Struve has obtained from some kinds of meat a substance which also yields the same absorption spectrum as blood, from which, however, it can be distinguished by other reactions. Following the path of Professor Vogel, another German, named Wunder, has studied the absorption spectra of different kinds of ultramarine, including the green and violet, as well as the blue. Reimann states that the spectroscope is a good instrument for the detection of mixtures of coaltar colors. He has published, in his *Färber Zeitung*, the position of the absorption bands of several of the best known colors. Thus the spectroscope seems likely to prove exceedingly useful in organic chemistry, especially for distinguishing dyestuffs and detecting adulterations.

Many of the rare metals have been carefully studied during the year, and new properties discovered and new uses devised for them; and as each in turn becomes more valuable in the arts, new sources of it are being discovered. This is strikingly true of vanadium—a metal known since 1830, and yet so rare as to sell for $300 per ounce—which has found a use in the manufacture of aniline black. It is now the subject of much study at home and abroad. Gerland has studied its sulphates; Crow, its tetroxide; Guyard, Rosenstiehl, and others, its action in producing aniline black; while Dr. I. Walz, of this city, has rendered valuable service by pointing out a new source of this metal in our own immediate vicinity—namely, in American magnetites, where the quantity is often quite considerable, sometimes 0.3 per cent. Mr. C. M. Stillwell, continuing the search, found vanadium, but in smaller quantities, in hematites and other secondary iron ores.

Platinum and the metals associated with it have been the subject of study in France. Boussingault has made it combine with silicon, as has also Guyard; while Meyer has investigated its catalytic action, and Zdrawkowitch has devised a new method of making platinum black. It consists in mixing together 15 parts of glycerine and 10 parts caustic potash of specific gravity 1·08, heating to boiling, and adding 5 parts dilute perchloride of platinum. Among the new alloys proposed is one by Schmitte, which contains platinum, copper, and tungsten, and resembles 18 carat gold. Daubrée has produced an alloy possessing the most intense magnetic polarity by adding to fused platinum one fourth its weight of iron. Osmium, long known as the most poisonous metal, has been found by Déville and Débray to be the heaviest metal, its density being 22·577 times that of water. Cæsium and rubidium, the two eldest children of spectroscopic research, and rarest of the rare, have been the subject of careful study by F. Godeffroy, who has determined their atomic weights, besides making a silico-tungstate of each. Thallium, also born of the spectroscope, but most abundant of this class of bodies, has received the attention of Nietzki, Krausi, and Muir. The two former were chiefly interested in the preparation of the metal, the latter of the chlorate. Krausi speaks of having made 23 lbs. of thallium from soot by simply leaching out, precipitating as chloride, and reducing with zinc. Indium, the next born, and, excepting gallium, the last, has received but little attention, except from Professor Cornwall, who has chased it through all the new blendes he could lay hands upon, and with some success.

The rare metals of the earth, cerium, lanthanum, and didymium, have been prepared and studied by Hillebrand and Norton, while Rammelsberg has determined anew the atomic weights of cerium and yttrium. Columbium and tantalum, fast friends and companions, have been examined by Jolly and Santesson, and some new compounds have been prepared. Zirconium, titanium, glucinum, and uranium have likewise received attention. Selenium has recently acquired a new importance from its sensitiveness to light, and Dr. Siemens has devised an electrical eye that will wink in the bright sunlight and open in the dark. This peculiar property of selenium promises to be of use in the manufacture of photometers. It is the crystalline form only in which the electric conductivity varies with the illumination. As selenium is found abundantly in the soot of certain sulphuric acid works, and is not difficult of preparation, its price will no doubt fall as soon as it is introduced into some practical use. It now sells for $4 per oz. The researches of Pieverling on the organic compounds containing selenium prove it to be, like sulphur and tellurium, sometimes a diad, and often a tetrad. Tellurium has been brought somewhat into prominence recently by the discovery of large quantities of it in combination, as usual, with precious metals, both in the West and Chili. No use has yet been devised for it, and the terrible odor that its compounds impart to those experimenting with them have, perhaps, frightened chemists who delight in social enjoyment. Kastner advises the use of grape sugar in the quantitative analysis of telluric compounds. Becker has prepared pure tellurium, and studied and described some tellurium compounds, such as the tartrate and tri-ethyl-iodide, as a platium compound.

Dr. Vogel has continued his experiments in regard to the action of light of different colors upon the bromide of silver. Among his many remarkable discoveries, we may here only mention one. A plate coated with bromide of silver and a thin film of naphthaline red was very sensitive to yellow, that very non-actinic light, provided an excess of nitrate of silver were employed; if an excess of bromide of potassium were used, it was sensitive to blue and violet only. These interesting experiments were interrupted by his appointment as one of the German jury at the Centennial.

The action of water and saline solutions upon copper, a subject on which very little was previously known, has been carefully investigated by T. Carnelley. Dr. A. Wagner has also examined the action of saline solutions, both hot and cold, upon tin, copper, zinc, and other metals (See SCIENTIFIC AMERICAN, p. 295, vol. XXXV.) Kaiser, who has investigated the action of sea water on lead, reports that the lead soon became coated, and was then protected. Balard is of the opinion that it is the exygen of the air dissolved in water which causes it to attack lead, even when salts are present in small quantities.

Hardened glass continues to attract attention, but little new can be said of it. The generally received impression is that it is the familiar phenomenon of the Prince Rupert drops on a large scale; the glass, being under tension, sometimes explodes violently.

In manufacturing chemistry and technology, there is not much which is radically new to record. Improvements rather than revolutions have been the order of the day in inorganic chemistry. The ammonia soda process is slowly gaining headway; the De Hemptinne sulphuric acid process is not yet in practical operation; many things are kept as trade secrets, and hence the world knows nothing of them for years. S. Lupton proposes a new method of making nitrogen, namely, by allowing air to bubble through strong aqua ammonia and then passing it over heated copper. The action is continuous and the nitrogen pure, an important point if it is to be employed for medical purposes. Dr. Steinbrueck states that tuberculosis, in the first and second stages, may be cured by the inhalation of nitrogen.

Organic chemistry has so many triumphs to record that we must delay a review of them until our next issue. H.

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### Novel Method of Ornamenting Furs.

Messrs. Jules and Georges Mathias, of Paris, France, have patented through the Scientific American Patent Agency, November 21, 1876, the application of gold, silver, and other metallic powders to all kinds of furs, the powders being applied to the points or ends only of the hairs by means of a brush or otherwise. The preparation employed for the purpose is composed of varnish and gold, silver, or other metallic powders, which are well known.

Black furs and others of a dark color may, in this manner, say the inventors, have a fawn colored and brownish tinge or luster imparted, which will much improve their appearance and value. These metallic powders, when mixed with suitably colored varnishes, may be applied to white and other light-colored furs, for producing fancy furs or imitating costly varieties of furs.

If it is desired that the ends of the fur fibers shall present the color of the metal, the impalpable powder is mixed with white varnish; but if it is desired to secure a shade or tint that differs from the metal, the powder is mixed with a varnish of suitable color.

The fur is first slightly glazed with a flat hair pencil or brush, so as to impart the desired color to the fiber ends, and after drying is combed lightly to separate the individual hairs which have been united by the varnish.

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### Medical Specimens.

For rapidly preparing bones and ligaments for museum purposes, Dr. L. Frederick recommends that, after the soft parts have been taken away, except the ligaments, the preparation should be washed in water, dehydrated by alcohol, and then plunged into essence of turpentine. After two or three days' maceration in this fluid, the skeleton is placed in the position in which it is designed to keep it, and dried in the air. In drying, the bones and ligaments become beautifully white, and the whiteness increases as time passes. The same process gives less satisfactory results for muscles. For a parenchymatous organ, on removing it from the turpentine bath Dr. Frederick plunges it into melted wax or paraffin during half an hour or two hours, till the bubbles of turpentine have ceased to pass off. When withdrawn and cooled, the piece resembles a wax model, but it is far superior in its minor details; the color of the organ persists.

### WATER VELOCIPEDES.

A recent attempt at applying foot power to the propulsion of a boat was made by the late Crocé-Spinelli, whose experiments were interrupted by the Franco-German war; and the inventor's talents were then devoted to the science of aerostation, in experimenting in which he lost his life. M. Jobert has recently revived the subject, and he exhibited a new river velocipede at the Maritime Exposition held last year in the Palais de l' Industrie, Paris. It was composed of two cigar-shaped floats made of tinned plate, united by a platform of very light wood, which carried the seat of the operator. To the platform the mechanism was also attached; and it consisted of a paddle-wheel, with two cranks on the axles, with straps for the feet. The action is exactly that of a terrestrial velocipede, and therefore requires no further explanation.

To steer the velocipede, a light rudder is placed in the rear of the apparatus, and it is handled by the cords shown passing round a pulley turned by the handle in the hand of the operator. It will be seen that the operation of the machine is simple and easy, and M. Jobert claims that a very high speed can be obtained.

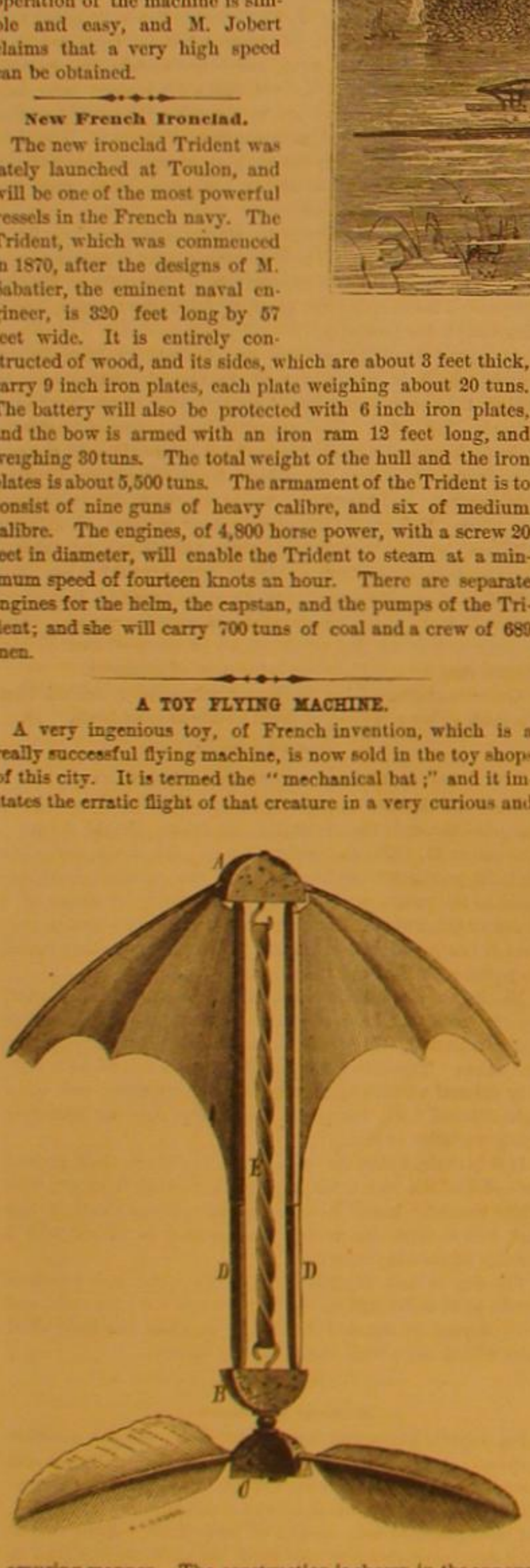
NEW WATER VELOCIPEDE.

### New French Ironclad.

The new ironclad Trident was lately launched at Toulon, and will be one of the most powerful vessels in the French navy. The Trident, which was commenced in 1870, after the designs of M. Sabatier, the eminent naval engineer, is 320 feet long by 57 feet wide. It is entirely constructed of wood, and its sides, which are about 3 feet thick, carry 9 inch iron plates, each plate weighing about 20 tuns. The battery will also be protected with 6 inch iron plates, and the bow is armed with an iron ram 12 feet long, and weighing 30 tuns. The total weight of the hull and the iron plates is about 5,500 tuns. The armament of the Trident is to consist of nine guns of heavy calibre, and six of medium calibre. The engines, of 4,800 horse power, with a screw 20 feet in diameter, will enable the Trident to steam at a minimum speed of fourteen knots an hour. There are separate engines for the helm, the capstan, and the pumps of the Trident; and she will carry 700 tuns of coal and a crew of 689 men.

### A TOY FLYING MACHINE.

A very ingenious toy, of French invention, which is a really successful flying machine, is now sold in the toy shops of this city. It is termed the "mechanical bat;" and it imitates the erratic flight of that creature in a very curious and amusing manner. The construction is shown in the annexed engraving. A, B, and C are semicircular pieces of cork. Between A and B are secured two thin wooden rods, D, made of orange or some other light strong wood. From A, extend arms, between which and the adjacent rods, D, are pasted tissue paper wings. In A is rigidly secured a hook. The similar hook in B turns freely therein, but is fastened in another piece of cork, C. Between the rods and from hook to hook is stretched a rubber band, E; and in the cork, C, are inserted two feathers, like the fans of a propeller.




The apparatus is wound up by turning the cork, C, until a strong twist is thrown in the rubber, E. Then the machine is released, when it will fly for a considerable distance either vertically upward or horizontally, return, and circle about, until the revolution of its propeller ceases, when it sinks to the ground.

The principle of the device embodies both the plans which, it is now generally admitted, must underlie the construction of any successful flying machine—namely, the kite and the screw. The screw drives the machine ahead, and at the same time causes the resistance of the air to furnish the component of force vertically applied, which, acting on the wings, sustains the apparatus against the action of gravity.

The device is one of the most amusing philosophical toys that have come under our notice. It may besides serve a very useful purpose in illustrating some important, though not very clearly understood, mechanical truths. The toy is 8½ inches in length, and 8 inches in breadth from tip to tip of the wings.

### An Arizona Bonanza.

The Silver King Mine, located on the western slope of the Pinal ranges, about 30 miles from Florence, is a private mine, and is, therefore, little known to the public, though it is probably one of the richest mines ever discovered on this coast. The proprietors have been steadily working it for the past twelve months, and have shipped, in every month of the present year, one or more parcels of selected ore of the value of \$1,000 to \$2,000 per tun, to the works in Mission street, near Fremont, where it has been ground and subsequently sold by private tender, the owners of the Selby Smelting Works having been considerable purchasers. There is now on the way from the mine to San Francisco 40 tuns of ore, which assays from \$1,250 to \$2,500 per tun, and 1 tun of nuggets, which it is estimated will return \$14,000; 27 tuns of this ore is on the steamer *en route* from Fort Yuma to San Francisco. There is on the dumps at the mine about 3,000 tuns of third class ore, estimated to be worth \$350 per tun. The ore hitherto extracted has been chiefly taken from between the 43 feet level and surface, and in both stopes and drifts the showing of ore is magnificent. Work is now being pushed on in the 100 feet level, where the showing is equal to the best parts of the upper levels. There are about 40 men employed on the mine. The fortunate owners of this splendid property are Messrs. Reay and Mason. The superintendent is Mr. Mason, brother of the owner of that name. The ledge is located for several miles north and south of the Silver King. Within the past month the Silver King South Mining Company, which has about 4,000 feet on the southern extension, have started up work under the superintendence of Mr. M. L. Power; their shaft is now down about 45 feet, and they are in hourly anticipation of cutting the ledge. A new discovery has just been reported from about four miles south of the Silver King, where \$1,000 ore is being extracted from what is believed to be the continuation of the Silver King led[illegible]

### The Duration of Life.

Dr. William Farr, F. R. S., in his letter to the Registrar-General on the mortality in England and Wales during the ten years 1861-70, states that the annual mortality in the city of London was at the rate of 80 per 1,000 in the latter half of the seventeenth century, and 50 in the eighteenth century, against 24 in the present day. This implies that the mean duration of life in London was little more than twelve years in the seventeenth century, was about twenty years in the eighteenth century, whereas it is now about forty years. The mean duration of life depends upon the death rate at various ages, which show the widest range in different parts of the country, dependent upon their sanitary condition.

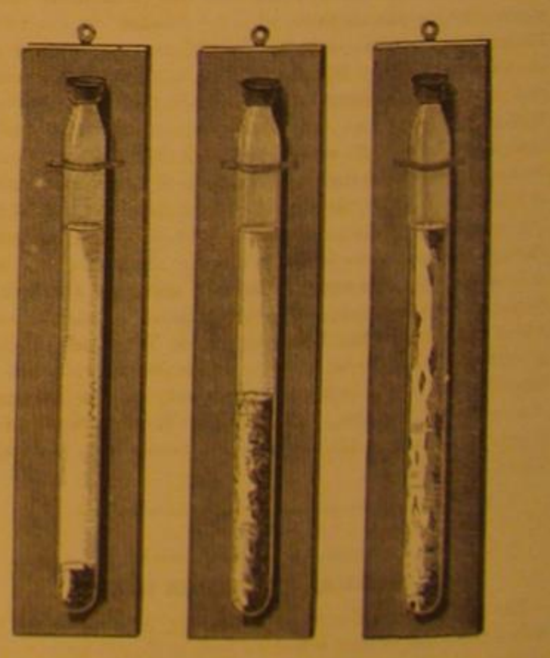
### STORM GLASSES AND THEIR INDICATIONS.

Our readers have doubtless noticed in the stores of opticians a weather indicator, now widely offered for sale at a low price. It consists of a glass test tube, hermetically sealed and fastened to a piece of wood, so that it may be hung up against the wall. A thermometer is often likewise attached to the wood. The tube contains a transparent liquid in which are needle-like, pearly crystals, which vary greatly in appearance, forming sometimes at the bottom, sometimes at the middle, and sometimes at the surface of the fluid, as shown in the annexed engraving. It is said that the alterations of form of the crystals presage atmospheric changes, and announce variations of temperature, tempests, storms, etc.

This instrument was invented nearly a century ago; but whether the inventor was an Italian named Malacredi, who lived in England, or a French lawyer named Le Gaux, is exceedingly doubtful. One or the other of the two is entitled to the credit of the discovery; but neither succeeded in rendering the invention of any practical utility. In 1864 it was revived by Messrs. Negretti and Zambra, and its value was soon after vouched for by Admiral Fitz Roy, R. N. The crystals consist of camphor 2 parts, nitrate of potash (saltpeter) 1 part, and sal ammoniac 1 part, dissolved in pure alcohol and partially precipitated with distilled water.

The instrument must be fixed in the open air, out of the sun, but exposed to diffused light. The mixture then shows changes according to the direction, but not according to the force, of the wind, which changes Admiral Fitz Roy considered to depend on the electric tension of the atmosphere. If the wind comes from the northward, by examining the mixture with a lens the crystals will be seen to agglomerate and group themselves into leaf-like forms. On the other hand, if the wind is southerly, the crystals vanish; and if the wind is constant for some time, the mixture looks like sugar in solution.

An east wind produces stars more or less numerous; the liquid is somewhat turbid. With a west wind, the liquid is clear, and the crystals well defined. When the solid portions appear at the bottom or top of the liquid, positive electricity in the atmosphere is indicated. A confused mixture shows the coexistence of a north current with a south current in the same locality. Dirty, flocculent masses in a confused mixture, or stars in motion, indicate a strong south wind or gale. When in the tube a soft material, like honey or sugar, seems to be present, a weak south current of air, with negative



electricity, is predicted. These facts were determined by Admiral Fitz Roy by repeated experiment with a delicate galvanometer in measuring the electric tension of the air.

We have had one of the tubes exposed to the air, but concealed from the storms, for several years. It is curious to observe the changes of the crystals; but we have never had much faith in its prognostications of changes in the weather.

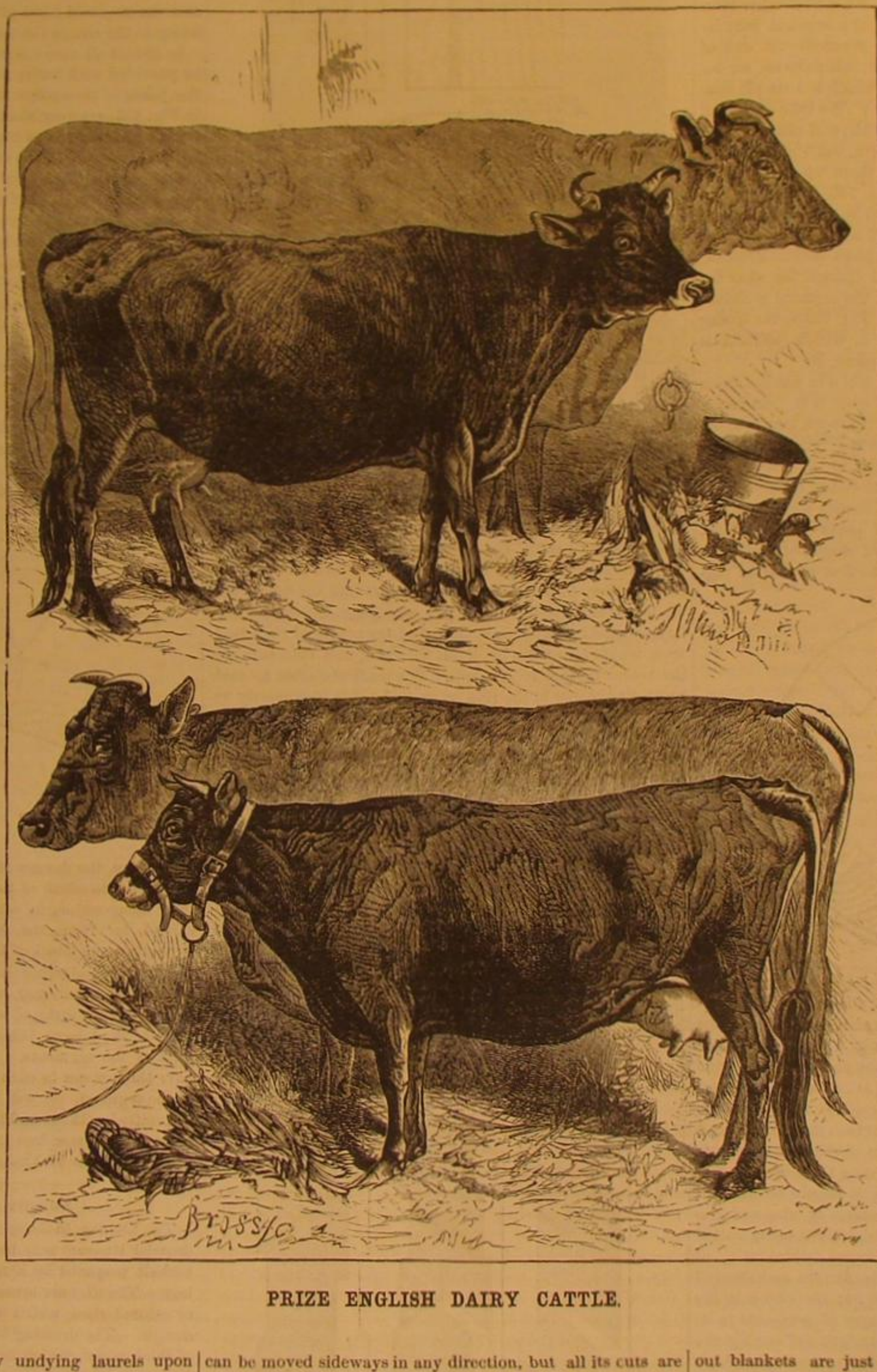
### Relics of the Spanish Armada.

Two treasure galleons of the celebrated Spanish Armada were, it seems, wrecked on Chesil Beach, Dorsetshire, England, where, after every heavy storm, the Portlanders keep a sharp lookout on the blue clay in West Bay. The recent heavy gales having scoured away the shingle, among other waifs, the London *Times* says, a bar of pure silver, 3 lbs. 2 ozs. in weight, was lately found, which, having been tested, has been valued at \$60.

### DAIRY CATTLE.

We recently illustrated the cheese and butter making processes as exhibited at a cattle and dairy show recently held in the Agricultural Hall, London. Many valuable prizes were offered for the best milch cows, the awards being divided mainly into two classes, those for Channel Islands cattle, and those for all other breeds. The principal prize was in the latter class, and consisted of a gold vase—value $525; it was gained by Mr. W. T. Carrington. In the former class, Mr. W. R. Leigh took the first prize. The two winning animals are shown in the upper part of our illustration, the bright little intelligent-looking Jersey cow of Mr. Leigh being in the foreground. In the lower part of the engraving are also shown Mr. J. A. Mumford's short-horn, which gained a $105 prize, and a Channel Islands cow belonging to Mr. G. Simpson, which was awarded the second prize in her class—value $262.50.

In all, 140 cows were exhibited, the entries being made by the chief cattle breeders in England. The show was largely attended, and it is intended to hold a similar exhibition annually.



PRIZE ENGLISH DAIRY CATTLE.

### American Progress.

In these times, it has become fashionable to talk of modern degeneracy and to regretfully look back to the "good old times." It is therefore pleasant, for a change, to hear such sentiments as are embodied in the following extract from the annual message of Governor Hartranft, of Pennsylvania. The Governor speaks of his own State, but his views apply equally well to the whole country.

"A hundred years have wrought a wonderful change. The population has increased tenfold, the area under cultivation a hundredfold, and wealth almost beyond comparison. Thousands of miles of canals and railroads intersect the Commonwealth. Immense mining, manufacturing, agricultural, and carrying enterprizes give employment to the toiling millions of the State. All the products of the earth are within our reach; fuel and provisions are brought to our doors; gas and water are in our houses, and the news of the world of yesterday is laid on our breakfast tables in the morning. Thousands of schools and colleges are scattered over the State, and the post is burdened daily with millions of letters, attesting the general diffusion of knowledge. The people are more intelligent, freer, and happier; more cheerful, tolerant, and liberal. The charges of modern degeneracy are refuted by the clear testimony of a hundred years. The cant of politics is a wilful perversion of the truth of history. Comparing 1876 with 1776, it is apparent that we have advanced not only in population and wealth, but in freedom, in intelligence, in morals, and in general welfare."

### A Warning to Bad Plumbers.

The crushed worm will (metaphorically speaking) sometimes turn, and bite the foot which treads upon it; so also will the luckless householder, goaded into desperation, rebel once in a great while against the remorseless plumber. History will bestow undying laurels upon the bold citizen of Cincinnati, who recently, when a plumber sent him an exorbitant bill for $300, in his turn sued that plumber and recovered to the extent of $2,000, for damages, etc., on account of the abominable manner in which the work was performed.

### Stenochromy—A New Art.

A recent number of the *Journal of the Society of Arts* contains a lecture read before the Society by Mr. Meyerstein, in which he describes the new art of color printing, termed "stenochromy." This consists in producing pictures composed of many different colors, by one impression, on paper. The making of pictures by setting together a great variety of differently shaded bits of stone, known as mosaic work, has been practised for several hundreds of years, and many most valuable and remarkable specimens of this style of ornamentation exist. Some of the most precious works of this kind, from Italy, were shown at the Centennial, one of which, a mosaic table top, was valued at fifty thousand dollars. If now a print on paper from such a mosaic could be taken, showing all its multitudinous colors, that substantially would be "stenochromy," the new art we are speaking of. Instead of stones, cakes of colors are substituted, the colors being so compounded that, when moist paper is pressed upon them, they yield a print in kind.

The colors are originally prepared and used in a liquid state, but are of such a character that they rapidly solidify. A little of the color is poured on a flat slab into a sort of little cell or compartment formed by slips of metal standing edgewise on the slab. As soon as this has become solid, the slips are removed, and the little mass of color pared away to the outline required, say the form of a green leaf. The next color is similarly applied, and cut, say to the form of a rose leaf, then the next to that, and so on, until the picture is thus built up piece by piece, in different colors. The paring away is done by a vertical knife fixed in a frame, so that it can be moved sideways in any direction, but all its cuts are perfectly vertical. From the compound block thus produced the picture is printed in a press like that used for lithography.

The specimen now before us, a floral picture, is marvellous for the purity, brilliancy, depth, and freshness of the colors. Some of the pictures exhibited by the lecturer contained no less than seventy-two different shades of colors, and were quite artistic in their general effects. The new art promises well in respect to future development. The field for its employment commercially is very large. To say nothing of pictorial and book illustrations, it would seem that the publication of daily newspapers, illustrated by artistic pictures in colors, is among the possibilities of the near future. But if the new process had but one capability—namely, that of a color exhibitor—it would, in an educative sense, be a boon to the public. By its use the beautiful hues of the spectrum may be economically represented with such approximate correctness as to satisfy the eye.

### Hydraulic Propulsion of Cars.

About midway on a line or network of tramways, or at any other point of the same line, a motive power engine is, according to the invention of Mr. L. Rosseau, C. E., of Brussels, mounted and arranged in combination with pumps and apparatus in a similar manner to those employed in ports, docks, or warehouses, where the lifting apparatus is actuated by hydraulic pressure. For this purpose a pipe or tube for conducting water under pressure is laid down along the whole of the line of tramway or its branches, and in communication with a reservoir or receiver. At suitable distances apart valves or taps are placed in the said pipe or tube in order to supply water under pressure to the carriages of the train, which are placed at certain stations in communication with the reservoir or receiver above mentioned. At these different points or stations each carriage completes or renews and stores away the necessary quantity of water under pressure which is required to enable it to act automatically in the distance comprised between two hydrants for taking in the water. In order to maintain the water under pressure stored in each carriage, a receiver is fixed either horizontally or vertically under the floor of the carriage. This receiver is composed of one or more cylindrical metallic vessels containing compressed air at high pressure (from 20 to 30 atmospheres) according to the power required. The compressed air contained in each receiver acts by its elasticity similar to a spring, either direct or by means of a piston, on the water supply, contained also in one or more cylindrical vessels. The water under pressure in the reservoirs or receivers puts in motion the mechanism, and thereby gives rotary movement to the wheels of the carriage. In order to put the mechanism in motion, an ordinary hydraulic capstan is employed, or the well known multiple cylinder apparatus of Brotherhood or West, or the well known cyclo-dynamic machines of Mathon, or any other suitable mechanism, in order to obtain the same result.

### Two Harmless Doses That Make One Poison.

Chlorate of potassium and iodide of potassium are both entirely harmless in suitable doses. Furthermore, these two salts do not react upon each other in solution, even at a boiling heat. Yet it has been proved that, when they are administered together, they do combine in the stomach, producing iodate of potassium, which is poisonous. M. Melsens found that dogs could take the chlorate or iodide in doses from five to seven grammes with impunity, but that a mixture of the two killed them in a few days, with the symptoms of poisoning by iodate of potassium. This combination must therefore be avoided. Indeed, as a general rule, the chlorate is so unstable, and so ready to give up its oxygen, that it cannot safely be combined with any substance capable of oxidation.—*American Journal of Pharmacy.*

### Effect of Cold Iron on the Mucous Membrane.

People who clip horses and leave them out of doors without blankets are just now the objects of the attention of societies for the prevention of cruelty to animals. There is another cruelty often thoughtlessly practised, which, unfortunately, the above associations cannot prevent, and that is the putting of intensely cold iron bits into the mouths of the animals. Cold iron acts on the delicate lining membrane of the mouth, very much as if the metal were red hot, and excoriates and blisters the tender parts in its vicinity. There was a great excitement one cold day, not many winters ago, in the usual crowd which throngs Broadway near this office, brought about by a newsboy who was foolish enough to test this property of cold iron. He touched an iron railing with his tongue, and, to his astonishment, found that useful member frozen fast. Of course, he yelled lustily, and the sympathizing crowd, equally astonished, were at loss for a remedy. Finally, the boy was taken away from the iron railing, but he found himself *minus* the skin of his tongue.

### PRACTICAL MECHANISM.

BY JOSHUA ROSE.

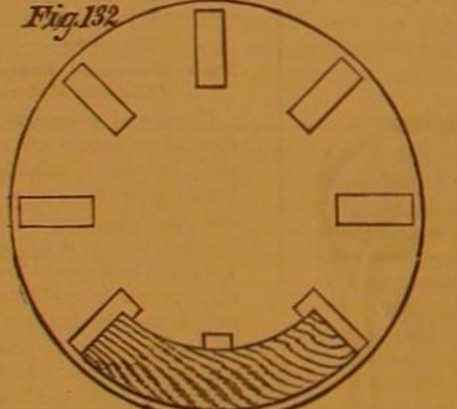
SECOND SERIES.—Number XVIII.

PATTERN MAKING.

Our templates being made, we plane up some pieces of board a trifle thicker than the courses are intended to be. It is easier to plane up the pieces of board while yet square than to plane up the segments separately. From the template, with a black lead pencil, we mark off on the planed pieces of board the requisite number of segments, and cut them out with a band or jig saw. We now proceed to building up, for which purpose we employ a chuck as a base whereon to build. It will save time, however, to have two chucks, building one half of the pattern on each and both halves simultaneously, which will give sufficient time for each course to dry, without requiring nails or pegs to assist the glue in holding them together. The two chucks having been prepared, we glue to them strips of paper at intervals where the points of the segments will come, as shown in Fig. 132; and if the segments are very long, we glue another strip between each of these strips, so that the segment may lie level on the chuck. As the building proceeds, the end of each segment must be planed; and for this purpose, we require what is called a shooting board, which is a simple contrivance made in the following manner: We take a piece of board about 2 feet long, 8 or 9 inches wide, and nearly 1 inch thick, and also a piece of the same length, but 6 inches wide, and ⅝ inch thick; and after planing them up straight, we screw one to the other, as shown in Fig. 133, at A B. S is a raised piece called a stop, and it should be recessed about ⅜ inch into B, and dovetailed. It should not be glued, as the shooting board is useful for other purposes besides dressing segments; and it may be necessary to change the stop for one of a different height. In Fig. 133, the segment is shown in position for being dressed; while in Fig. 132 *a*, the truing plane is shown lying upon its side, in which position it works along the board, guided by the piece, B.

The shooting board, made as above, when in use lies upon the bench, butting against the bench stop, B G. In cases, however, where the space is confined, the work bench being small, the shooting board may be worked lying across the bench, providing the stop, C, be affixed to it. The use of the shooting board, then, is to plane the end of each segment to its necessary length and angle; and having so dressed one segment, we glue it to the pieces of paper on the chuck upon which a circle of the necessary diameter has been marked, as a guide whereby to set the first course of segments.

Fig. 132.



We must not forget, while gluing the segment to the pieces of paper on the chuck, to give the ends of the segment a coat of glue for sizing, as explained in a previous example. Our next segment we treat in a precisely similar manner, save that, while gluing it to the chuck, we also glue it on the ends, so that it shall be sized at one end, and glued at the other to the segment already glued to the chuck, the object of the end gluing being to strengthen the building and at the same time to prevent the corners of the segments from breaking out during the process of turning them in the lathe. As each segment is glued to its place, it should be clamped or weighted down, so as to expel the excess of glue and also to prevent it from shifting while its neighbor is being butted against it. Having completed one course (which will, of course, be one of those intended for the flange), and allowed sufficient time for the glue to dry, we put the chuck in the lathe, and true up by facing off this layer of segments to its proper thickness, making the face straight and testing the same by using a chalked straight edge to make the high places more plainly visible. We then true the diameter of the course.

Our work is at present fastened to the chuck by glue only; and for small work, only two or three courses high, this will suffice. But if the work is large, one screw should be inserted through the chuck into each segment, about half way between the points; and even then, if we build far out from the chuck, it will be necessary, after a few more courses have been added, to replace these screws by longer ones, which may be done (without disturbing the work) by replacing them one by one. If screws are inadmissible by reason of the danger of splitting the segments (as is sometimes the case), we must adopt another method; and that is to discard the paper, and glue an extra course of segments firmly to the chuck, this extra course being afterwards turned away until cut through.

The second and consecutive courses of segments are built up in the same manner as the first, the planed faces of the segments being glued to the respective faced courses on the chuck, until we arrive at the last course in the half pattern; and into this the half spokes or disc, whichever it may be, must be recessed, as shown in Fig. 131. The hubs are to be turned in the lathe separately, with a short plug on the under side to fit a slight recess turned in the disc. If it is preferred, the disc or spokes may be made solid and fixed to one half of the pattern, the other half and its half hub being left loose.

Fig. 133.

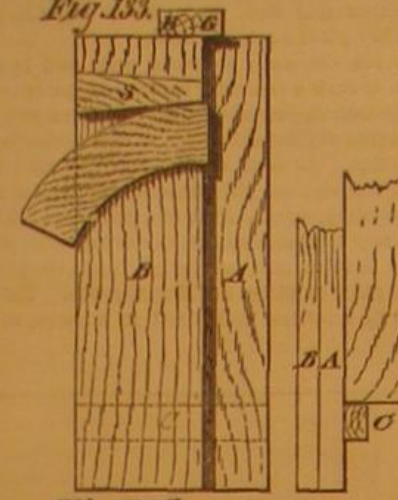
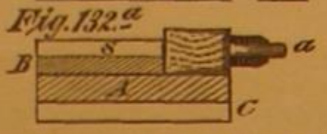
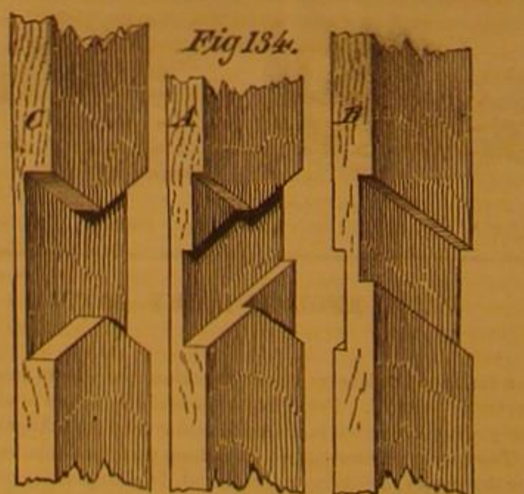



Fig. 132 a.




As we have stated that this may be a spoke wheel, it will be as well to explain the operation of making and fitting the spokes or arms. If the spokes are four in number, the process is very simple. We take two pieces of timber long enough to reach across the wheel, and plane them to the required thickness of arm, and have them sufficiently wide to shape the hollows about the hub and towards the rim. Then we make a mark with a pencil on one side of each, which we call the face. We then set a gauge to half the thickness of the spoke, and with it mark lines on both edges of each piece, always gauging from the face side. We meet at the center of the length, cut a recess out of each, sufficiently wide and deep to admit the other, so that the pieces, when put together, form a cross, which we let into the wheel and fix temporarily with brads. We now place the work in the lathe, and start the lathe so as to find the center of the wheel, from which center we draw out the arms, and then turn out the recess to receive the hub. We mark the arms to their respective places in the rim, so as to be able to correctly replace them, and then we take them out of the rim and shape them to their proper conformation. This being done, we glue them to their places in the rim. In the case of six arms being required, all these operations are similar, with the exception that there are three pieces to be framed together for the spokes instead of two, and we proceed in the following manner: We divide the thickness of any one piece into three equal parts, and mark lines to these equal divisions on the edges of all the pieces. These gauge lines need not extend the full length of the pieces, but only for some distance, about the center of the length where it is expected the recess will be cut out. We next gauge center lines on the flat sides, and find the centers of the length approximately. A, B, and C, in Fig. 134, represent our three pieces, which, when put together, are to form the six arms. Setting the compasses to a radius of one half the width of the pieces, we mark (from the centers already found) circles on one side of the pieces, A and C, and also on both sides of B. We next set a bevel square to an angle of 60°; and with this set to touch the edge of the circle, we draw, on A and C, tangents crossing each other; and on the piece, B, four such tangents, two on each side, must be marked. The piece, A, must now be recessed between one pair of tangents to a depth of two thirds of its thickness, and between the other pair to a depth of one third. B must be recessed on each side to a depth of one third its thickness; while on the piece, C, the whole of the space included between the tangents must be cut away to the depth of two thirds. The recesses must be cut true to the lines, and level, a rabbet plane being useful for the purpose, unless the work is small; and if the job has been carefully executed, the pieces will fit right together, and may be glued without further labor. For an odd number of arms, such as 3, 5, or 7, the method of putting together is different, and is not so strong as the foregoing. It is as follows: Upon a flat piece of board, fasten a piece of paper, and describe upon the latter a circle; then divide the circumference of the latter into as many equal parts as it is required to have arms, and draw lines from this center of the circle to the circumferential points of division, as shown in Fig. 135. Then bevel the ends of the pieces equally on each side, so that each shall exactly cover its own division of the circle; and as each is fitted, fasten it temporarily down, and when all are fitted, verify the work as follows: Observe if the pieces are equidistant from one another, at an equal distance from the center of the circle, and at or near the extremities, when any error will be easily detected and rectified. Then glue the pointed ends all together, fastening each piece temporarily to the board as before, and set the whole away until it is quite dry, when the piece may be taken from the board, and the required form given to the arms, ready for finally fixing to the rim of the pattern.

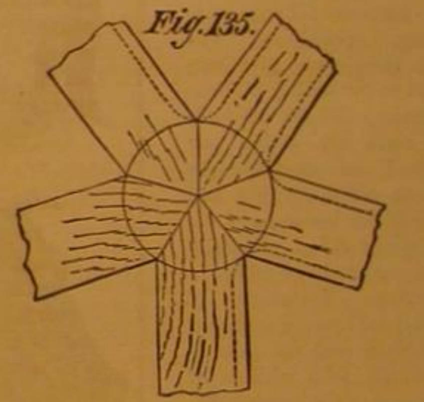
Fig. 134.




In almost all cases, it is necessary that wheels of this kind be provided with hubs; and by the attachment of the latter, the joints of the spokes at the center, when made as shown in Fig. 135, are very much strengthened. But in the rare event of having to put together such a combination of arms without hubs, it will be advisable to turn out a recess at the center, making it as large as practicable, and fitting into it a disc of hard wood. Before cutting out the spaces in the rim to receive the extremities of the arms, it is necessary to turn out that part of the rim to the finished size, as it will be inaccessible to the turning tool when the arms are glued in. The arms being fitted to their places and made fast to the rim, we proceed to turn all that can be got at—that is to say, the exterior diameter of the body of the half of the half-pattern, and also the flange. It is needless to add that each half of the pattern must be similarly treated.

The work is now to be reversed on the chuck, and the inside turned out, together with a recess at the center to receive the hub. To maintain the two halves of the pattern in coincidence, two, and sometimes three or more, pegs are inserted in the arms of one half, which pegs fit into holes bored to correspond in the arms of the other half of the pattern. In some cases, the flanges of the pattern are required to be so thin as not to admit of two layers or courses of segments in their composition, in which event, especially if the flanges extend far from the body of the pattern, it is well to strengthen the joints of the segments. Perhaps the neatest way of accomplishing this is to make a saw cut in the ends of each segment, and, at the time of gluing, to insert a tongue or thin strip of wood, nicely filling the saw cut, the grain of the tongue being at right angles to the line of the joint of the segments. Care should, however, be taken to have the saw cut in each at a similar distance from the face of the segment. It will be perceived that the flanges might be omitted without making any difference in the method of construction; nor does the method to be pursued vary to any great extent for all kinds of rope or chain pulleys.

Fig. 135.



### Novelty in Flooring Tiles.

The London *Building News* states that at the Bavarian Industrial Museum may be seen a collection of square tiles of asphalt prepared by a new process, and intended for floorings. The tiles are ornamented with mosaic, in white china or colored glass, which may be arranged according to any design. The drawing to be reproduced is traced on a sheet of thick paper, which is afterwards covered with the various fragments of china or glass, which will form the mosaic; a border is made to the sheet, and boiling asphalt poured upon it. After the whole is cooled, the paper is taken away with cold water, and the tile is finished. A flooring covered with such tiles bound together by a string of asphalt appears to have been made by a single melting, and has a good appearance. It indefinitely resists damp, and is consequently useful in bath rooms, halls of houses, and balconies.

### Bell Metal.

An improved alloy for bell metal is proposed, which, it is said, does not tarnish, is less likely to crack, gives a better sound, and is much lighter in weight than the alloy usually employed for the purpose. It is prepared as follows: Nickel, 1 lb., and copper, 6 lbs., are melted and cooled. Add zinc, 1 lb.; aluminium, ½ oz. Melt and cool. Melt again, and finally add ½ oz. quicksilver and 6 lbs. melted copper.

### Indian Corn Culture.

In the "Transactions" of the Department of Agriculture, of the State of Illinois, for the year 1875, a volume just published, there is a valuable prize essay by Mr. B. F. Johnson, of Champaign, Ill., on the culture of Indian corn and the ways in which it may profitably be utilized. The author thinks that the best variety for a profitable present crop is probably that which fifty years of cultivation has developed in a given county or neighborhood; but in selecting, preference should always be given to seed having a more southern rather than a more northern origin, since we go south to find the corn crop in its highest perfection, which is at latitude 37°; and further because presumably southern grown corn contains more, of the elements which make Indian corn a perfect food, than grain of northern growth. The best variety for general cultivation is, however, yet to be produced; but it is believed that the same will come from the careful selection of parent stock, special manuring for the purpose of producing the largest amount of desirable elements, and careful and intelligent cultivation.

Mr. Johnson's essay abounds in excellent practical hints, among which we find the following: In the preparation for crops of Indian corn, fall plowing on central Illinois prairie soils is preferable to spring plowing, and deep plowing to shallow; but deep plowing should be confined to rich lands plowed in the fall, and shallow to thin ones plowed in the spring, leaving the middle course for the medium soils. Manure when used should, if possible, be spread and plowed in during the fall; but if spread on the surface as fast as made, during the winter season, it suffers less waste and depreciation than when heating in the barn yard. Barn yard manure stimulates stalk and leaf growth at the expense of the ear; but manufactured fertilizers exercise a contrary effect. In fact, to grow the largest crop of corn, grain being considered, recourse must be had to plant or animal ashes.

In fall-plowed land, the best preparation for the seed bed is to throw up, by means of a shovel plow, a slight ridge where the rows are to stand and where the planter is to follow; then after planting, pack the loose soil, to insure germination, by using the plank drag. Finally, since the atmosphere furnishes from 96 to 98 per cent. of plant food, there can be no such thing, says our author, as too much cultivation, unless it is carried so far as to retard growth by wounding plant roots or firing the crops in dry weather.

The most profitable use of Indian corn—that is in returns of dollars and cents—is to convert it into whiskey, because this affords a large revenue to the Government, ensures a home market to the farmer, and makes money for the distiller. In an agricultural sense, the most profitable use is found in the old custom of out-of-door feeding of cattle. To our Eastern agriculturists this will seem a wasteful method of disposing of a grown crop; but, to again quote our author, "when the price of corn ranges from 25 to 50 cents per bushel, and the price of hogs and cattle from $3 to $6 (live weight). per 100 lbs., when indifferent farm labor costs $26 a month for eight months of the year, and skilled labor is not to be had at any reasonable price; when the farmer has poor barns, and runs in debt for a cooking apparatus, the cooking and grinding of corn as food is pretty sure to result in a decided failure." It is cheaper, in brief, to fence off enough corn to last a number of hogs for a month at a time, and let them eat it as they like, than to gather, grind, and cook the crop, and feed the hogs or cattle with it.

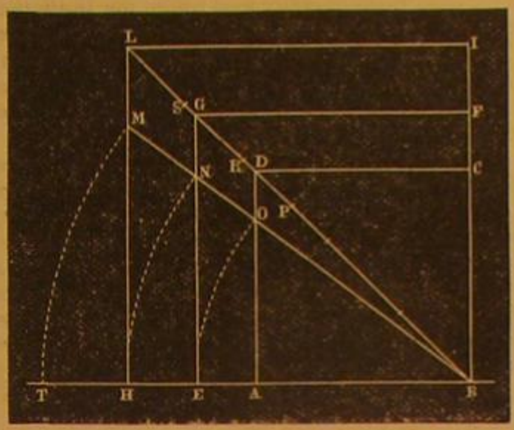
Among the minor profitable uses of Indian corn are soiling milch cows in summer, and preparing whole green corn for winter food for these and the younger stock. There is no better food for the production of a full flow of rich milk from cows than green sweet corn, fed ears, stalks, and all.

The new process, termed "ensilage of maize," now moreover enables the farmer to preserve his corn in a partially green state, and hence in valuable condition for fodder. To "ensilage" is to bury in *silos* or pits; and the ensilage of maize consists in cutting up the green Indian corn plant, which has made a full growth, into small pieces, and burying them in pits or trenches. The pieces are of such a size that there shall be no cross section of stalk or ear of more than a third of an inch in thickness. The pit is made in well drained land, about 2 or 2½ feet deep, from 3 to 6 feet wide, and in length sufficient to hold the material to be stored. The inside is lined with straw, and then the chopped mass is packed in hard. More straw is placed above, and then the earth is piled on to a thickness of 3 or 4 feet. Indian corn and other forage plants undergo a fermentation when so treated, not unlike that of cabbage when made into *sauer kraut*, and is greedily sought for by all kinds of domestic animals, being particularly relished by cows giving milk. It is important that the corn be cut very fine, that the packing be thorough, and that the weight of superincumbent earth keep all in place, and prevent either the escape or entrance of moisture.

### THE DUPLICATION OF THE CUBE.

We find the following new and ingenious demonstration of this problem in *Les Mondes;* it is credited to Dr. Gaetano Buonafalca. The author's proposition is: If on one side of a square, the sixth part of its diagonal be laid off, the right line joining the point of division and the apex of the opposite angle will represent the side of a cube of double the cubic contents of a cube constructed on the same square. Let A B, in the annexed figure, be the side of the given cube, and A B C D its square. Divide the diagonal, D B, into six equal parts, of which let D P be one. Lay off D P to D O, and draw O B. Then O B will be the length of the side of the double cube sought.

Let the hypothesis be that this line, O B, really expresses the side of the double cube. Carry O B on the side, B A, indefinitely prolonged, and mark the point E. Now construct the square, E B F G, and divide the diagonal, G B, into six equal parts, as previously done. Carry one of these parts, G R, to G N, and draw N B. Then the line, N B, will express the length of the side of the cube quadruple the first. Take now the same line, N B, carry it on the side, B A, prolonged, and mark the point, H, where it terminates. Then complete the square, H B I L, divide the diagonal, L B, into six equal parts, as before, take one part, L S, carry it to L M, and draw M B. This line, M B, from the hypothesis with which we started, will express the side of a cube octuple that of the given cube.




Now knowing that the octuple cube of any given cube should have its side double the side of the latter, it follows that, if the line, M B, represents the true side of the octuple cube, it should be double the side, A B. If T B be made equal to 2 A B, the line M B will be found to be equal to T B. Hence, as we are sure that the line, M B, expresses the side of the octuple cube, it follows that the line, N B, obtained by identical and analogous means, represents the side of the quadruple cube, and finally the line, O B, for the same reasons, represents, as we supposed in the beginning, the side of the double cube, and hence is the cube root thereof.

The analytical demonstration of the above, which we append, was prepared by Father Secchi:

$O B = \sqrt{O A^2 + A B^2} = \sqrt{(A D - O D)^2 + A B^2} = \sqrt{(A B - \frac{1}{6} B D)^2 + A B^2}$ · and as B D is the diagonal of the square, we have $BD = A B \sqrt{2}$: whence

$O B = \sqrt{(A B - \frac{1}{6} A B \sqrt{2})^2 + A B^2} = A B \sqrt{(1 - \frac{1}{6}\sqrt{2})^2 + 1} = A B \sqrt{2 + \frac{2}{6^2} - \frac{1}{3}\sqrt{2}} = A B \times 1.2606.$

The side of the double cube should be $x = A B \times 1.2600$, which gives the value to within $\frac{1}{1000}$, about, which is near enough for all purposes of graphic construction.

### Removal of Hyposulphite of Soda.

In writing upon that ever recurring subject, the elimination of hyposulphite of soda from silver prints, Herr Rotter, of Dresden, stated that every photographer knew that the indispensable hyposulphite of soda was the photographer's greatest enemy, and that the most varied contrivances had been invented in order to eliminate it completely by washing from the fixed picture; but a little reflection showed that in this way all that was obtained was a greater or less dilution of the soda, part of which was sucked up and retained by the spongy fibres of the paper, so that even after long continued washing some traces of the fatal stuff still remained. It was, therefore, natural that one should endeavor to remove the hyposulphite by chemical means—namely, powerful oxidizers, which change the dangerous hyposulphurous acid into harmless sulphuric acid.

Hydric peroxide, which was first suggested for this purpose, could not be used on account of its instability and its doubtful effect upon the organic matter present. Just as little could a solution of iodine be recommended, as, in addition to its poisonous properties, it was apt to form iodide of silver so as to discolor the whites of the picture. On the contrary, all requirements were fulfilled by the *eau Javelle*—that is, the spotting water of washerwomen, which costs about 6 cents per quart—of Herr Günther, of Berlin, and which is really a solution of hypochlorite of soda. This gave off the oxygen of the hypochlorous acid to the hyposulphurous acid; the chlorine thus set free combined with the hydrogen of the water to form hydrochloric acid, and the oxygen set free from the water went to the hyposulphurous acid, which was thus changed in a few minutes to sulphuric acid. The operation was exactly the same as when hyposulphite was used as a bleaching agent, only that in our case, when the durability of the fibers of the paper was not in question, an excess of hypochlorite of soda must be present. One proceeds as follows: Immediately on removing the pictures from the soda, lay them in water containing about one tablespoonful of *eau Javelle* to 5 pints of water, and when removed from this water place them in another bath of the same composition. At the third removal they may be placed in pure water, and are then ready to be taken out and dried. They do not fade at all in these baths, and come out of them brilliant in the whites. On account of the shortness of the time the pictures are in the water they are uncommonly brilliant, and the blisters, often so troublesome, are perfectly harmless. In a word, says the *British Journal of Photography*, we are informed that whoever has tried this simple, thorough, and cheap process will never use another. It is especially cheap for those photographers whose supply of water is limited and dear.

### GYNOMANIA AND OTHER MANIAS.

It is not strange that we sometimes hear it asked: Is anybody sane? A large proportion of men are harmless monomaniacs on some question or other. Some have an insane passion for old postage stamps and other worthless relics; and perhaps they cherish bits of a house where Washington lived, or where Ellsworth was killed. These insane relict-hunters are frequently scourges of civilization, and direct enemies of art. They have broken up and carried off piecemeal many of the finest monuments and ruins of antiquity; and but for the vigilant police, they would have destroyed many of the most beautiful exhibits at our Centennial.

There is a more dangerous class of semi-lunatics, persons whose deeds are more or less criminal. This class includes the victims of dipsomania, kleptomania, and many another mania yet unnamed and undescribed. Dipsomania is now treated as a disease; the poor drunkard, whose feeble will is unable to resist his powerful desire for intoxicating drinks, is now confined in an asylum, and treated with drugs instead of moral lectures. Punishment is in part replaced by medical advice and remedies. The kleptomaniac is more rare, and perhaps more harmless. What treatment he should receive is still an open question. We sometimes hear of ladies of wealth and high social standing who are subject to attacks of kleptomania, and bring home loads of stolen goods, for which their husbands willingly pay to avoid the disgrace of permitting their arrest on a charge of stealing. Unfortunately, if the victim of this passion is poor and without influence, it is looked upon as a crime and punished as such. There are many, in fact, who think that, because they have no desire to drink or steal, others who have such desires can overcome them if they will, and that it is only by yielding to their passions and desires that the latter have obtained the victory over common sense and virtuous intentions. Others look upon these persons as suffering physically as well as mentally, and consider them proper subjects for medical treatment. Kleptomania is far more rare than dipsomania; but there is another mania rarer even than the latter, and to many, probably, its existence is unknown and unheard of. As yet it has not even a name; hence we shall call it, for want of a better title, *gynomania*, and apply to its victims the familiar botanical term, *gynandria*. We refer to the passion that some young people have for the dress and manner of the opposite sex. At no time in history have the coats, hats, and boots worn by ladies so closely resembled the corresponding articles of male attire. It is true that in most cases it is possible to distinguish the two by the superior elegance and finish of those intended for the gentler sex. Then, too, a miss who would follow too closely the dress of her brother is designated "fast;" and hence, modest and virtuous girls relinquish the extreme styles to their sisters of a bolder class. Young men have reached the limit of effeminancy when they have curled their hair, and parted it the middle. There is no other safety valve for the escape of their pent-up womanhood; and he that would go further must adopt the entire dress and appearance of a woman. Startling as it may seem, there are men, some of them no longer young, who can no more refrain from skirts and bustles than the toper from his glass. Some time since a young man was arrested in the streets of a neighboring city, dressed like a fashionable lady. His slender form was rendered more so by the tightest of stays; his legs were bound together by a pulled-back skirt and bustle; his narrow feet were encased in high-heeled boots; his hair was crimped and frizzed; he was adorned with ear rings, breast pin, ruffles, and laces; he was accustomed to walk the streets at midday, unsuspected by either sex. Although heavily punished by fines and imprisonment, he always returns at the earliest possible moment to his peculiar practices, unable to break away from this strange infatuation. He states that he can assign no reason for his odd conduct.

This gynandrion, or female man, was a gentleman of respectability, wealth, and influence, and had worn this dress long enough for the novelty of the thing to wear off; but he took the risk of exposure, shame, imprisonment, and social ostracism, merely because "he can't help it." As with the drunkard and kleptomaniac, he acknowledges his sin, makes repeated efforts to reform, but all to no purpose. Is it a mental disease or a physical one? What treatment does it require? May it not be a *lusus naturæ*, a mistake or freak of Nature? This man seems to be, in all his tastes and desires, a woman; with the feet, hands, waist, and hair of a woman; skillful in all the pursuits of women; lacking in strength, courage, and manly qualities. "Who hath sinned, this man or his parents," that he is thus constituted?

The case of gynomania above cited has never before been published, but we can vouch for its truth; and we fear that it is not an isolated case. Its features are so remarkable that we call the attention of medical men, philanthropists, and more especially biologists to it, hoping that a careful study of the disease may result in the discovery of an antidote more effectual and more humane than that of fine and imprisonment.

SIR TITUS SALT, to whose ingenuity the useful fabric known as alpaca is due, is dead. He was the head of the firm of Titus Salt & Sons, to whom the immense factories and the town adjoining them, known as Saltaire, in Yorkshire, England, belong. This is one of the largest establishments ever created by the labor of one man.

### TIME LOCKS.

So many times have bank officers and others been seized in the dead of night, and compelled to open their safes and vaults, that although it may be very interesting and exciting to the parties immediately concerned, the thing is becoming monotonous to the public in general, who would much rather see the newspapers filled with matter having more novelty or utility in it. We may, therefore, be pardoned for suggesting that a few patents have been granted for locks that cannot be opened by any one until the proper business hour arrives. The attachment of any of these locks would effectually prevent any success attending these raids; and it is, therefore, the duty of every banker or banking company to see that such safeguards are provided for the property in their charge.

It is commonly supposed that the time lock is a newly patented invention, and that its manufacture is therefore a monopoly; but it is not so, for we find no less than seven expired American patents, to say nothing of foreign ones which have no force here, and hence the manufacture of time locks can be monopolized by none. So far as we at present know, the time lock originated in England, as the first known patent for such a device was granted there to W. Rutherford, Jr., April 14, 1831, (No. 6,105, old law). This patent describes three styles of time locks, or rather two styles and a modification of the second one. The first style mentioned describes the use of a spring clock work (which may consist of two independent movements, to avoid the inconvenience which might result from the stoppage of a single one), giving motion to a shaft carrying a circular guard plate, having a notch cut in it of the size of the bolt. When the door is locked, the outer edge of the periphery of the guard plate is against the back end of the bolt, and prevents its retraction until the clock movement has carried the notch in the guard plate around opposite the bolt, when the latter can be withdrawn. The second style shows a bolt which is held locked by one end of a horizontal lever resting in a notch in the bolt, until a weight belonging to and driving a clock movement, descends upon and depresses the other end of said lever, which raises the first mentioned end out of the notch in the bolt. Another figure in the drawing shows a modification of, or an addition to, this last style, in which the horizontal lever is held by a vertical catch, having an inclined projection on its side that is struck by the weight as it descends, and is pushed aside, thus liberating the end of the horizontal lever, and allowing it to fall when the weight presses on it. The specification mentions the use of falling sand in an instrument on the same principle as the clepshydra instead of clock work for operating the lever by the weight of the sand or liquid; and it also proposes to use oil or other combustible material, to be used as a counterpoise on the lever that will allow it to rise when sufficient weight has been removed by burning.

The first American patent, appears to be that granted to J. Y. Savage, October 9, 1847, which shows a bolt shot by a spring so as to be self-locking, which bolt is held locked by a drop hook. A notch on a wheel moved by clock work at the proper time for opening the safe operates a lever that releases a weight, which moves a slide that just raises the drop hook, and then pushes back the bolt, thus unlocking the door.

The next patent (W. L. Bass, December 23, 1851) provides a device for unlocking the door, should the clock happen to stop; but it cannot be used when the latter is in motion.

As an improvement on the last two devices, Holbrook and Fish obtained a patent dated April 28, 1857, for an invention which consisted in arranging the clock work in the same case with the lock, and using two independent clock movements, each of which controls a pawl that, at the proper time, will fall into a notch in a revolving guard, and allow of the retrograde motion of the bolt necessary to unlock the door of the safe.

On May 5 of the same year, Williams and Cummings procured a patent for a time lock having a system of toggle levers held in such a position by a cam wheel, revolved by a clock movement, that the bolt cannot be drawn back until at the appropriate time for opening, this cam wheel bends the toggle joint, and allows a spring to withdraw the bolt, when the door can be opened.

The next patent in this line was granted to A. Holbrook, April 12, 1858, for an arrangement designed to compact the mechanism and lessen the cost of this class of locks, to relieve the time work of the pressure of the springs that open the bolt, and to increase the difficulty of cutting or drilling the latter by making it round, so that it will revolve in its bearings.

The next patent to Holbrook's was issued November 2, 1858, to Lyman Derby, who shows a four-armed or cross-shaped bolt turning on a center, and a λ-shaped lever, pivoted at the apex of the λ, one leg of which rests on one of the arms of the bolt, so as to keep the door locked until a roller, on a wheel driven by clock work, strikes the other leg of the lever, moves the first mentioned legs off the four armed bolt, and allows the latter to move by its own gravity out of the keepers, so that the door may be opened.

On the 16th of the same month a patent was issued to Obadiah Bayley for another time lock, the main features of novelty consisting in the use of an ajustable pinion sliding on its shaft to change the time of opening, and an arrangement of levers to stop the clock movements when the bolt is drawn back.

All of these patents have now expired, and the inventions therein shown are common property, so that any manufacturer may make as many of these locks as he chooses. In addition to the above patents, there are the rejected cases of L. Yale, September 24, 1847, Jedediah Weiss, April 14, 1856, and R. S. Harris, January 12, 1867.

The existing patents for improvements of one sort or another, on the foregoing, number nearly forty.

### ROPE GEARING.

The substitution of rope gearing for toothed wheels, belting, and other modes of transmitting large power in factories, is at present exciting considerable discussion, generally favorable to the system, among European engineers. In this method of driving, the fly wheel of the engine is made broader than usual; and upon its periphery a number of parallel grooves are turned out for the ropes, the number and size of which are regulated by the power to be transmitted. We have before us two excellent papers on this subject, one by Mr. James Durie, recently read before the Institution of Mechanical Engineers, at Manchester, England, the other by Mr. K. Keller, published in the *Zeitschrift des Vereines der Deutscher Ingenieure*. The conclusions to which are drawn from practical experience in the system, as used in Scotch, German, and East Indian factories.

It is of course important at the *outset* to examine wherein the advantages offered by rope exceed those of toothed gearing and leather belting. Regarding the first, Mr. Durie notes the difficulty of accurately constructing the gears, as evidenced by the rumbling noise heard in the streets of any manufacturing town, "showing that all is not as it should be for the safe and economical transmission" of steam power; and a necessity consequently exists, where power is taken off by bevel wheels and shafting, of rendering the factory a rigid and immovable structure. This objection to cogged gearing loses much of its force to any one who has examined the admirable working of the massive gear attached to the Corliss engine, at the Centenniai, and who is familiar with the accuracy whereby the largest wheels may be cut with the new Corliss gear cutter. In the case of rope gearing, however, the ropes by which the power is transmitted, consist of an elastic substance, namely, carefully selected long-fibered hemp; and their lightness, elasticity, and comparative slackness between the pulleys, which may be from 20 to 60 feet apart, are highly conducive to their taking up any irregularity which may occur in the motive power. Hence all attachments and bearings may be light, and there is considerable saving in the foundations of the engine, and in the wall boxes and the strength of walls, which need not be so ponderous as required for upright shafts. For high speeds, the friction of rope gearing is found to be considerbly less than that of toothed gearing. No data from special tests is given on this point: but note is made of increased steadiness of driving after the alteration from cogged gearing to rope, and a greater weight of yarns was turned off from the machinery in spinning mills in the same time.

Comparing ropes with belting, the question of cost may be considered. One of the largest leather houses in this city quotes leather belting at from 80 cts. to $1.00 per lb. Rubber belting (heavy) is worth 35 cts. per lb.: and we have an estimate from a manufacturer of ropes, wherein the best hemp article in large quantities, say a thousand or more fathoms, and varying in circumference from 4 to 6 inches, is offered at about 21 cts. per lb. Grooved pulleys for ropes cost more than plain pulleys; but making allowance for this, it is probably safe to say that the total cost of ropes and grooved pulleys for transmitting a given power, will not exceed one-half or two-thirds the cost of leather belting, and flat pulleys. The cost of fitting up a mill with rope gearing, Mr. Durie states, is considerably less than with tooth gearing, when the shafts to be driven revolve at high speed; otherwise the expense is about the same. As regards the comparative friction of ropes and belts, the experiments quoted exhibit wide differences, so that it is impossible to reach any definite proportion; but they show that ropes have a considerably greater hold on the V-shaped grooves per square inch of bearing surface than flat belts have on pulleys. The lifetime of a rope is found to be from three to five years, as a general rule; and the cost of maintenance in Scotland is about $25 per 100 indicated horse power transmitted per annum. The main advantage of ropes over belting, however, lies in the power being divided up into a number of ropes, so that in the case of any one of the ropes showing symptoms of weakness—and this is always the case long before the rope breaks—that rope may be removed by stopping the engine for a few minutes, the remaining ropes continuing to do the work until the stoppage occurs. In the case of belting, as only one belt is employed to drive one flat of a mill, if anything were to happen to the belt, all the machinery in the flat would of course have to stop until repairs could be effected.

The ropes used are three-stranded cables, made of the best hemp. Cotton ropes have been unsuccessfully tried, and leather ropes are too costly. The sizes employed are from $3\frac{1}{2}$ to $6\frac{1}{2}$ inches, although there are do definitely ascertained limits in this respect. The weight corresponding to any circumference per foot in lbs., is easily found by multiplying the square of the circumference by 0.031. Grooves in the pulleys usually have their sides at an angle of 40°, which is found to be the best V—that in which the ropes have least tendency either to slip or bind. The ends of the cables are united by what sailors call a "long splice," which is not of greater diameter than the rest of the rope, and is about 9 or 10 feet long.

We have now to consider the practical questions of the number and diameter of cables to be employed under various circumstances. The stress upon a rope is twofold, and is due first to longitudinal tension, and secondly to curvature. When the diameter of the first pulley is not less than 45 or 50 times that of the cable, the tension resulting from curvature may be neglected. The flywheel or first driving pulley should, therefore, have a diameter equal to double the above or not less than ninety times that of the rope, which works on it. This is essential, as, if the diameter of the pulley is too small, the rope in bending over is subjected to strains which greatly impair its durability. According to Keller, experiment shows that the longitudinal tension may be estimated at from 107 to 114 lbs., per square inch of section of area of the rope. Taking the larger estimate, the total tension on a $5\frac{1}{4}$ inch rope for example will be about 275 lbs. If it be admitted that, of the two tensions produced in the cable, the larger, that of the motive portion, equals twice that of the smaller, the power to transport at the circumference of the pulley will be equal to one half the above total tension, or 138 lbs. Suppose the velocity to be as low as 32 feet per second, or 1,920 feet per minute: the work done will then be 264,960 foot lbs., per minute, or something over 8 horse power. This, with other velocities, will of course be greater. From the foregoing, however, we may easily calculate the number of cables necessary in any case, if their diameter, the power to be transmitted, and the velocity be known. Taking the cable again as $5\frac{1}{4}$ inches in circumference, and supposing the velocity to be 48 feet per second, and power 90 horse, we shall have the number of cables necessary under such conditions $=\frac{90}{8}\times\frac{32}{48}=$ between seven and eight. But it would be better to use nine, the extra one being advantageous in order that, when repairs are needed to any single rope (and it is hence thrown out of operation) a greater stress than the 114 lbs., per square inch may not come on the series.

To determine the diameter of cable needed Mr. Keller gives the following formulæ: Diameter $=0{\cdot}58\sqrt{\frac{P}{a}}\times0{\cdot}58\sqrt{p}$ in which P is the total power to be transmitted, $p$ the tangential force to be transmitted by one cable, and $a$ the number of cables. Or letting R represent the radius of the pulley, N the horse power and $n$ the number of turns: Diameter $=155\sqrt{\frac{N}{a\,n}\times\frac{1}{R}}$. These give the diameter in centimeters; to reduce to inches, multiply by 0·393.

It will be interesting, in conclusion, to note some of the practical conditions quoted by the authors. The engine fly wheel of a jute weaving and spinning factory, in Dundee, Scotland, is 22 feet in diameter, and has 18 grooves cut in its circumference: its width is 4 feet 10 inches over all. The engine makes 43 revolutions per minute, and the velocity of the fly wheel run is 2,967 feet per minute. The power of the engine varies from 400 to 425 indicated horse power, so that each of the ropes, which are $6\frac{1}{4}$ inches in circumference transmits about 23 horse power, 115 horse power is transmitted to the ground floor by 5 ropes on to a pulley 7 feet 6 inches in diameter; 92 indicated horse power to the first floor by 4 ropes to a 5 feet 6 inches pulley; 138 indicated horse power to the attic by 6 ropes to a pulley of the same size as the preceeding, and 69 indicated horse power to a weaving shed on the other side of the engine by 3 ropes to a pulley 7 feet 6 inches in diameter. The tension on each rope is $\frac{33000\times23}{2967}=256$ lbs.

In a jute factory in Calcutta, the engines are 1,000 horse power and make 43 revolutions, the fly wheel is 28 feet diameter and 6 feet 7 inches wide, and the velocity is 3,784 feet per minute. There are 18 ropes, $6\frac{1}{2}$ inches in circumference used to transmit the power to the spinning machinery, and 7 ropes drive the weaving machinery. Each rope, therefore, transmits 40 indicated horse power, and the tension on each is 349 lbs.

At Lindgen's spining mills, at Hochneukirch, 88 horse power is transmitted by 7 cables. The fly wheel is 17 feet 11 inches in diameter; the cable are 5·7 inches in diameter, and the velocity 3·030 feet per minute.

At Heyerdahl's sail canvas factory, in Christiania, Sweden, 270 horse power are transmitted by 13 cables. Diameter of fly wheel is 11 feet 9 inches, and of ropes 5·7 inches; and the velocity is 4,416 feet per minute.

Mr. Durie in his paper draws especial attention to the advantages of the rope system in lieu of belting in rolling mills in this country. He is confident that from the slackness with which the ropes can work, and the hold they have on the grooves of the pulleys, they would be admirably adapted for taking up the shock which is thrown upon the gearing of a train when the iron enters the rolls.

### Legal Definitions in Mental Pathology.

A leading English authority, Mr. Phillips, in a late work, lays down the following distinctions in forensic medicine:

"Every person whose mind, from his birth, by a perpetual infirmity, is so deficient as to be incapable of directing him in any matter which requires thought or judgment, is, in legal phraseology, an idiot.

"Every person *qui gaudet lucidis intervallis*, and who sometimes is of good and sound memory, and sometimes *non compos mentis*, is, in legal phraseology, a lunatic.

"Every person who, by reason of a morbid condition of intellect, is incapable of managing himself and his affairs as an idiot or a lunatic, not being an idiot or a lunatic, or a person of merely weak mind, is, in legal phrascology, a person of unsound mind."

# Recent American and Foreign Patents.

## NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

### IMPROVED MACHINE FOR EDGING LUMBER.

George W. Bobo, Rock Mart, Georgia.—This is a machine for edging lumber while being sawed. It is so constructed that it may be adjusted to edge thicker or thinner or wider or narrower boards, as may be required, and without stopping the mill.

### IMPROVED CARRIAGE POLE HEADS.

George Bray, Jr., Deptford, Eng.—This is a simple arrangement of the pole head for securely holding the pole straps. It is easily shifted for connecting and disconnecting, and will disconnect the strap self-actingly in case a horse falls down. The eye pieces for holding the straps are made in separate parts, and are attached to the pole by separate socket pieces, one of which is rigidly fixed on the pole, while the other is capable of turning for opening and closing the eyes. The two socket parts have cam projections, and are fixed with a spring, by which the eyes are kept closed, but which allow them to open, by a certain amount of pressure, to allow the straps to escape.

### IMPROVED MACHINE FOR SAWING CIRCULAR SLABS.

John J. Dimond, New York city.—This consists of stationary shafts, on which a saw frame with sleeve-shaped ends is reciprocated by suitable power, the connecting rod being secured to one of the sleeve ends by a collar placed intermediately between fixed collars. When circular slabs are required, the saws are first applied to one side of the block for cutting down a semicircle, being then applied to the other side to cut down the other semicircle until the cuts meet.

### IMPROVED DRAFT ATTACHMENT FOR VEHICLES.

George W. Wilson, Batavia, Ohio.—This invention is an improvement in that class of platform spring vehicles in which the draft is applied directly to the front axle instead of the platform springs supported thereon. The double tree, and the draft rods attached thereto, are supported from the front spring by means of jointed bars, which allow the spring to play up and down without changing the position of the double tree, or deflecting the line of draft.

## NEW AGRICULTURAL INVENTIONS.

### IMPROVED PLANT SUPPORT.

Anthony Daul, Newark, N. J., assignor of one half his right to Emil Krause, New York city.—This consists of an elastic band with a fastening device at each end, and an attaching staple in the middle. It is designed as a substitute for cord or other material for tying up growing plants. Being elastic, it adapts itself to the increasing size of the branches.

### IMPROVED HOE.

Eliphalet W. Oakley, Babylon, N. Y.—This consists in a hoe provided with a scoop blade for removing fine mud and sand from the bottom of a ditch. The hoe can also be used for various other purposes with better effect than a hoe constructed in the usual way.

### IMPROVED CIDER MILL.

John A. Schwob, Miltonsburg, O.—This mill is constructed of wooden sections, so as to be readily set up, moved to any place, and stored away after use. There is an interior stationary masher of conical form, provided with spiral recesses, and an outer revolving grinder extending around the masher and having recesses running in opposite directions. Both masher and grinder are made of plank, arranged at cross grains and bolted together.

### IMPROVED REVERSIBLE PLOW.

Daniel F. Vickery and William P. Prickett, Oxford, Ala., assignors to themselves and Richard G. Roberts, of same place.—This plow is so constructed that the beam and handles may be reversed. It will turn the furrow the same way as it is drawn back and forth across the field, whether it be used upon the hillside or upon level ground. The beam and handles are to be turned by and with the team, leaving the plow in position to turn a furrow in the same direction as the preceding one, the two plows working alternately.

### IMPROVED FRUIT PICKER.

John Sager, Augres, Mich.—This device embodies spring jaws having cutting knives arranged above the hoop, to which the fruit-conveying tube is attached. The cutters are operated by a sliding rod guided in the handle of the picker, and connected by pivot links with the spring jaws. The picker is placed directly under the fruit, and raised until the hoop comes in contact with the stem. The picker is moved slightly forward to cut the stem as close as possible to the fruit, and the sliding rod is pulled back for cutting. The hose then conducts the fruit to the basket without getting bruised.

### IMPROVED FENCE.

John A. Burnham, Delaware, O.—This invention relates chiefly to confining wooden palings by means of wrought iron brackets, whose arms are bent at right angles to adapt them for application to the supporting rods, in such manner that they conceal the rods.

### IMPROVED CORN HUSKER AND SHELLER.

George E. Luckey, Paris, Tenn.—In using this machine, the butt of the ear is presented to the husking cutter, which removes the husks, and shells about an inch of the ear. The ear is then withdrawn, reversed, secured in a clamp, and fed forward to the shelling cutter, by which the rest of the corn is removed from the cob.

### IMPROVED GATE.

Robert E. Stevens, Owen Sound, Ontario, Canada.—This gate is so constructed that it may be conveniently adjusted higher or lower to adapt it for winter or summer use. It will not sag, may be opened in either direction, will fasten itself as it swings shut, and will receive a small or wicket gate within it.

### IMPROVED CORN MARKER.

George W. Graves, Villisca, Iowa, assignor to himself and Amos P. West, of same place.—Two sets of bevelled wheels are arranged on two axles. The rear and longer axle is capable of embracing four rows, and is connected to a short one in front by bars, in such a way that the front axle is capable of moving vertically, independently of the rear one. The invention also includes a peculiar manner of attaching and locking the tongue.

### IMPROVED DRUGGIST'S SHELF BOTTLE.

Edward L. Witte, White Mills, Pa.—In order to overcome the defects of the present glass labels which usually are cemented on shelf bottles, this inventor proposes a label, of suitable enamel and colors, that is placed on the shelf bottle and burned into the glass of the same.

### IMPROVED BUTTER PACKAGE.

Samuel C. Williams, Peterstown, W. Va.—This consists in the arrangement, in a suitable box, of a series of trays, having muslin pockets for roll or print butter.

## NEW MISCELLANEOUS INVENTIONS.

### IMPROVED STEP LADDER.

John Dillon, New York city.—This extension step ladder may be folded up into narrow space, extended to its full length without getting shaky or wabbling, and may be changed into two separate step ladders of different height, with great facility, whenever desired. The step and brace sections of the lower ladder are jointed, when detached, by a lateral hinge rod and top step, the step section being made of side pieces, with a lowermost full step and short upper steps dovetailed into the sides. The upper part of the side supports of the lower step section is strengthened by metallic encircling bands, through the holes of which the connecting rod of the upper ladder passes. The brace section is extended at the bottom to greater width than the step section and connected by a lateral screw rod to the brace rod of the upper ladder.

### IMPROVED REIN HOLDER.

Ephraim Mears, Attica, Ind.—A follower holds the reins drawn in from the top of the device, which is attached to the dashboard in tight manner, the pressure thereon being increased the greater the strain exerted on the reins. By pulling the reins back the follower clears the recess of the frame and admits the ready detaching of the reins.

### IMPROVED UMBRELLA SUPPORT.

Asa T. Martin, Jr., Waverly, Iowa, assignor to himself, Millard F. Potter, and James Brotherton, of same place.—This consists in a plate having sockets formed in it in such a manner that they are capable of holding the umbrella staff either perpendicularly or at any desired angle. This plate is secured to the bottom of the carriage in such a position that its central socket is directly under a screw clamp attached to a metallic supporting frame or to the edge of the seat.

### IMPROVED TELEGRAPH INSULATOR.

Robert A. Cunningham and David F. Crowell, Zanesville, O.—This consists in constructing the head of the insulator with a transverse groove which divides the head into two sections, the convex section of which is made higher than the other, so that the wire may be bent around the same, and kinked with a curve corresponding to the transverse groove.

### IMPROVED TOBACCO-CUTTING MACHINE.

Eben Goodwin, New York city.—This is an attachment for tobacco machines for applying a sweetening or flavoring liquid to tobacco while being cut. In the front or throat plate of the cutting machine is arranged a series of small tubes, that are connected with a reservoir for containing the liquid. The pipe connecting the tubes with the reservoir is provided with a valve for controlling the flow of liquid.

### IMPROVED BRUSH.

George R. Davies, Yarmouth, Nova Scotia, Canada.—This is designed for cleaning the sounding boards of square and grand pianos. It consists of a small spiral brush of sufficient length, that is placed between the wires and revolved in a supporting stand by suitable gearing.

### IMPROVED CRACKER MACHINE.

Eli P. Waste, New York city.—This consists in a die for molding and stamping crackers, the same being provided with double discharges, each of which, acting independently of the other, insures a free discharge of a well formed cracker.

### IMPROVED FLEXIBLE BLACKBOARD.

John R. Minehart, Brownsville, Penn., assignor to Harry W. Minehart, of same place.—This consists of a blackboard made of suitable fabric with a slate surface, and mounted on top and bottom rollers, being tightly stretched for use by elastic straps of the lower roller applied to nails.

### IMPROVED FARE BOX.

Joseph Adler and Heinrich Freimuth, New York city.—This is a fare box for street car conductors, by which the fare or tickets are collected from the passengers and placed directly into the box carried on a suitable belt. The new features relate mainly to a swing guard-plate and other devices which prevent money being shaken out of the box through the orifice by which it is inserted.

### IMPROVED SOLAR CAMERA.

Chancy R. Jenne, Okolona, Miss.—It is a new camera for taking and enlarging pictures from a photograph or any opaque object. It is intended to be used by portrait painters for making their drawings. The picture is fastened to one of the wings at 45° to a mirror, and is reflected in it, and is seen by the lens at right angles to it; it is reproduced in a darkened room on a screen or paper.

## NEW HOUSEHOLD INVENTIONS.

### IMPROVED BROOM.

Theodore B. Lewis and Thomas O. Lewis, Battle Creek, assignors to themselves and Charles Veeder, Hillsdale, Mich.—A piece of wood is bored centrally to fit the lower end of the handle, and is notched to receive the upper end of the brush. The upper edge and ends of this shoulder are rounded to give the required form to the hood of the broom, which is attached to the handle, in the ordinary way, immediately above the shoulder, and is brought down over the body of the brush, and stitched. The shoulder, previous to covering, is nailed to the handle.

### IMPROVED TABLE CUTLERY.

Richard N. Oakman, Jr., New York city, assignor to John Russell Cutlery Company, of Turner's Falls, Mass.—This is an improved carving fork, by which an extension of the common pivotal spring guard serves in a very simple and neat manner as a support or rest for the fork when the same is placed on the table.

### IMPROVED DRAWER FOR SEWING MACHINE TABLES.

John Mulchahey, Newburyport, Mass.—This is an improved swinging drawer applied to the under side of the table of a sewing-machine, for the purpose of storing sewing machine needles, spools, and other articles. It includes a needle tray, gauging devices, a spool receptacle, and a needle sharpener.

### IMPROVED MILK CAN.

Dennis S. Lewis, of Moline, Ill.—This consists in placing a milk can having two compartments—one for a quantity of milk and another for milk from a single cow for children's use—in a larger can having a double cover and a bottom strengthened by wood. Sufficient space is left between the inner and outer can for a body of ice or cold water, and faucets are connected with the compartments in the inner can, that project through the outer can.

### IMPROVED BLIND ADJUSTER.

Robert J. Stuart, Yonkers, N. Y.—This is an improved device for adjusting and locking blinds from the inside of the room into any suitable position. A double elbow lever is pivoted to the window sill, adjusted by a spring button having an eccentric pin to an arc-shaped rack, and connected by an outer pin with guide strips of the blind.

### IMPROVED SPRING BED BOTTOM.

Caleb E. Brown, Jackson, Mich.—In this spring bed bottom the slats are prevented tipping over, and a bottom of uniform strength and elasticity is obtained. The slats and spiral springs are connected by a U-shaped toe piece, and attached to slats by bottom hooks, so as to alternately unite two adjoining slats.

### IMPROVED HEATING STOVE.

Ignatius Droege and Charles Bogenschutz, Covington, Ky.—In combination with the heater chamber, there is a diving and bottom flue extending nearly to the front end of stove, enclosing side and return flues, a rear rising and enclosing flue, and suitable openings for securing direct draught, or causing the products of combustion to pass through the flues as desired.

### IMPROVED MEAL BIN.

William H. Mangold and Harry Summerville, Anna, Ill.—This consists of a number of flour and meal bins arranged at the upper part of the pantry, with spice drawers below the same, closed by a hinged kneading board. The dough rollers, &c., are stored in a space below the cornice, while the shelves in the cupboard at the lower or base part are employed to store bread pans, pie plates, and other articles.

## NEW MECHANICAL AND ENGINEERING INVENTIONS.

### IMPROVED POST AUGER.

Charles W. Pool, Wiscoy, N. Y., assignor to himself and James W. Van Buskirk, of same place.—This consists in the combination of a pair of blades with adjustable supporting arms, which are secured in a socket formed in the lower end of a shank, provided with a suitable handle. The arms are capable of being moved to vary the size of the hole to be bored.

### IMPROVED LEAK STOPPER FOR BOILER TUBES.

John McConnell, Glasgow, Scotland.—This consists in the combination of a packing device with a short section of tube in such a manner that, when the tube is placed in the boiler flue, packing rings may be compressed between the exterior of the short section of the tube and the interior of the boiler tube in such a way as to stop the leak and not impair the utility of the tubes.

### IMPROVED COAL CHUTE.

Theron Kelsey, South Brooklyn, N. Y., assignor to himself and James E. Kelsey, of same place.—This is an improved apparatus for dropping coal and other material from a height to a floor or pile below, so constructed as to prevent the coal or other material from being broken by collision, and thus avoids the formation of fine coal or dust.

The outflow of the coal may be checked at any time, and may be readily controlled to keep the chute filled to the proper point. The construction also guards against all the coal running out of the chute should a slide occur in the pile below.

### IMPROVED MACHINE FOR STICKING NAILS IN HEEL BLANKS.

William E. Forster, Nashua, N. H., assignor to himself and Albert H. Saunders, of same place.—This is an improved machine for sticking nails into the former or heel in rapid manner, so as to dispense with the slow sticking in of the nails by hand. The invention consists, mainly, of a reciprocating shaker for arranging and dropping the nails, a funnel shaped partitioned conductor or guide casing for conveying the nails, an inclined and notched grate with vibrating rapper and clearers for tipping up and sliding the nails in forward direction, and of converging conducting tubes for dropping the nails into the former or heel. This machine is exceptionally ingenious in construction. It simultaneously sticks the required number of nails into any size of heel. To large shoe manufacturers it will doubtless prove very valuable.

### IMPROVED ROAD SCRAPER.

Edward Huber, Marion, Ohio.—The invention relates to certain improvements in earth or road scrapers, designed to simplify, cheapen, and improve the construction of the same. It consists, first, in the manner of attaching the handles by extending the plate metal sides of the scraper in the form of an acute angle, and wrapping the end of said extended side around the handle, which, in connection with a bolt passing through the forward end of the handle and the side of the scraper, firmly secures the same to the scraper. It also consists in the peculiar means for the attachment of the bail to the scraper.

### IMPROVED BLOW-OFF DEVICE FOR STEAM BOILERS.

Mathew Rhoda, Allentown, Pa—For the purpose of obviating the formation of scale, and for keeping the crown and bottom sheets perfectly clean and efficient for work, a number of radial exit tubes are arranged near the crown and bottom sheets; they are connected by a tube, that extends around the outside of the boiler, and is provided with a blow-off cock which, on opening, admits the ready cleaning of the sheets of any sediments by the powerful agitation of the water caused by the steam.

### IMPROVED HORIZONTAL SCREW PROPELLER.

William S. Myers, Southington, Conn.—The wheel or screw is concealed or incased in the bottom of the boat or vessel, and the water conducted to and away from it by a channel formed in the bottom of the boat or vessel. The agitation of the water by the screw, being confined into the casing and flumes, will not, it is claimed, produce any washing of banks when used in canals, the device being also adapted to vessels of war, which require protection for the screw, and to vessels plying in shallow rivers and waters.

### IMPROVED BOOT AND SHOE SOLE.

Elisha Hanshew, Brooklyn, N. Y.—This consists of a leather sole made with a beveled recess, extending along the greater part of the ball of the foot, and being filled by a tapering and flanged section or sole of soft rubber. A layer of horsehair, or other absorbent, is placed on the rubber section, and retained by the insole that is skived off at the inner part.

### IMPROVED CAR COUPLING.

Samuel W. Kilbourne, Bethel, Me.—This consists of a draw bar with open top, tapering mouth, and recess back of the bottom shoulder, on which the swinging coupling hook locks when passing back of the same. A hinged table swings in the recess, and is connected to the coupling hook of the draw head to raise the head of the opposite hook simultaneously therewith for uncoupling.

### IMPROVED CAR COUPLING.

Martin C. Mohr and Newton F. Lawrence, Manchester, Iowa.—This is an improved automatic car coupling that locks with the common link-and-pin coupling in perfectly safe and reliable manner, and without danger. A swinging block is retained by a side recess and a swinging latch-shaped handle pin of the draw head in raised uncoupled position. Top and bottom shoulders of the drawhead, in connection with an extension of the block, secure the extent of swinging motion in the block. The link couples automatically by entering the mouth of the draw head, raising the block, and passing into the middle recess of the locking block, it being uncoupled by swinging the block in upward direction so that the link is allowed to pass out.

### IMPROVED MECHANICAL MOVEMENT.

Adolf Hünerwadel, Washington, D. C.—The invention consists in combining a peculiarly constructed crown wheel and worm, with a view to attainment of certain advantages, particularly in respect to friction. For full description, see patent. The device is specially adapted to driving bobbin spindles.

### IMPROVED TURBINE WATER WHEEL.

Stephen M. Smith, York, Pa.—The invention relates to certain improvements in turbine water wheels, designed to increase the percentage of power and render the wheel more effective. The improvement consists in inclining the plane of the buckets in the direction of the movement of the wheel, and curving them reversely to the usual direction, so that the water strikes the convex portion of the bucket. This form of bucket throws the water well out to the periphery, where it exerts the best leverage upon the wheel, while the curve and vertical inclination of the buckets, being in the direction of the movement of the wheel, the buckets simply present a sharp edge in entering the streams of water, and do not involve the back lash and loss of power produced by the resisting surfaces which the back of the buckets curved in the usual form affords.

### IMPROVED GOLD SEPARATOR.

Thomas W. Irvin, Eureka, Cal.—This is an improved machine for separating gold from the gravel and earth as the same is tunnelled or worked off for removal from the bank. An exhaust fan is connected with a separating tube that is provided with gratings of different width, and with quicksilver at the lowest grating to separate the finer and coarser particles of gold, while the heavy gravel is discharged through the hopper, and the lighter dust through the exit tube of the fan.

### Artificial Butter.

*To the Editor of the Scientific American:*

Owing to the receipt of much correspondence concerning my article on artificial butter, which appeared in the SCIENTIFIC AMERICAN SUPPLEMENT, N. Y., Nos. 48 and 49, I wish to state that I own no patent on the process. The only patent held is Mège's, which is owned by the United States Dairy Company, 6 New Church street. All letters, therefore, should be forwarded to that address. The process I described in my article is simply an elaboration of that patented by Mege, and cannot be used without infringing on the United States Dairy Company's patent. HENRY A. MOTT, JR., E. M., PH. D.

New York City.

## Business and Personal.

*The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.*



## Notes & Queries

It has been our custom for thirty years past to devote a considerable space to the answering of questions by correspondents; so useful have these labors proved that the SCIENTIFIC AMERICAN office has become the factotum, or headquarters, to which everybody sends, who wants special information upon any particular subject. So large is the number of our correspondents, so wide the range of their inquiries, so desirous are we to meet their wants and supply correct information, that we are obliged to employ the constant assistance of a considerable staff of experienced writers, who have the requisite knowledge or access to the latest and best sources of information. For example, questions relating to steam engines, boilers, boats, locomotives, railways, etc., are considered and answered by a professional engineer of distinguished ability and extensive practical experience. Inquiries relating to electricity are answered by one of the most able and prominent practical electricians in this country. Astronomical queries by a practical astronomer. Chemical enquiries by one of our most eminent and experienced professors of chemistry; and so on through all the various departments. In this way we are enabled to answer the thousands of questions and furnish the large mass of information which these correspondence columns present. The large number of questions sent—they pour in upon us from all parts of the world—renders it impossible for us to publish all. The editor selects from the mass those that he thinks most likely to be of general interest to the readers of the SCIENTIFIC AMERICAN. These, with the replies, are printed; the remainder go into the waste basket. Many of the rejected questions are of a primitive or personal nature, which should be answered by mail; in fact, hundreds of correspondents desire a special reply by post, but very few of them are thoughtful enough to inclose so much as a postage stamp. We could in many cases send a brief reply by mail if the writer were to inclose a small fee, a dollar or more, according to the nature or importance of the case. When we cannot furnish the information, the money is promptly returned to the sender.

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J. A. O. will find an answer to his query as to the relative motion of parts of a wagon wheel on p. 298, vol. 31.—R. W. C. will find a good recipe for baking powder on p. 123, vol. 31. This also answers E. A. H.—W. P. will find a recipe for a depilatory on p. 362, vol. 32.—J. F. will find a description of flexible shafting on p. 217, vol. 35.—F. L. J. will find directions for fireproofing shingles on p. 280, vol. 28.—J. M. will find directions for gilding on China on p. 43, vol. 29.—J. P. will find, on p. 315, vol. 35, a recipe for a white alloy that will do well for fine castings.—C. N. L. will find directions for putting a fine finish on shirt bosoms on p. 203, vol. 31.—W. M. J. will find directions for making his cellar walls watertight on p. 246, vol. 35.—J. P. K. will find directions for putting a fine polish on edge tools on pp. 488, 549, vol. 2, SCIENTIFIC AMERICAN SUPPLEMENT. For a black finish for light-colored woods, see p. 299, vol. 30.—J. M. will find an answer to his query as to the compressibility of water on p. 27, vol. 36.—L. H. R.'s discovery as to evolving electric sparks from rubber is very old.—J. H. K. will find directions for making superphosphate of lime from bones, and the quantity of sulphuric acid necessary therefor, on p. 323, vol. 27.—H. P. will find directions for building an icehouse on p. 255, vol. 31.—G. H. will find a recipe for acid-proof paint on p, 278, vol. 35.—F. D. B. will find directions for lighting gas by electricity on p. 161, vol. 27.—G. W. P. will find directions for making transparent paper on p. 241, vol. 28.—P. F. M. and many others who ask for directions for enameling cooking vessels, are referred to p. 21, vol. 36.—T. H. S. will find directions for making a cheap continuous battery on p. 43, vol. 35,—J. C. D. can dissolve shellac by following the directions on p. 327, vol. 35.—T. P. H. will find directions for hardening rubber on p. 203, vol. 35.—J. L. B. will find a recipe for a hair dye on p. 138, vol. 27. For waterproofing canvas, etc., see p. 282, vol. 32. Paraffin is described on p. 95, vol. 30. To keep cider sweet, see 11, vol. 31. Birdlime is described on p. 347, vol. 28.—O. S. will find directions for proportioning cone pulleys on pp. 26, 73, vol. 25.—P. C. M. will find directions for a dry photographic process on p. 215, vol. 30.—S. M. K. will find an answer to his query as to bodies sinking in deep water on p. 208, vol. 33.—L. M. Y. will find a recipe for a hair wash on p. 138, vol. 33.—J. T. C., C. T., F. C., J. S., J. C. W., E. T. H., F. M., R. J. F., C. J. W., J. G., and others who ask us to recommend books on industrial and scientific subjects,should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) J. F. S. says: In the works with which I am connected, we are running one of the most improved style of cut-off condensing engines. In case we should need more power, which would be the most economical, and which of the two following plans would give the most power: placing another engine alongside the present one to work with it as a pair, or placing another cylinder of about double the size, connected to work with the present one on the compound principle? A. Place another engine alongside of the present one.

(2) R. C. H. says: I have been building a small engine, and find myself fast on one point. How and by what means shall I find the right distance to place my driving box from the cylinder? A. Push the piston crosshead forward until the piston strikes the cover, and mark a line on one guide and guide bar: then push the crosshead back to the amount of the clearance between the piston and cylinder head. Then, the piston being at the end of its stroke nearest to the crank, the length of the connecting rod, less the length of the crank, is the distance of the main journal box from the crosshead journal.

(3) A. M. H. asks: Is it safe to have cast iron packing rings to work in a cast iron cylinder to pump hot water into a boiler? A. Yes.

(4) F. L. A. asks: How are threads formed on lamp burners and collars? A. They are cut.

(5) O. A. L. asks: Will grinding bits, cutters, knives, etc., on an emery wheel draw the temper, if they are not heated in the operation? A. No.

(6) H. J. W. asks: 1. Can I obtain a fine casting from an alloy of 16 parts copper and 1 part tin? A. Try the following: Copper 8 parts, zinc 1 part, tin 2 parts, antimony 1 part. Fuse the copper first, then add the zinc, tin and antimony in the order given. It will be necessary to add a little excess of the tin, as some of it will be lost in the smelting. 2. Can porcelain be used in a mold for a fine casting? Plaster of Paris will not stand a great heat. A. Porcelain or earthenware molds will not answer.

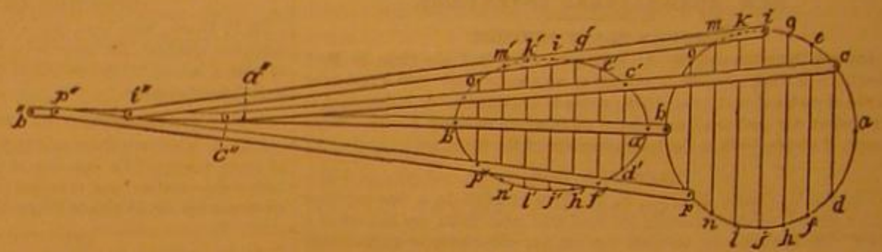
(7) A. S. asks: 1. How much wire and what sizes will I use to make a good coil for a sounder? A. Two hundred feet of No. 23 silk-covered copper wire will make a good coil. The wire can be purchased from any dealer in telegraph apparatus. 2. Will one coil do for telegraphing purposes and for giving electric shocks? A. Yes. 3. Is there any work published on the construction of coils and electric apparatus in general? A. Du Marcel's work on telegraphy is one of the best, but we believe that there is no English translation.

(8) J. F. asks: Supposing the portative force of an electro-magnet to be known, what formula will express its attractive force when its keeper is removed from a distance $x=0$ to $x=$ some finite quality? Is the formula similar to that expressing the attraction of gravity between two bodies $\frac{x\,(a+b)^2}{(a+b+x)^2}$, where $x=$ the attraction, when $x$, the distance between the bodies, is 0, and $a$ and $b$ are the distances from the center of gravity of the bodies to their attracting surfaces, respectively? A. Mr. Hunt, in a paper read before the Institution of Civil Engineers, England, gives the following figures for the great electro-magnet of the Polytechnic:

| | | | | |
|---|---|---|---|---|
| Lbs. supported, armature in contact | | | | 200. |
| " " " | $\frac{1}{16}$ inch from cover. | | | 90. |
| " " " | $\frac{1}{16}$ | " " " | | 50. |
| " " " | $\frac{1}{8}$ | " " " | | 47. |
| " " " | $\frac{1}{4}$ | " " " | | 40. |
| " " " | $\frac{1}{2}$ | " " " | | 36. |

(9) J. V. R. says: 1. I have made an induction coil (yielding a spark somewhat more than 6 inches in length), the core of which is composed of No. 14 soft iron wires. Can I add to the length of spark by making the core of smaller sized wires? A. Probably not enough to pay for the construction of a new core. 2. Is there any rule or law indicating the proper size of wire for the core? A. Nos. 18 to 22 are generally used. 3. What kind of wire is the best for the above purpose? A. The purest and softest obtainable.

(10) W. H. P. says, in reply to M. M. C., who asks if a point on a connecting rod, between the centers of the crank pin and crosshead journal describes a perfect ellipse, or is the figure which it describes slightly larger at one end than the other: An instrument constructed upon that principle is a most perfect ellipsograph. This is clearly shown by the following diagram: Let the double dotted lines from $b$ to $b''$ represent a connecting rod 8 feet in length, from center of crank pin at $b$ to center of crosshead journal at $b''$, and let the marking point or a pencil be just half way between at $b'$.




Then, of course, by a half revolution of the crank, the crank pin will be at $a$ and the crosshead at $a''$ (2 feet stroke. But, while the longitudinal movement of all parts of the rod is the same, the vertical movement of the crosshead is zero, and that of the crank pin is 2 feet; and the pencil being half way between them is just one foot, or the vertical movement of the pencil is at all times just one half that of the crank pin. Obviously, then, we should detach the crank pin from the crank, and, with the crank pin, describe the line, $c$, $d$, the pencil would at the same time describe the line. $c'$ $d'$, just one half of the length $c$ $d$, and so of all the lines $e$ $f$, $g$ $h$, etc. Then the lines, $c$ $d$ and $o$ $p$ being of equal length, it follows that $c'$ $d'$ and $o'$ $p'$ (being just half as long) will be equal to each other, and the figure will not be wider at one end, but a perfect ellipse. When the crank pin is at the points $a$, $c$, $i$, $b$, $p$, the crosshead journal center will be at $a''$, $c''$, $i''$, $b''$, $p''$, and the pencil at $a'$, $c'$, $i'$, $b'$, $p'$, and as the crank pin passes the successive points, $a$, $c$, $e$, $g$, $i$, etc., through an entire revolution, the crosshead traversing a straight line equal to the diameter of the circle, the pencil passes through the points, $a'$, $c'$, $e'$, $g'$, $i'$, etc., describing a perfect ellipse. The same will obviously be the case if the pencil be placed at any other point in the rod, the major axis of the ellipse being always equal to the length of stroke, and the minor axis in the same proportion thereto, as is the distance between the crosshead and the pencil to the length of the rod.

(11) A. C. G. asks: How many lbs. will an electro-magnet, 6 inches long, with a core ¾ inch in diameter and each pole being wrapped with 2 lbs. cotton-covered No. 20 wire, with a 4 cell Grove battery, lift? A. This is best determined experimentally. The same weight of No. 18 wire would doubtless give better results with 4 Grove cells.

(12) O. F. says: I have made a small induction coil: the primary coil is of No. 16, and the secondary coil of No. 35, copper wire, wound with silk (about ¼ lb. of the latter). The current breaker is a vibrating armature over a small electro-magnet. The adjusting screw over the armature has a hardened steel point. Will a platinum point give better satisfaction than the steel one? A. Yes. 2. Would the condenser described in your last volume, No. 22, be of any benefit? A. Hardly enough to pay for its construction for so small a coil.

(13) H. P. K. asks: 1. How can I make an electro-magnet? I made one by coiling the iron core wire covered with cotton, the cotton being coated with shellac varnish, but it would not work; then I left the shellac off, and still it would not go. Where is the difficulty? A. Cores about 1¼ inches long and ⅜ inch diameter, wound with 200 feet of covered copper wire, No. 22 or 23, will make a good magnet. Commence winding each core at the end that joins with the yoke piece, and wind in the same direction; when done, connect the inner ends together. 2. I want to make an electro-magnetic machine. How fine a wire will I have to use for the armatures, and how shall I insulate it?" A. We presume you mean a magneto-electric machine; for that purpose cores as above, ½ inch in diameter, answers very well. 3. How many turns of wire are necessary? A. The same amount of wire also will do, but stronger shocks are given if smaller wire is used. Ordinary silk covering is sufficient insulation.

(14) E. L. S. says: I wish to use horn, heating it in pressing; but I fear I shall render it brittle. Is there any process by which I can preserve its pliability? A. Boil well in water till it becomes flexible, and then press it.

(15) E. E. N. says: Why cannot I make nickel stick well to steel knives, when I have no trouble with brass or copper? I am sure the knives are clean. A. Cover the steel with a thin film of copper from an alkaline solution first, and you will have no trouble.

(16) R. S. B. asks: What is the refractive index of the glass for the objective described in "Notes and Queries" of February 19, 1876? A. Index of flint = 1·601, index of crown = 1·528. Dispersive proportion, 0·683. Specific gravity of flint = 3·432, of crown = 2·514. The above index is for the fixed line E in the solar spectrum.

(17) A. S. asks: What will dissolve asbestos, so that I may use it as a paint or coating? A. Asbestos is not soluble without decomposition in any menstruum. It is made into a paint by grinding with oil.

(18) A. C. H. K. asks: Can you tell me what substance is best adapted to the cutting or channelling of soft sand stone in quarrying? A. Use a plain blade of soft iron or copper. Diamonds are not necessary. Well crated corundum pebbles will answer very well in such stones: quartz will not give satisfactory results.

(19) H. E. W. says: We have just been building a church the tower of which is 112 feet from the ground to the highest point. We propose putting up a lightning rod consisting of 12 No. 14 copper wires; twist them in form of a rope making about ½ inch diameter. This rope is close to the spire and is firmly soldered to all the tin and iron work of the spire. The point is of solid copper with a sharp point terminating with a platinum point about ¼ of an inch long; the point from rod to platina tip is silver plated. This projects above the spire about 2 feet. The rope of copper extends into the earth a sufficient depth to reach permanent moisture; it is then attached to the ground plate (which consists of 3 strips of copper each 6 feet long and 1 inch wide and ¼ inch thick, riveted and soldered at one end and spread out like a turkey's foot) by solder. The rod is packed in charcoal and filled up. Is this sufficient? A. The rod is an excellent one, and the ground connection better than the average, but we should increase the earth plate still more. Painting the rod will not interfere with its conducting properties.

(20) J. S. H. says: I am trying to make a magneto-electric machine. I took a pasteboard tube 1 inch in diameter and 6 inches long, on which I wound about 100 feet of each of No. 20 and 23 cotton covered wire, in four layers. The wires are wound alongside of each other, 290 times around the tube. For a magnet, I used a piece of steel ½ an inch thick and 3 inches long, around which I wound an insulated wire 60 times, and connected the ends to the battery; it will lift two ounces. The vibrating armature will not work. A friend says that, if each layer is not leveled off before the next is wound on it, it will be no good; another says I must have five or six numbers of wire in the coil. Please give me some information. A. The instrument is too small to give much of a shock, and the core should be of soft iron instead of steel. One thousand feet of No. 28 or 30 wire will answer much better than Nos 20 or 23

(21) G. W. C. says: I wish to make a galvanic battery of 20 elements. If I move the last terminal wire backwards along the series,shall I get a current from only those elements between the two terminal wires, or from the whole number, as they are all connected? A. From the cell included between the terminal wires only.

(22) A. L. B. asks: 1. How can I electrotype? I have found several difficulties. My moulds, made of plaster of Paris, will not come off, but stuck to the type; if made of beeswax, they crack in cooling. A. Rub the object with a little sweet oil before taking the plaster casts. The latter, before being covered with black lead, should be baked gently to drive off moisture, and then thoroughly saturated with tallow, stearin, or paraffin. 2. I use 2 cells of Daniell's battery, covered my mould with black lead, and immersed it,and it was in about 10 days before it covered. Why was it so slow? A. The ordinary article to plumbago sold for household use cannot be relied upon; it is best bought of a dealer in scientific apparatus. The gas carbon used for battery plates, if very carefully ground in water, answers perfectly.

(23) F. R. says: I have seen a preparation applied to house lamp chimneys which acts as a reflector. It will not wash off in hot water, and resists heat. It very much resembles the preparation applied to mirrors. Please inform me how it is made? A. Use an ammoniacal solution of tartrate of silver, and deposit on glass with gentle heating.

(24) F. S. asks: How many Bunsen batteries (two gallon jars) do I need to run an electric light? A. From 30 to 40 Bunsen cells will give a fine light, but you will require an electric lamp if a steady light is wanted.

(25) J. V. R. asks: Is there any substance other then sulphate of indigo that can be added to an iron and nutgall ink without causing precipitation, something that will answer the purposes of the indigo as a coloring medium? A. There is nothing of the kind that we know of which will satisfactorily replace it. You can try soluble Prussian blue.

(26) J. S. N. asks: What is the cheapest and best mode of making a still for distilling essential oils from herbs? A. Any small retort of glass or stoneware, with a suitable condensing-worm of glass or tin, will answer the purpose.

(27) H. D. & CO. says: 1. We have used crude glycerine with great success as a scale solvent in our boilers. We use artesian well water, heavily charged with lime, soda, and magnesia. Can you tell us as to the chemical action of the glycerine? It softens the old scale, and in many cases seems to get under it and detach it from the iron. A. Its chemical action would be probably due to the power possessed by many organic substances of taking up oxide of iron and holding it in suspension, instead of allowing it to deposit on the boiler and compact the mineral salts precipitated out on boiling natural waters. 2. Would it be better to put a week's charge in on Monday, or feed it in daily? A. When in solution in water, glycerine will slowly evoporate and distil off. For this reason it would be better to put in small charges at shorter intervals. 3. At what temperature does glycerine evaporate? We carry about 75 lbs. pressure, and usually run from Monday morning to Saturday night without stopping, using the same boilers. A. Glycerine is slightly volatile at the boiling point of water. But if an attempt is made to distil it at this temperature, the greater part of it undergoes decomposition, intensely pungent vapors of acrolein, being disengaged, which excite a most painful irritation of the eyes. Glycerine was originally proposed by Asselin in the *Zeitschrift des Vereins Deutschen Ingenieure*, as a preventive of boiler incrustations. Asselin claimed that it increased the solubility of gypsum. That it formed a soluble compound with calcic sulphate, and that it formed precipitates of a gelatinous character which could be readily removed, which were not carried along with the steam, and which did not corrode the valves.

(28) F. Q. B. asks: I am using large quantities of glue, which, during the cold weather, troubles by freezing. In place of drying after I have applied it. Can you suggest something which would obviate this difficulty? A. Try mixing it with a little warm acetic acid.

(29) C. W. W. says: 1. I wish to know what size and style of boiler is best for an engine with a bore of cylinder of 2 ½ inches and stroke 4 inches? The diameter of fly wheel is 12 inches, and the wheel weighs 15 lbs. A. A boiler 2 feet in diameter and 3 feet high will probably answer. 2. I tried my engine with a 4-horse boiler, and it would run very well, but not fast; and the more steam I let in, the *slower* it would run. I would like to know why? A. From your account, we imagine that the valve is improperly proportioned, or set, so that the exhaust is choked, or there is some other derangement.

(30) R. H. F. says: I have made two or three small electric engines, and have just completed one to run a watch lathe, using 1-inch round iron for the magnets. I used 2 magnets and No. 16 cotton-covered copper wire, 4 ½ lbs. of the latter on the 2 magnets. The armature wheel is 7 inches in diameter. For a battery I used 2 stone 1 gallon jars, with a closely fitting copper hoop next the jar, and a zinc tube 4 inches across, and 6 inches long. I used sulphate of copper for the fluid. I first connected the wires on the magnets so as to be continuous, and the machine would barely run. I next cut the wire, and attached so as to split the current, and it did better. I tried it with the jars as an intensit, and then as a quantity battery, but it did not make much difference. I next cut the wires so as to make four branches, one to each leg of the magnets, and I joined the zincs together, and the copper also, and it went in fine order. Have I proportioned it rightly? A. We should think from your description that the engine does reasonably well for the amount of wire used. A single cell of large plates is better than two cells formed of the same amount of metal and joined in parallel circuit; and a large size bichromate potash battery will be found preferable to the sulphate of copper. 2. Would a battery as above described make the air of a close room impure? A. It is always best to avoid breathing the battery fumes; in this particular, however, the sulphate of copper is least objectionable of all batteries. Both sides of the plate are usually counted.

(31) M. R. C. S. asks: 1. How can I make a battery so as to furnish an electric light capable of lighting a room 100 feet long by 50 feet wide and 15 feet high, the walls of which are old uncolored wood? A. The best apparatus for that purpose is a magnet-electric machine, to be run by steam or water power, and it is best bought of a manufacturer. 2. Can the light be contained in a glass globe 1 foot in diameter? A. The lamps used for the electric light occupy, as a general thing, less than 1 cubic foot of space. 3. How can I prepare carbon plates? A. Plates cut from the densest of graphite obtained from gas retorts are the best; but on account of the difficulty in sawing, they are expensive.

(32) P. H. C. asks: Can you give me directions for making dye colors for painting on muslin? They leave the muslin flexible so that it may be folded, and they are applicable for theatrical scenery, panoramas, charts, etc. A. Use the analine colors directly upon the lightly sized canvas. These colors are soluble in water or mixtures of spirits of wine, or wood spirit and water. 2. Please give receipes for grease paints, used on the Italian and German stage? They are stick pomatum, somewhat hard, and of different colors, and give off their color very easily. A. We know of only one preparation of this kind. In this the colors are incorporated with oil and soap. It is not manufactured in this country.

(33) C. J. H. says: I want to paint flowers and letters on parchment with chloride of gold, to make them shine without burnishing. How can it be done? Have tried a solution of chloride, 1 part to 4 of water, and exposed it to hydrogen gas; but it has not shone "with all the splendor of burnished gold," as promised by this recipe. Have any of your readers tried this plan with success? A. Use a stronger solution of the gold, dry the drawing, place it back downwards upon a large hot brick, with a piece of copper foil between it and the brick. It is best to have the drawing in full, strong sunlight, and to have the hydrogen warm or hot. The gas should be pure and dry. This will reduce the gold perfectly, but the drawing is much improved by a little burnishing.

(34) O. B. M. says: I notice on the telegraph poles a new insulator. It seems to be an iron cylinder about six inches long, with two iron (?) pegs on the under side, to which the wire is fastened. Can you explain it? A. The insulator referred to consists of an outside iron cup, within which is placed a thin glass cylinder containing an iron hook for supporting the wire; the whole being consolidated by plaster and paraffin.

(35) J. F. M. asks: What is brewer's varnish and how is it made?—G. R. W. asks: 1. What is the greatest range yet attained by artillery? 2. The printed description of the 14 inch Krupp rifle at the Exposition stated its range to be 15 English miles. Was not this an exaggeration?—A. N. asks: Please give a good rule for finding the dominical letter for any year since the commencement of the Christian era?—W. H. G. asks: 1. Please inform me how to prepare and wire together a skeleton, taken just as it comes from the dissecting room? 2. Is there any wash used in preserving the bones?—H. D. asks: How long should a rifle be, to shoot accurately at 1,000 yards, and what should be the form and twist of the grooves?—T. J. L. says: I read as follows: "the seed of sunflowers is the most healthy feed that can be given to horses in winter and spring; half a pint a day keeps them in health and spirited, with sleek coats, and more animated than any other feed. It prevents heaves and some other diseases." Is there any truth in it?

(36) J. J. B. asks: 1. With two plano-convex lenses, ¾ inch in diameter and of ¾ inch focus, and one of ⅛ inch diameter and ¼ inch focus, can an eyepiece be made to show objects not inverted? A. Yes, but not as well as with four lenses. 2. How should the lenses be made? A. Place the two larger lenses 1½ inches apart, with their flat sides toward the object glass; then place the small lens 1 inch from these on the side toward the eye, with the flat side outward. The distance of this eyepiece from an object glass of 30 inches focus is 30¼ inches, and power 80.

(37) J. E. R. asks: How can I dry Carolina tar so as to mix it with oil, for paint? A. The only practicable method is to keep it at a temperature of 212° Fah. until all the water is all expelled. The tar is sometimes mixed with a small quantity of powdered caustic lime, which completely absorbs all traces of moisture. This is, however, in many cases, objectionable.

### COMMUNICATIONS RECEIVED.

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

On a Night Light. By L. L.
On Beet Sugar. By H. P. K.
On the Gardens of Civilization. By J. H.
On a Meteor. By M. W.
On Christmas. By S. W. E.
On Diatomaceous Earth. By C. L. P.

Also inquiries and answers from the following:
L. T.—X. A. X.—J. J. H.—W. F. H.—A. J. B.—F. S. H. E. B.—T. D. J.—W. S.

### HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who makes steel springs, of given power? Who sells the Jacquard portraits of Washington and other great men? Who makes the best envelope machines? Whose is the best boiler plate iron? Who sells preserved eggs, and is the preparation really made of eggs? Who manufactures acetic acid in large quantities? Whose are the best mathematical instruments? Who sells the best rifles, for target practice?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

Up to the hour of going to press, the list of patents issued during the week ending December 5, and bearing that date, had not arrived from Washington.

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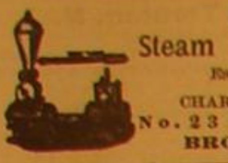

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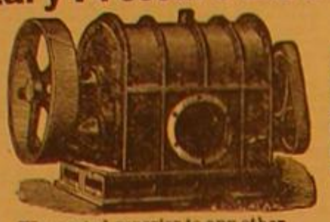
FORCED  BLAST!
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## WROUGHT IRON TUBULAR SAFETY BOILER.

The inventors of the improved steam generator herewith illustrated hold that the principle of having a boiler directly over the fire is wrong, inasmuch as the heated gases, ranging from 1,700° to 2,000° Fah. in temperature, when striking the cooler surfaces so near them, which are heated only to about 300°, become condensed, and, as a result, there is imperfect combustion, smoke, and a large expenditure of fuel. To obviate this difficulty the present boiler was constructed, so that a flame from 12 to 18 feet in length is obtained, wherein, it is claimed, almost all gases, etc., are consumed. Actual tests made upon a boiler in use at the Centennial Exhibition demonstrate the temperature of the escaping gases to be very nearly of the same degree as the steam, in lieu of from 600° to 1,200°, as is commonly the case. It thus appears that the heat of said gases is almost fully utilized for steam production, and that the steam was 40° to 50° hotter than that obtained from other generators tested. The log of the tests referred to exhibits in some instances a difference between the steam temperature and that noted by the pyrometer in the uptake, of less than 40°, and an inspection of its figures also indicates a high evaporative efficiency. The calculation, made by Professor Thurston of the Stevens Institute, from the log of the tests furnished him and made by the experts appointed by the Centennial judges, shows that, for each lb. of combustible consumed, 11·737 lbs. of water were evaporated at 212°.

The engravings given herewith represent a sectional view, Fig. 1, and a perspective view, Fig. 2, of the boiler. In the latter illustration, portions are broken away so as to exhibit the interior. At A are the two horizontal mud drums; at B two drums, each half filled with water and steam, the water line being in the center; and at C is a steam drum. The mud drums and the steam and water compartments are connected by a number of heating tubes, D, arranged obliquely. The grate is located between the two mud drums. The fire bridge wall, E, divides the interior of the brickwork into two compartments, while the inclined walls, F, Fig. 1, placed at a suitable distance from the heating tubes in the rear compartment, divide this into two side passages with an interior air chamber. Thus the gases of combustion are compelled to take a course from the fire box upwards over the bridge wall and downward in the two rear channels, whence they escape to the chimney by the duct, G. The mud drums vary from 12 to 28 inches, and the upper drums from 20 to 40 inches, in diameter, and in length from 4 to 18 feet, according to the capacity of the boiler. The heating tubes are from 2 to 5 inches in diameter, and from 3 to 16 feet long. They are arranged in two or three rows and are expanded in the mud and upper drums. The masonry consists of plain brick walls lined in the inner side with fire brick. All the drums are provided with large manholes, which admit of ready examination of the whole interior of the boiler and easy cleaning and the removal of sediment. By holding a light in each heating tube from the inside of the mud drums, and examining them from the upper drums, their condition can be at once ascertained; and by striking them lightly upon the outside, the deposits, if any, we are informed, may be quickly removed. There are no heating tubes placed horizontally or nearly so in the boiler, so that no resting place is afforded for soot and ashes, nor for sediments, to accumulate to cause the burning of tubes or destructive explosions.

To the rear and entirely outside of the boiler are two 4-inch circulating pipes, through which the water is constantly passing, causing a continuous circulation of water in the generator.

The water is forced into the mud drums, and the inventors claim that, as it is heated, the impurities fall to the bottom of the drums, whence they can be easily removed. It is further claimed that nearly every particle of carbon in the fuel is consumed, and that the flame is actually brighter at the top of the furnace than at the bottom. This is partly due to the introduction of heated air from the rear or air chamber into the fire box, through the downwardly inclined passages shown in the fire bridge wall, which furnishes a proper supply of oxygen of a temperature of about 800° or more. The ignition of all the unburnt carbon contained in the gases of combustion is thus produced. The supply of this heated air is regulated by a damper in the rear wall, controlling the ingress of cold air to the said rear chamber. Any description of fuel can be burned, including tan bark, sawdust, slack, etc. For the heating of dwellings and public houses, for power purposes on small vessels and in oil regions, the boilers are made portable, from 2 horse power upward. The general advantages claimed may be summed up as follows: Safety from destructive explosions, durability, no cleaning of flues, no deposit of soot or ashes, easy access to all parts, no leakage from unequal expansion, saving in first cost, entirely dry steam, and every facility for removing injured parts for repairs, etc. One of these boilers supplied steam for driving part of the machinery at the Centennial Exposition, and received a medal of award and a log by experts as already stated, showing it to be more economical and productive of dryer and hotter steam by 40° than other boilers tested. A generator of this type, rated at 160 horse power, has been in use, we are informed, for over three years night and day, under a pressure of from 90 to 100 lbs. of steam, without any external cleaning or repairs. The manufacturers have complete tables and calculations prepared by Professor Thurston from the log above alluded to, copies of which they will furnish upon application.

Patented July 5, 1875, November 16, 1875, and January 6, 1876. For further particulars or regarding agencies throughout the United States, address the manufacturers and patentees, Messrs. Joseph & George Firmenich, 13 to 23 Mortimer street, Buffalo, N. Y.

### Blue Lamp Chimneys.

Noted oculists, for instance Gräft, Arlt, and Stellwag-Carion, recommend either blue, bluish gray, or smoke-colored glasses as a protection for weak eyes against the unpleasant effect of red, orange, and yellow light. On the same principle, the trying reddish yellow light of candles, lamps, and gas, on normal eyes as well as weak ones, can be pleasantly modified by the use of blue chimneys or globes (or at least of shades for the reflection of the light) colored a light ultramarine blue. A remarkably near approach to a light as agreeable as daylight is said to be produced by a petroleum lamp with a round wick and a light blue chimney of twice the usual length, the latter causing so great a draught that the petroleum burns with a nearly pure white flame.

The distance apart of the rivets used to connect two pieces of metal plate together is regulated by the rule that the joint sectional area of the rivets shall be equal to the sectional area of plate left after punching the rivet holes.—*Rankine.*

Fig 1

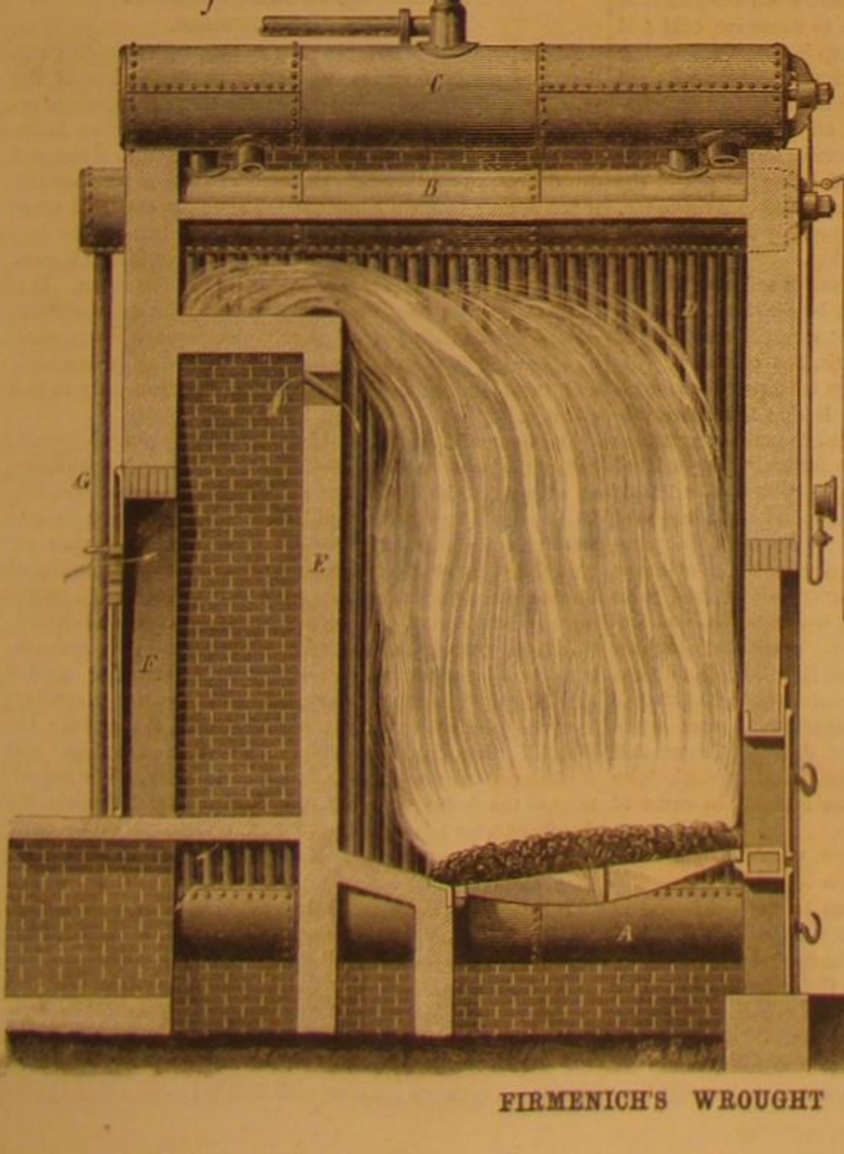
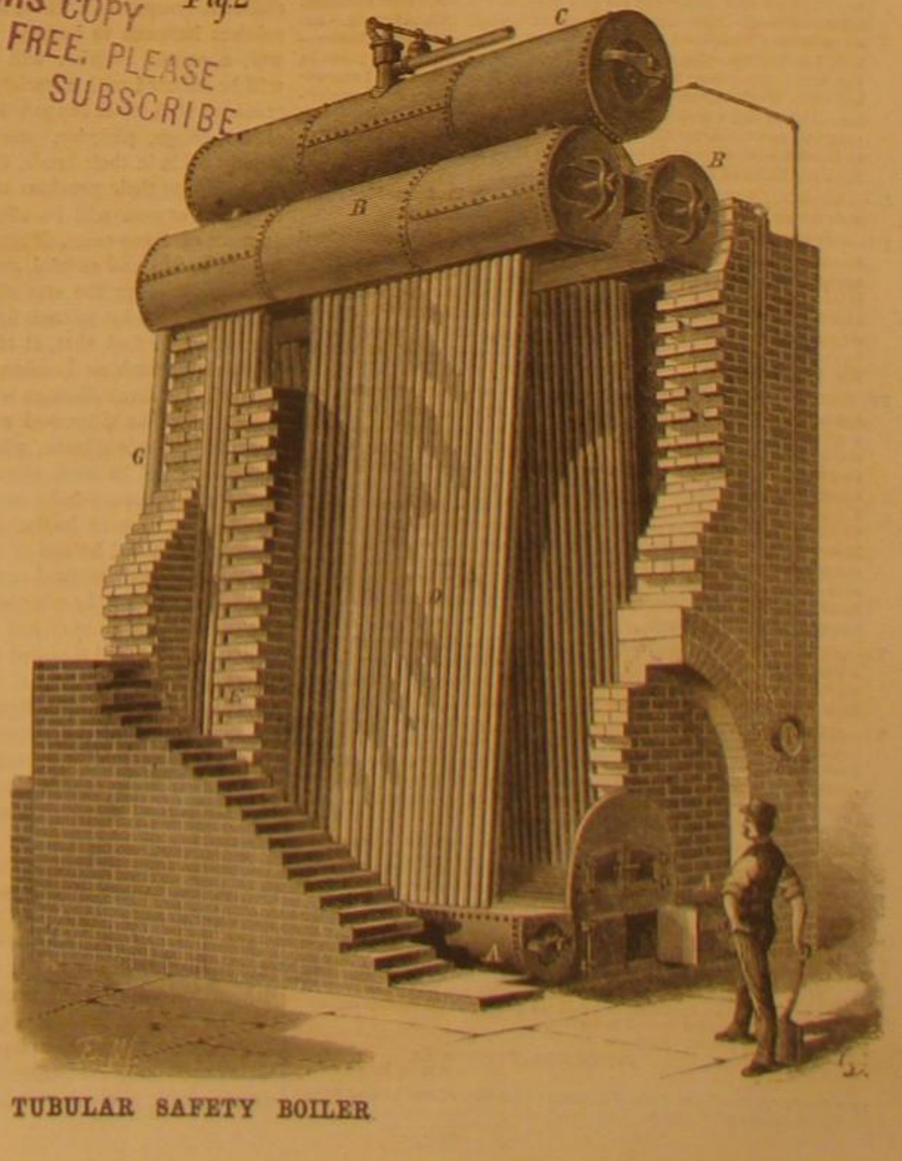





Fig 2

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**Contents.**

(Illustrated articles are marked with an asterisk.)



TABLE OF CONTENTS OF
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## THE MODERN TENDENCY OF THE MEDICAL ART.

In regard to the manner of conducting a thorough diagnosis of an impaired human constitution, Dr. Willard Parker, of this city used, in his lectures to the students of the College of Physicians and Surgeons, to make an appropriate comparison, likening the process to hunting up a thief known to be hidden somewhere in a large house. In place of running about, without system or plan, and looking carelessly about, the proper course is to submit each apartment of the house to a thorough and exhausting search, looking in all closets and recesses; and when sure that the thief is not in any particular room, the apartment should be closed, and the search commenced in another. So, in making a medical diagnosis, the first thing would be, for instance, to inquire into and examine the circulation of the blood, count the pulse, listen to the beating of the heart; then the respirations may be counted, the lungs sounded by percussion and auscultation, etc. All these may be normal, and then the digestion may be investigated; then the various organs of secretion, especially the liver; and if these are all found to be in working order, they may be considered as disposed of, and another section taken up, say, for instance, the nervous system: beginning with the brain, then the spine, the sympathetic nerves, etc. In proceeding in this or a similarly systematic manner, the skillful and acute physician is sure to find the disease, if it is not an imaginary one; even if the latter be the case, it is a disease of the mind, and has to be treated accordingly, sometimes merely with advice for the mind, sometimes with medicine for the body, each being adapted to the character of the patient.

This way of searching for a disease is eminently practical; but it must not be considered to be based on the old idea that a disease is like a thief or an enemy, trying to take possession of certain organs, and who must be driven out by drugs. In ancient times, many human ailments were actually attributed to personified evil beings, who could be driven out by incantations or ceremonies, and we find this belief still prevailing among certain races of savages; and we regret to say, even among certain classes of our civilized and enlightened peoples, there are some who believe in charms, and in magnetic and mesmeric manipulations. But, thanks to the light shed by recent thorough investigations in two important branches of biology, namely, physiology and pathology, more correct views now prevail among all educated physicians; and they now know that diseases are mere phenomena, proceeding from the constant and intimate relations of man with surrounding Nature; and in place of attempting to suppress such symptoms by the use of dangerous prescriptions, the properly qualified physician, knowing that every disease and symptom has a certain cause and must run a certain course, watches carefully, and, recognizing the all-powerful *vis medicatrix naturæ*, in place of interfering with Nature, he assists her efforts to save the sufferer. This is the true basis of modern enlightened medical treatment.

This rational way of considering a case shows also how absurd are the claims put forth on behalf of so-called specific remedies and the danger of treating with such nostrums the mere exterior symptoms, which may proceed from one of many different causes; and conversely, the same cause, acting on variously constituted individuals, will produce widely different symptoms. Thus, for instance, when a regiment of soldiers happens to become exposed to excessive cold and wet, a certain number will be laid up in hospital, but they will be afflicted with a variety of ailments. Those who are troubled with weak lungs will exhibit such diseases as bronchitis, cough, pleurisy, pneumonia, etc.; others will have merely colds in their heads, others rheumatism or even gout, according to their previous manner of living; in others the digestive organs will be affected, producing diarrhœa, etc. In most of these cases, drugs cannot possibly be of as much benefit as rest and careful, good nursing.

In considering the statistics of diseases and mortality in olden times, so far as such figures can be obtained, it is encouraging to find that, at the present day, the mortality of large cities, such as London and Paris, has enormously decreased, and many diseases which were once very fatal are no longer so. The decreased mortality is due to modern progress in hygienic science, which has led to sanitary measures being adopted in such cities, where formerly people lived under the constant influence of an atmosphere full of effete exhalations, due to imperfect drainage and the absence of cleanliness, a real hotbed of contagion. These sanitary improvements have resulted in the total disappearance of many diseases, such as the plague and scurvy, which used to be always present, more or less, in many communities, and frequently spread and traveled to others. Small pox, of which the ravages were such that at present it is difficult to form any idea of its former malignity and universality, has, thanks to Jenner's discovery, become comparatively rare; while other diseases, such as spotted fever, dysentery, fever and ague, etc., from which many persons formerly died, have lost their fatal virulence, and now are seldom the cause of death.

Medical science is now upon a new, unselfish, and noble career, and is aiding the introduction of sanitary measures by enlightening public authorities as to the best means of preserving the health of communities by anticipating and preventing disease; and it cannot be denied that society in general has been largely benefited by the progress of medical research, and by the labors of investigators in pathology and its kindred sciences, who have given the world the benefit of their continually increasing knowledge and insight into the nature of the ailments to which human nature is subject.

## IDEATION IN UTERO.

It is admitted by all physiologists that the mother exerts a general formative control over the fœtus *in utero*. Hitherto the belief has been that this influence is altogether structural, even where it is manifested, not merely in physical resemblance, but also in active tendencies, disposition, and modes of thought and action. But there are manifestations of maternal influence which this hypothesis does not easily cover: for example, those strange, yet well authenticated, cases in which children have described or recognized places which they have never seen before, but with which the mother is familiar. Still more unaccountable has been the common and perplexing feeling which poets and speculative thinkers have held to constitute subjective evidence of previous existence—the feeling that a particular occurrence or locality witnessed or visited for the first time has been seen before—or the sensation that some particular act in the drama of life is but the repetition of something witnessed or performed in some unremembered state or period in the past. In many cases these sensations are, no doubt, vague reminiscences of dreams or equally unreal creations of the waking imagination: still, after this allowance is made, there remain instances which cannot be so accounted for. For these the most satisfactory explanation yet offered is furnished by a suggestion made in the *Lancet*, the other day, by Dr. Mortimer Granville.

It is well known that, for several weeks before birth, the vital organs are all in more or less full operation; also that portions of the brain are so active as to produce concerted muscular contractions and automatic movements; and there is no reason to suppose that the intimately related cerebrum is not likewise, to some extent, capable of action previous to birth. At any rate Dr. Granville contends, and with a good show of evidence, that, during at least six weeks or two months of the ordinary period of human life *in utero*, the brain is susceptible of passive ideation, or the reception of impressed ideas derived from the mother's mind.

There is abundant evidence that a lively though fleeting impression made on the mind of the pregnant mother, or a prolonged dominant thought or emotion, can so modify the nutrition of the child's brain as to fix on it a permanent shadow, so to speak, of that impression or mental state. Thus a child will in after years exhibit tokens of special dislike or dread of a particular animal by which the mother has been frightened during the later months of pregnancy, or will have an otherwise unaccountable antipathy to a particular person or article of food, or will unconsciously mimic through life the mother's moods or prevailing states of mind or temper during that critical period. In like manner, it is suggested that scenes or occurrences, deeply engraved or repeatedly forced upon the mind of the mother, may become fixed as images in the fœtal brain, while it is yet incapable of thinking; and in later years, when they are vaguely recalled by something similar, an undefinable sense of repetition is felt. Memory, like education, thus has its beginning back of birth; and as the mother's structural and emotional characteristics are echoed in the child, so sometimes her special thoughts and ideas may be. The suggestion is a fertile one, and furnishes a clue to more than one of the mysteries of heredity.

## INEBRIETY AS A DISEASE.

Ethically, there is but one view to take of inebriety; and that necessarily involves unsparing condemnation of the practice, and earnest endeavors on the part of society to reclaim those addicted to it. But Science, on the other hand, draws a broad distinction between drunkenness as a vice and drunkenness as a disease. The man who drinks for pleasure, it holds, may look for benefit in the counsels of others or in his own strength of will; but he who drinks because he cannot help it, being led by an irresistible impulse, is a sick man, and needs not a temperance pledge but a physician. It is in this last aspect that we propose to consider the assertion, quoted from a daily journal, that "intemperance is a growing vice, bearing constantly heavier upon the rising generation," and incidentally the subject of inebriety generally in this country.

Dr. George M. Beard, of this city, not long since delivered, before the American Association for the Cure of Inebriates, an address on the "causes of the recent increase of inebriety in America," in which he embodies many of the conclusions which medical men have reached relative to the disease superinduced by alcohol. Inebriety he holds to be a functional disease of the nervous system, and should be treated on the same principle as other nervous diseases. It becomes classed, therefore, with dyspepsia and neuralgia; and like neurosis, it possesses periodicity, and—the fact is a startling one—is hereditary. When hereditary, it is all the harder to combat; in conformity with the laws of inheritance, it may take the place of other disorders, or may, in turn, lead to them; and it often conduces to various forms of insanity. The periodicity of the desire for liquor, the feeling which impels the drunkard who has abstained for a certain period to enter upon a "prolonged spree," is too well known to need more than mere reference.

It is a curious and somewhat paradoxical circumstance that, while drunkenness as a vice—public opinion to the contrary notwithstanding—is actually decreasing, the disease of inebriety is on the increase. "There never was a time," says Dr. Beard, "in the history of our race, when in proportion to the population there was so little intemperance and so little drinking among the higher classes as to-day." The nervous systems of Americans are now such that we cannot bear alcohol as our fathers could; and there is no doubt but that the efforts of reformers and the general progress of culture has exercised a potent effect toward temperance. Cases of drunkenness were rare among the thousands who visited the Centennial. But on the other hand that very heightened nervous sensitiveness, which prevents our indulging in alcohol for pleasure, equally heightens the susceptibility to nervous diseases; and of these, inebriety not being considered, it is well known the increase of late years has been marked.

It is not necessary here to repeat the facts, which every observer of American habits has noted over and over again, in order to prove that we live too rapidly. For the pursuit of wealth, we concentrate an enormous quantity and intense quality of work; we carry the seriousness of labor into our amusements; we crave the sensational and the fever of constant excitement; and under the terrible tax put upon it, the nervous force necessarily weakens. Thus, in accordance with all analogies, nervous diseases increase with the progress of modern civilization; and hence the greater prevalence of the nervous disease known as inebriety during the present time.

Dr. Beard further supports his views by inductive reason based upon extended examination. By comparing the higher and lower classes, he shows that, among the latter, such functional nervous diseases as sick headache, neuralgia, and hay fever are wanting: while the vice of drunkenness abounds in its most revolting aspects. Comparing the prevalence of functional nervous maladies now with the same half a century ago, he points out various diseases, such as hay fever, now common but then unknown. He also suggests various refinements in nervous troubles, which are peculiar to the present, but not to an earlier, period. Going back still further for purposes of comparison, he shows that "not only were many of the nervous maladies, so prevalent now quite unknown three centuries ago, but those which are common to those eras and ours are far less abundant than now." Lastly he points to the multiform nervous disorders now found among women.

There is no specific for inebriety. It is a constitutional ailment, to be treated constitutionally. It is not necessarily due to alcoholism. Chloral and opium inebriety are already becoming dangerously common; and there are hundreds of other stimulants and narcotics to which resort may be had. The only remedial course is to place the inebriate where alcohol or the provoking cause of his ailment cannot be had; for the sight of it, or the smell of it, will excite all the desire for it. To this treatment, sedatives, tonics, and nutritious food to build up the system may be added. To persons having any tendency to inebriety, the only safe course is absolute abstinence during early life. As regards the human race, the disease finds its remedy in itself; for degeneracy in any direction cannot go on indefinitely; and after any qualities, good or bad, attain a certain stage of growth, they cease to reproduce themselves. The excessively feeble and nervous stocks must perish, and the fight for existence be maintained between the less feeble and less nervous and the well balanced and strong; and thus, by a process of successive eliminations, a race may be developed that shall be every way adapted to the complex conditions of a high civilization.

## A NEW HUNTING GROUND.

With the rapid extinction of the large game of our Great West, and the scarcely less rapid disappearance of the once numerous herds of South Africa, there remains but one country with virgin attractions for the modern Nimrod. That is also the highest, and in many respects the least known, region on the globe—the lofty plains of Thibet.

The first scientific traveler to penetrate that country, so zealously guarded from European invasion by both man and Nature, is the Russian officer, Colonel Prejevalsky, who, in the triple capacity of explorer, zoologist, and sportsman, spent three years in the hitherto unexplored wastes of Mongolia and Northern Thibet, crossing the desert of Gobi twice and traveling in all upward of 7,000 miles. Of the additions thus made to our knowledge of the geography of those strange regions, it is not our purpose here to speak, nor especially of the rich collections of plants and animals which he brought home—a large portion of them new to Science—though 5,000 specimens of plants, including a hundred new species, 37 large and 90 small mammals, 1,000 birds, embracing 300 species, 80 specimens of fish and reptiles, and 3,500 insects furnish a record of scientific work well worthy of minute description. Our present purpose is rather to notice the claims of this new land to the attention of the adventurous huntsman in search of large game.

Chief among the wild beasts of Northern Thibet is the wild yak, which Colonel Prejevalsky describes as an animal of extraordinary beauty. When full grown, the male yak measures eleven feet in length, exclusive of his bushy tail, which is three feet long. He stands six feet high at the shoulder hump, and weighs from ten to sixteen hundred weight. His head is adorned with ponderous horns, from two to three feet long, and sixteen inches in circumference at the root. The body is covered with thick black hair, a deep black fringe hanging from the flanks almost to the ground. The females are smaller and less hairy, with shorter and lighter horns. The yak is enormously strong, but has a small brain and comparatively little intelligence. His sense of smell is very keen, but his sight and hearing are defective. The females, young bulls, and calves assemble in vast herds, like our American bison, to protect the young from wolves. The herds make long journeys for pasturage; and when in danger they form a phalanx with the calves in the center, some of the full grown males advancing to reconnoitre. The old bulls do not journey with the herds, but have their fixed abiding places, always selecting the coldest spots they can find for resting, and preferring to sleep on snow in the shadow of some cliff. At breeding time they fight savagely with each other, all the old bulls killed by Colonel Prejevalsky bearing numerous wounds received in these fierce combats.

Wild yak shooting is exciting and dangerous sport, as the bulls charge when wounded, and are very hard to kill. Fortunately for the hunter, their courage exceeds their decision in attack, giving the marksman ample opportunity to aim. On one occasion Colonel Prejevalsky, supported by a Russian companion and a Cossack servant, fired volley after volley at an old bull, who stood his ground until it was too dark for the hunters to continue the fight. The next morning he was found dead with thirteen balls in his body and three in his head. The flesh of the cows and young bulls is excellent eating; but that of the old bulls is "indescribably tough." The wild yak is peculiarly characteristic of the highlands of Thibet, where he must be seen to be appreciated. There, on the vast plains, 1,500 feet above the sea, swept by violent storms and seamed with rocky ridges, as wild and barren as the surrounding desert, these animals swarm in such numbers that it is a marvel how or where they find subsistence. They also wander to the confines of Siberia, and are said to haunt the mountain ranges of Kan-su.

Another characteristic animal of the highlands of Asia is the argali, or mountain sheep. Colonel Prejevalsky often asked himself which was the finer beast, this or the yak; and the best answer he could give was that each was perfect in its way. The mighty size of the yak, his ponderous horns, long fringe, bushy tail, and jet black color, make him a magnificent specimen of the brute creation. On the other hand, the gracefulness of the argali, his great curving horns, snowy breast, and proud bearing, entitle him to rank among the noblest creatures of the desert.

The white-breasted argali (*ovis Poli*) is found only in Northern Thibet. It frequents the more elevated plateaus, avoiding steep and rugged mountains, and may often be seen feeding with the wild asses and antelopes in the ravines. It is an exceedingly wary animal, though scarcely ever hunted, the matchlocks of the natives being altogether useless for this purpose. The more common mountain sheep of the highlands of Central Asia (*ovis argali*), ordinarily prefer the most rocky places, only descending to the valleys in early spring to graze on the young grass. Their senses are keen, but they lack the wariness of their Thibetan rival. The poorly armed Mongols and Chinese are unable to kill them from sheer lack of skill, so let them alone. They are easily stalked; and when one is killed the rest remain with it, regardless of the approach of the hunter. They will jump from considerable heights, always alighting on their feet. The stories about their throwing themselves down steep precipices, and alighting on their massive horns, Colonel Prejevalsky pronounces pure fiction.

A far more attractive game for the sport-loving naturalist is the wild camel which abounds in Northwestern Tsaidam, where the country is so barren and so destitute of water that the camels have to go seventy miles to drink. Reports of these rare creatures have reached the outer world time and again, but European naturalists have always doubted their truth; and though Colonel Prejevalsky was unable to penetrate their country, owing to want of money, the accounts he received of them were so direct and convincing that there remains little, if any, doubt that they are a distinct variety which has never been brought under the subjection of man. They are hunted in the desert of Tsaidam for their delicate flesh and fine wool, and are described as smaller and more slender than the domestic camel, with smaller humps and more pointed noses. They are long-sighted and keen scented, but are unable to see well at short range. That they are not the descendants of camels escaped from domestication seems altogether probable from the circumstance that the latter are unable to procreate without assistance; besides, the new-born domestic camel is the most helpless creature imaginable, and has to be lifted by hand and placed under the mother's teats.

In the same region (Western Tsaidam) troops of wild horses are occasionally seen, but are more numerous in the vicinity of Lob-nor. They generally go in large herds, are very shy, and when frightened continue their flight for days, and do not return to the same place for a year or two. They are never hunted by the Mongols and Chinese, owing to the difficulties of the chase. Their color is uniformly bay, with black tails and long manes hanging down to the ground.

Another interesting animal of this quarter is the kulan, or wild ass, which ranges over Northern Thibet and Tsaidam, but is most abundant on the steppes of Koko-nor. In size and external appearance, the kulan resembles the mule. They keep mostly in troops of ten to fifty, though larger herds, sometimes several hundred in number, are occasionally seen about Koko-nor. Each lot of mares is led by a stallion, whose following depends on his age, strength, and courage. Their sight and hearing are excellent, and they are very hard to kill on level ground. The best time to stalk them is while they are drinking. They are hunted for their flesh, which is considered a great delicacy.

The antelopes of Mongolia and Thibet are small, but numerous and attractive. Specially characteristic of the eastern part of the desert of Gobi is the swift-footed dzeren (*a. gutturosa*), which was seen also in Western Mongolia and around Lake Koko-nor. The dzeren are most frequently seen in small herds; but where the pasturage is good, they collect in droves of a thousand or more. Like the Mongols, they migrate in search of food, traveling great distances, especially in summer, when the drought drives them to the rich pasture lands of Northern Mongolia. They belong exclusively to the plains, avoid hilly country, and shun thickets and high grass, except in May, when the does seek the covert to conceal their young. They are about the size of goats; they have great intelligence and keen senses, and are marvellously swift. They are hard to hunt, being wary, and extremely tenacious of life. Even with a broken leg, they can run faster than a horse can gallop.

Another species (*a. subgutturosa*), called by the Mongols the kara-sulta or black tailed, inhabits Ordos and the desert of Gobi as far north as the 45th parallel of latitude, and as far south as Kan-su and the saline marshy plains of Tsaidam. Unlike the dzeren, it avoids rich pasturage, and selects for its habitation the wildest and most barren parts of the desert, or small oases in the midst of sand drifts. The explorer often marvelled to find them in places where no water could be found for sixty or seventy miles. They generally go in couples or in small detachments: in winter sometimes fifteen or twenty may be seen together. Their color is so like that of the sand and yellow clay that they can scarcely be distinguished, except when in motion or when standing on the summit of a hill. They are more shy than the dzeren, and harder to kill.

In the Thibetan highlands, two remarkably beautiful antelopes were found; one, called the orongo (*a. Hodgsoni*), being about as large as the dzeren; the other (*a. picticanda*) one of the smallest antelopes known, standing only 2 feet 4 inches high and weighing no more than 36 lbs. The orongo has a beautiful body, set on long slender legs, and elegant black horns standing vertically above the head. It loves the valleys and rolling plains, where water abounds; and where pasturage is abundant, they were seen in troops of several hundred. When trotting, the legs of these swift and graceful animals move so quickly that at a little distance they are invisible. In their flight, the males follow the herd, while with the dzeren and kara-sultas the males take the lead. They are quite fearless, and are easily approached, though, like all antelopes, they are hard to kill, and will run a long way after receiving a wound. The orongo is held sacred by the Mongols and Tanjutans, and the horns are much prized by pilgrims and conjurors. Colonel Prejevalsky mentions as a prevalent superstition the belief that sometimes the orongo is a veritable unicorn, with a single horn growing vertically from the center of the head. It is quite possible, however, that single horned orongos may not be infrequent, as these pretty creatures are very pugnacious, and may occasionally lose a horn in their fierce battles.

The smaller antelope is the swiftest and most graceful of the antelopes of High Asia. It frequents the elevated plains, but prefers mountain valleys where water is plentiful. It goes in small herds and is exceedingly wary. Its swiftness is amazing; it bounds along like a rubber ball, and when startled seems absolutely to fly. Both this and the orongo are swift runners over smooth ice.

Among the mountains of In-shan, Colonel Prejevalsky had some fine sport hunting a little mountain antelope which inhabits the wildest and most inaccessible crags of the alpine zones. Its favorite and almost exclusive grazing places are the alpine meadows and small grassy spots between the rocks. It is extremely timid and wary, and, when startled, seeks safety in rapid flight, scaling the crags with chamois-like skill and speed. Colonel Prejevalsky declares that one, which he had startled, suddenly sprang from a rock a hundred feet high and got away apparently unharmed. The thick fine coats of their winter skins are much prized for clothing.

## Second Bridge Between New York and Brooklyn.

The projectors of this proposed bridge over the East River, between New York and Brooklyn at 77th street, by way of Blackwell's Island, have, in response to the invitation sent out, received ten separate designs and estimates from as many engineers. Ground will be broken as soon as a plan shall be decided upon. The preliminary specifications call for an approach on the New York side of 4,580 feet, 1,000 feet of which is to be in form of a tunnel extending from Fourth to Lexington avenues. From the end of the tunnel, an iron superstructure, curving to the center of the blocks between 76th and 77th streets, and thence direct, leads to the river. From the pier on the brink of the river, Blackwell's Island will be reached by a single span of 734 feet. An iron structure 700 feet long will then lead over Blackwell's Island, and the channel between the island and the Long Island shore will be spanned by a single arch of 618 feet. The shore approach on the Long Island side will be 3,900 feet in length. This will give in all a total length of 10,532 feet, or nearly two miles. A single track tramway will run across the bridge. There will be, in addition to the main approaches, two auxiliary ones, one from Avenue A on the New York side and the other from Vernon avenue, Long Island city. The spans are to be 135 feet above mean tide water. Double passenger elevators are to be placed at the piers on each side.

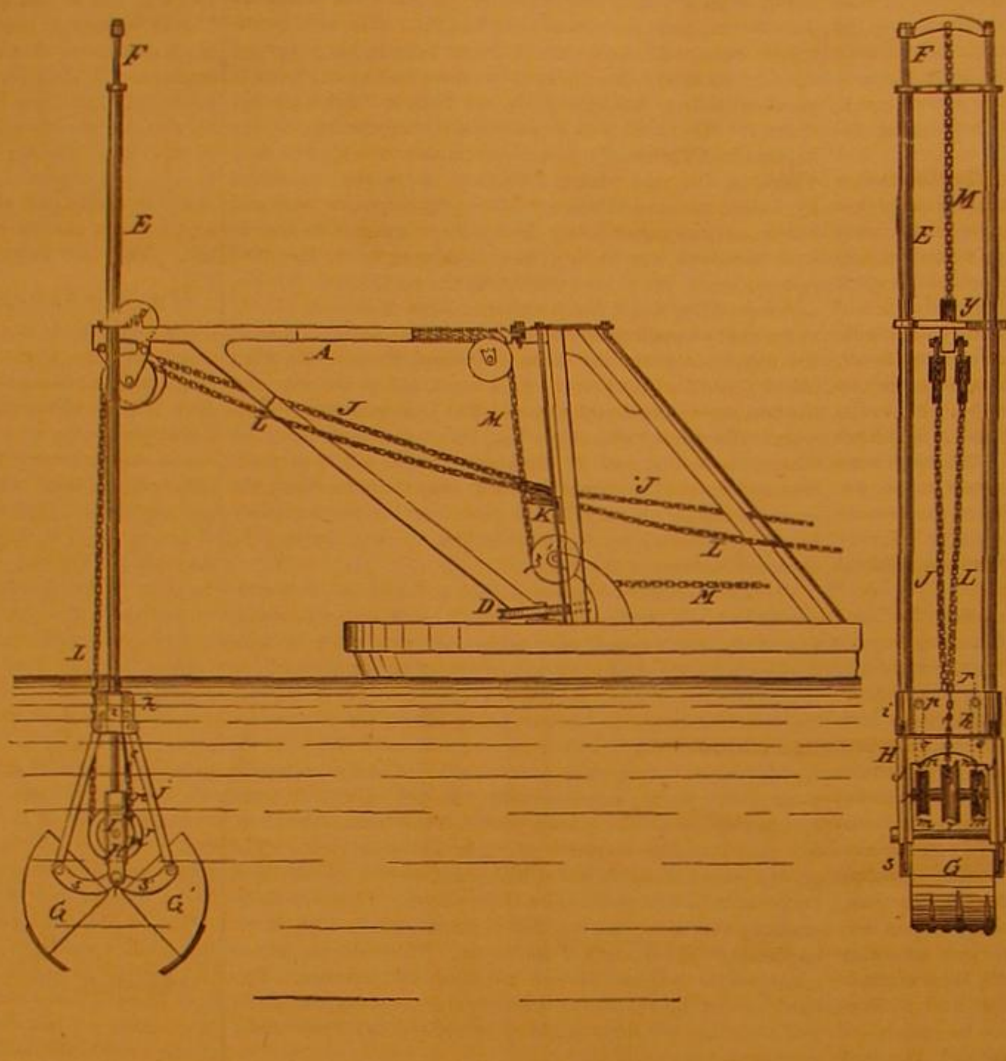
IN order that a wedge key or collar may be safe against slipping out of its seat, its angle of obliquity ought not to exceed the angle of repose of metal, upon metal which, to provide for the contingency of the surfaces being greasy, may be taken at about 4°.—*Rankine.*

## A NEW DREDGING MACHINE.

The object of the invention herewith illustrated is to obviate the difficulties experienced in operating dredges of ordinary construction, and provide a dredge whose buckets can be held down to their work with more or less force.

A is a crane rigidly made and swinging on an inclined axis. D is a friction wheel having a strap brake and lever. At E are tubular shafts held in suitable guides. These carry the dredge buckets. The operation of the apparatus is as follows: The chains J L H being connected with suitable drums driven in the ordinary manner, the crane is moved into the required position by pulling more upon one of the chains J L than upon the other. The strap is tightened on the wheel D by the lever. The buckets G G' are now opened by sustaining the weight mainly by the chain J, which permits them to hang by the bars *j*, while the weight of the bars F and frame H, resting on the pivot, throws the buckets open. The buckets are lowered by slackening the chains J and L, and when in contact with the surface to be excavated, if the weight of the buckets and superimposed parts is not sufficient to hold the buckets down to the work, an additional downward pressure is created by drawing the chain M. The chain L is now drawn, and, in unwinding from the sheave *r*, it winds the chain *n* upon the sheaves *m*, thus drawing up the frame H until the buckets are closed, when the chain M is slackened, and the load is raised by drawing equally on the chains J L. When the load is sufficiently high to dump, the strap on the drum D is loosened, and the crane moved in the required direction by pulling more upon one of the chains J L than upon the other. The chain L is slackened, while the chain J is held taut, which permits the frame H to drop and throw the buckets open.

The advantages claimed for the invention are, that by using a crane which is not capable of vertical motion, an amount of force may be put upon the buckets which is limited only by the strength of the parts and weight of the dredge. The crane can be effectively and quickly stopped and held in any desired position, and may as easily be released. It is peculiarly adapted to work in sand, and in other places where the earth offers resistance to the excavating buckets. Patented through the Scientific American Patent Agency, October 24, 1876, by Mr. C. O. Davis of Portland, Me.

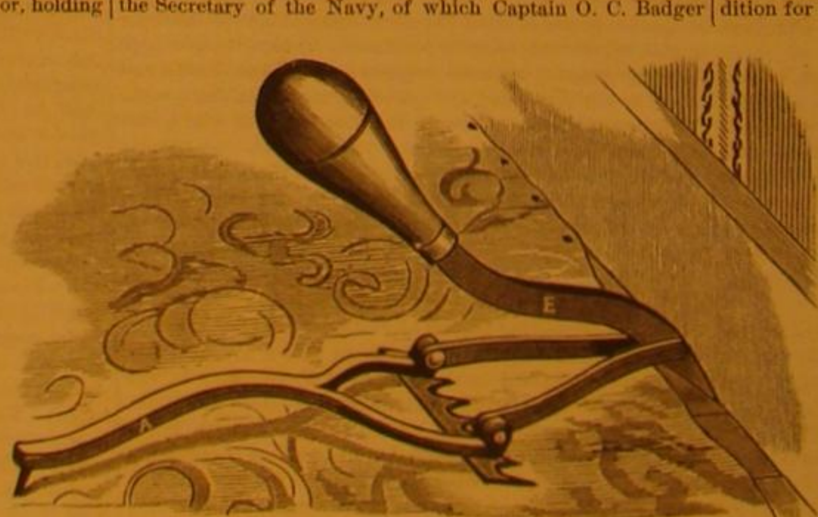


DAVIS' DREDGING MACHINE

## IMPROVED CARPET STRETCHER.

We illustrate herewith a new and ingenious device of especial utility to housekeepers, as it is calculated to save much of the tedious and arduous work of putting down carpets. It is light, simple in construction, durable, and inexpensive. It is easily operated, and is warranted by the patentee not to injure the finest carpet. It consists of a simple arrangement of a lever, by a gentle motion of which a broad spur seizes the carpet and draws it forward to its place, while a smaller spur at the rear sets through the carpet to the floor, holding the carpet fast, and thus giving the operator the free use of both hands to handle hammer and tacks. The lever, E, is then folded back and down upon the push bar, A, so that it will be entirely out of the way while the carpet is being fastened down. The device is manufactured of steel and malleable iron, thus assuring its durability.

Patented June 13, 1876. For further information relative to sale of the patent address to E. W. Bullard, P. O. box 16, Worcester, Mass.



BULLARD'S CARPET STRETCHER.

## Suspended Animation in Vegetables.

Captain Nares, of the late English Polar Expedition, reports the curious fact that wheat left in the arctic regions by Captain Hall in 1871 was planted in 1876, and it germinated and produced healthy plants under glass. Captain Young, of the Pandora, has also a rose tree, which has completely survived the intense polar cold. The plant to all appearances died on being subjected to the low temperature, and showed no sign of life until warm latitudes were regained, when it put forth leaves again, and became as flourishing as ever. It would seem as if, in both the above cases, the cold acted as a means of suspending animation in the vegetable, and that the latter resumed its functions at the point where they were arrested, on the cause of its insensibility being removed, without regard to its habits peculiar to the period of the year when the revival was effected. "American research has proved that the seeds of certain plants, if gathered in one climate and sown in another, will germinate earlier or later, and with more or less vigor, according as the new climate is warmer or colder than the old. And even a perceptible change of climate is not required to show these results; a difference of a few degrees only in latitude is sufficient to do so. For example, wheat from Scotland, sown in the south of England, will germinate and ripen much more quickly than wheat of exactly similar quality gathered in the south and planted in the same latitude in which it was grown.

"This fact is of the utmost importance to agriculturists. To secure early growing wheat, it is only necessary to take care that the seed is gathered in a colder climate than that in which it was sown. The process is perfectly practicable, as it might be so arranged that the wheat sown in the north should not be consumed, but preserved for seed for the next season in the south. The same thing is noticeable among other plants, and florists and horticulturists might take advantage of this circumstance to produce both earlier and stronger plants than they do now, without the appliances for forcing."

## Test of Fire Hose and Couplings.

We learn that an exhaustive test has been completed at the navy yard, Washington, D. C., by a board appointed by the Secretary of the Navy, of which Captain O. C. Badger was president, to establish a standard for hose and couplings. A great variety of hose was submitted, and subjected to one of the most elaborate tests that has ever been made, and the result was the approval and acceptance of hose, for ship use, made by the Eureka Fire Hose Company, of New York, and the "Work" patent coupling, made by the Allen Fire Department Supply Company, of Providence, R. I., as standards in the future, for naval purposes.

## The Human Hair.

*Hall's Journal of Health* has an excellent article on this generally interesting subject, in the course of which it condemns in its usual unequivocal way the numberless hair restoratives; and as a simple remedy for baldness it proposes the following wash: Pour three pints of hot water on four handfuls of the stems and leaves of the garden "box," boil it for fifteen minutes in a closed vessel, then pour it in an earthen jar, and let it stand ten hours; next strain the liquid and add three tablespoons of cologne water; wash the head with this every morning: it is cleansing and tonic, and if the root bulbs of the hair are not destroyed (which is the case where the scalp looks smooth and shiny, and then there is no remedy), the hair will begin to grow with vigor. If this wash fails after a few weeks' perseverance, the baldness may be considered incurable, because the structure of hair growth is destroyed.

But a more certain and more easily understood method of restoring the hair, when such a thing is possible, is to strive to secure a larger share of general health: keeping the scalp clean in the meanwhile, by the judicious application of a moderately stiff brush and a basin of plain old fashioned soapsuds: for, as a general rule, baldness arises from one of three things: inattention, which brought on a decline of health, dirt, or stupidity.

The girls of Brittany and the lower Pyrenees, says the *Journal*, repair to the annual hair fairs in droves, where each one waits her turn for shearing, with her rich long hair combed out and hanging down to the waist. The most valued head of hair brings five dollars and down to twenty cents, according to quantity and quality. The weight of a marketable head of hair when first taken from the head is from twelve to sixteen ounces, or from three-quarters of a pound to a pound, under twelve not being accepted, and over a pound, or sixteen ounces, especially if silken and long, bringing fabulous prices. Rare qualities have been sold at double the price of silver, weight for weight. Two hundred thousand pounds of hair are shorn from the heads of young girls every year, to supply the demands of the Paris and London markets, and from these we derive our supplies.

The hair growers seem to be rather a degraded set of people, living in mud huts, in filthy community, with garments so patched and worn as to scarcely hold together by their own weight. For once at least, fashion bows to profit, and the richest and most luxuriant head of black hair is accounted an incumbrance. Caps are worn by these people, so as to conceal the hair almost entirely; hence there is no need for combs and pins and plaits and ties, and as a consequence no hair is strained at its root, nor is it distorted by being pulled against the grain—against its natural direction.

The Manillans have the longest, blackest and most glossy hair in the world. They do not wear caps at all, but allow the hair to fall back behind in its own natural looseness. Taking these two facts together, it would seem that one condition for having a fine head of hair is that it should never be on a strain, and should hang pretty much in the direction of its growth, or if diverted at all, as from over the face, it should be in a gentle curve over and behind the ears, with a loose ribbon to keep it from spreading too much at the back of the neck, the hair hanging its length down the back.

The lessons learned from the study of fine natural growths of hair is that the hair of children should never be plaited, or braided, or twisted, or knotted. Nothing should ever be put on it except simple pure water, and even this not until the scalp is cleaned. The hair should be kept short, and should be always combed leisurely and for some considerable time, at least every morning, and neither brush or comb ought to be allowed to pass against the direction of the hair growth.

And if at times any falling off is observed, and it is desirable to arrest it sooner than mere cleanliness and improved health would do it, one of the most accessible washes is boiling water poured on tea leaves, which have already been used and allowed to stand twelve hours, then put in a bottle. It should be of moderate strength.

A WINE glass of spruce beer and three quarters of a wine glass of rum or whiskey, with brown sugar to taste, taken in a tumbler of hot water every alternate night, is said to be an excellent cure for lumbago.

## PROFESSOR MAREY'S INVESTIGATIONS ON THE ACTION OF THE HEART.

It is well known that the heart of an animal, after removal from the body, continues its pulsations for a time, longer or shorter in accordance as the animal was cold or warm blooded. In this manner, its muscular action, free from all mechanical effect, may be studied; and thus the cardiac muscle may be compared with others in the human economy. A simple way of experimenting is to place the heart of a frog or turtle in a small wax cup which contains it exactly, and to rest it on a tablet of metal. Above the heart, place a thin, light, wooden lever, articulated so as to have a free vertical motion, and terminating in a fine stylus which traces a line on a rotating cylinder. This apparatus is represented in Fig. 1, and is called the heart myograph. The lever, which is suitably connected with the ventricular portion, rises whenever the latter, contracting, swells as do the muscles of the arm when the forearm is vigorously bent. The point of the lever then describes an ascending line, more or less vertical according as the swelling of the muscle—that is, the systole of the ventricle—is more or less rapid. Then the lever descends as the systole ceases, when the cardiac muscle passes from the period of activity to that of repose. In this way, a curve is obtained whereby the movement of the heart muscle may be compared with that of any other muscle placed in identical or analogous conditions for exploration.

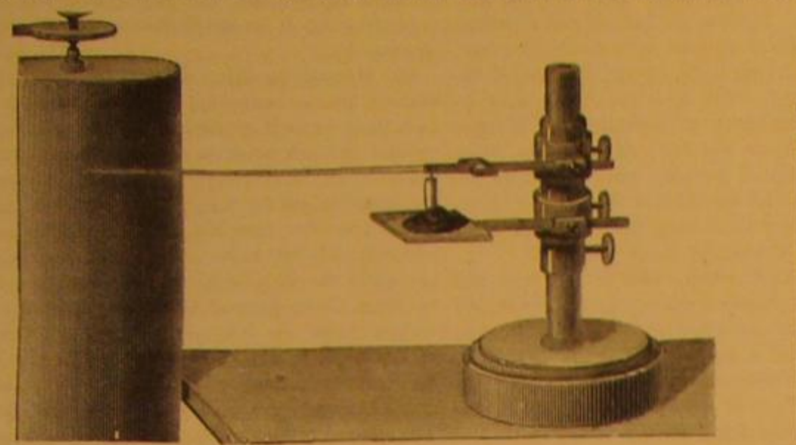


Fig. 1.—The Heart Myograph.

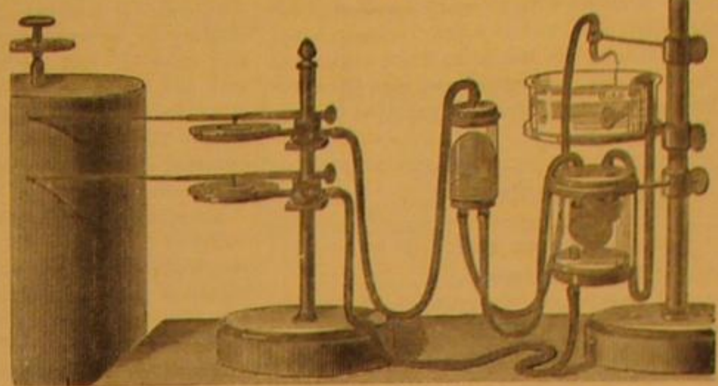


Fig. 2.—Apparatus for Studying the Changes in the Volume of the Heart, etc.

This comparison, when made, soon shows that each systole of the heart constitutes a simple act, which Professor Marey designates under the name of "shock" (*sécousse*).

The muscular shock is produced by the heart under the influence of a kind of simple discharge of the nervous apparatus which the heart contains in its sides, just as it is caused in any other muscle under the influence of excitation, similar in effect to the rupture of an electric current or the discharge of a Leyden jar. This simple action, which occurs at each beat of the heart, represents but one element of the more complex phenomenon observed in other muscles when they contract under, for example, the influence of the will. In this voluntary contraction, a series of shocks is produced which succeed each other so rapidly that practically a continuous action results. The same is observed when the nerve of a muscle is excited by rapidly interrupted currents; and it is evidently the more perfect as the interruptions of the exciting current are more frequent, or inversely. In the latter case dissociation takes place more easily, as the electric intermittences are the more separated. Now, by removing these excitations far enough apart, and conforming them, for example, to the rhythm of the heart: when a muscle is excited by electric currents, traces of independent shocks are obtained which are absolutely comparable, as Professor Marey has observed in the heart under the myograph. Consequently the systole of the heart is nothing more than a shock, an isolated element of the contraction, and not a true contraction. The complementary proofs of this theory are numerous. We cite one which is decisive: When the foot of a frog is removed and the nerve excited, the muscles contract. They furnish a simple shock when the excitation is single, and a series of shocks, more or less mingled (such as is termed tetanus) when the excitations are multiple. Now if, to the muscles in action, the nerve of a second foot, prepared in the same way, be applied, the remarkable phenomenon discovered by Matteuci, and by him called induced contraction, is observable. At each shock of the muscle excited, another shock is caused in the muscles of the other foot; at each tetanus of the first another is produced in the second; so that shock induces shock, and tetanus tetanus, and these truths may be considered to be laws.

It is now clear that, by substituting for the first foot a heart in action, the second foot will present either a shock or a tetanic contraction, according as the inducing heart gives either a shock or a tetanus.

Experiment shows that the induced foot gives a shock at each systole; and by virtue of the preceding law, it must follow that each systole is none other than a shock, and not a contraction. If we examine the effect produced by these systoles or shocks, we shall find that each of them drives from the heart and into the arteries the blood brought by the veins in the preceding diastole. It is important to discover whether work of the heart, that is to say, the quantity of blood thrown into the arterial system, increases proportionately to the number of systoles. For this investigation Professor Marey uses the heart of a turtle. He adapts one tube to the commencement of the arterial trunk, another to the opening of a vein, and shuts up all the other orifices, so that the organ is supplied with tubes leading to and away from it. Then he suspends the heart in a corked jar. The vein tube serves as a siphon to lead defibrinated beef blood into the heart, which thus maintains its motion, while the artery tube carries away the blood driven out. The arrangement of the apparatus is shown in Fig. 2. By dividing the volume of liquid carried through by the number of systoles which register themselves while the test tube is being filled, the average volume of each wave generated is obtained; and thus it is found that the quantity of blood pumped does not augment when the systoles increase in number. The same apparatus answers for determining the amount of mechanical work performed by the heart under various conditions. By connecting the interior of the jar in which the heart is placed with a suitable inscribing lever, Professor Marey is also enabled to take account of the changes in volume of the organ, which, as it swells or contracts, produces a compression or expansion of the air in its receptacle. By other apparatus, which need not here be described, the author obtains the curves of changes of arterial pressure with relation to the changes of the state of the heart. These changes of pressure constitute the pulse.

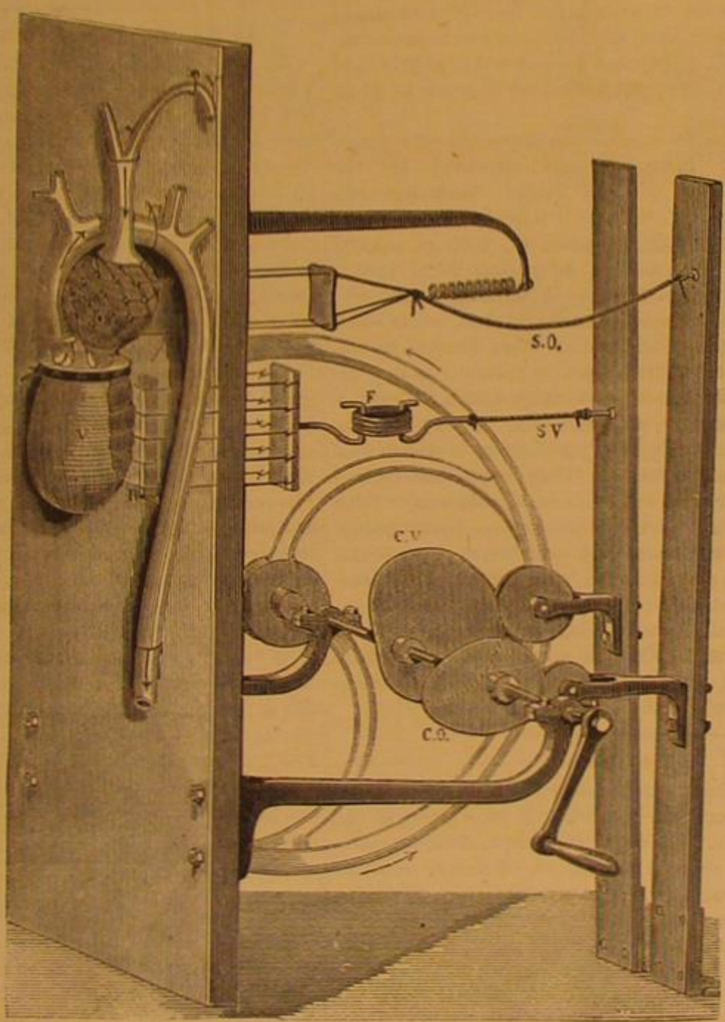



Fig. 3.—Schematic Apparatus for Demonstrating the Circulation of the Blood.

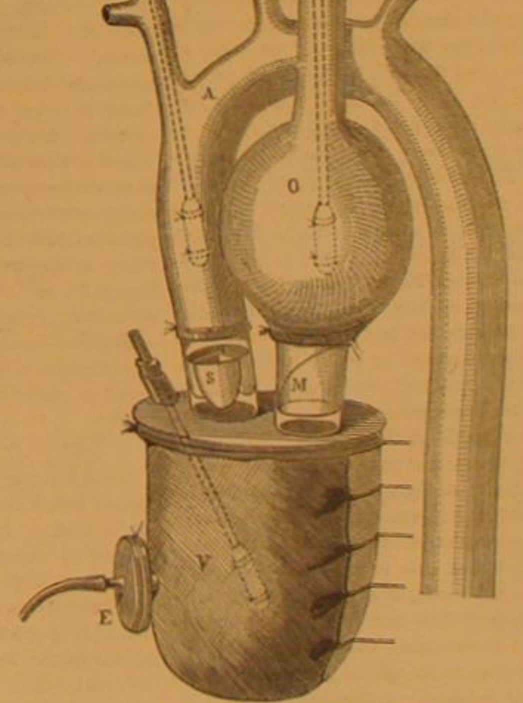



Fig. 5.—Arrangement of the Schematic Apparatus for obtaining Cardiographic Tracings.

Having determined a comparison of the heart with other muscles, and examined its mechanical effects, Professor Marey next investigates how the phenomena noted manifest themselves by the cardiac pulsation. To this end he constructs what he calls the schematic apparatus of the circulation; it is represented in Fig. 3. The heart and artificial vessels are disposed on an upright plate as shown. O is the auricle receiving the liquid from the tube above, and V the ventricle, separated from the auricle by a valve, the latter opening when the ventricle dilates, and shutting when the same contracts, to prevent reflux. The ventricle opens into a large tube which represents the aorta. A number of small sigmoid valves are located at the junction, and prevent reflux from the aorta. To the elastic bag which represents the ventricle are attached a number of cords; these connect with a small plate. To the latter is secured a hook which, in turn, is connected to another hook, S V, by a number of rubber bands. The force of traction of the cords augments with the number of bands, and the elasticity of the latter imitate the elasticity of the muscular tissue.

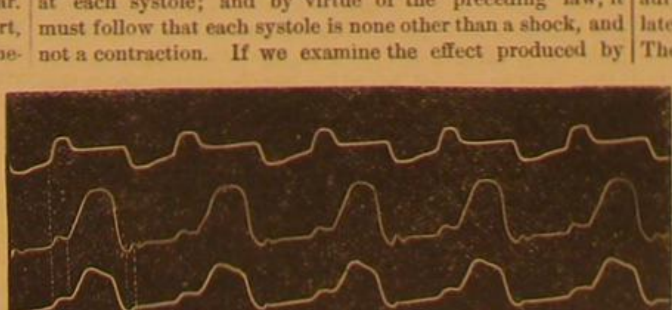



Fig. 4.—Tracings obtained by the Schematic Apparatus. O, pressure in the auricle; V, pressure in the ventricle; A, pressure in the aorta; P, beating of the heart.

The auricle, O, is surrounded by a silk net, to which four cords are attached, communicating with a small rectangular piece of wood, and then unite in one, being kept taut by a horizontal spiral spring. The vertical levers on the right connect with the cords, S V and S O. Now, these levers are oscillated by the cam mechanism shown, and they therefore produce movements of the auricle and ventricle similar to those of the natural heart. This is done by proportioning the cams according to the data previously obtained regarding the muscular action of the heart from the myograph. By applying, to the apparatus just described, proper indicating devices, it was found that it produced a tracing identical with that of the human heart.

In Fig. 4, we give the tracings obtained by the pressure of the ventricle, V, the auricle, O, the aorta, A, and the pulsation, P, of the artificial heart.

In Fig. 5, we represent the arrangement of the schematic apparatus used for obtaining the tracings.

The results of Professor Marey's investigations are that we are now enabled to interpret with accuracy a host of details presented by the tracings of the human heart. He has imitated, on the artificial circulation, the lesions to which organic affections of the heart are due, and reproduced both the abnormal sounds of the heart beat and the principal types of traces furnished by actual patients.

## Communications.

### Extinguishing Fire.

*To the Editor of the Scientific American:*

In your issue of December 30, you recommend discharging water through perforated pipes in the form of spray for extinguishing fire. If water in the form of spray be a good extinguisher, as it undoubtedly is, as numbers of proofs exist in our factories and picker rooms, why do not our fire departments use it in that form in all cases where they can? Leaving the firemen to answer that question, I will proceed to adduce a few facts in support of the theory that a spray is the true method of applying water wherever the burning object can be reached by it.

Water operates, in extinguishing fire, by absorbing the heat and reducing the temperature of the burning substance so low that fire cannot exist; and as the amount of heat that water will absorb depends on the amount of surface of water in contact with the fire, the more surface we can cover with a given amount of water, the better. As flame is the principal propagator of fire, to arrest it is the first thing to do; and as it is more than three thousand times lighter than water, and in most cases a mere shell or curtain, a fraction of an inch thick, the extreme absurdity of trying to subdue it with solid streams of water will be apparent. If a man in the character of a sportsman were to fire an inch ball into a flock of humming birds, with the intention of killing as many as possible, he would be regarded as a fool; but if he were to melt the inch ball up, and cast it into shot one-thirtieth of an inch in diameter, he would have twenty-seven thousand such shot, and their aggregate surface would be thirty times greater than the inch ball. If he were to load his gun with this shot, and fire into the flock, at proper distance, the slaughter of the little beauties would be terrible; and if a fireman would divide up his stream into spray, so that he could cover thirty times more flame, he might expect a corresponding result. The globules of water would be so small that a large portion of them would be heated through and converted into steam; and as steam contains five times more heat (latent) than boiling water, we gain a great advantage in this. Steam is also an excellent extinguisher, and this is an additional advantage. As a large portion of the water is converted into steam when applied in the form of spray, a small amount serves, and the damage by water is very small.

If the two first engines that reached the burning Brooklyn theater could throw five hundred gallons of water each per minute, and divide every cubic inch of water into sixty thousand drops, in two minutes the smoke and heat would have been sufficiently subdued to have enabled outsiders to enter and rescue the unfortunate inmates. I am well aware that this statement may seem extremely absurd to firemen, who have never experimented in this line; but before they condemn it, let them take out a couple of engines and try the experiment. The barbarous system now in use, that so frequently desolates portions of our cities, fills our houses with mourning and our cemeteries with new-made graves, must give way to the dictates of Science. Humanity demands it, and I call on the scientists and chemists throughout the land to aid in introducing this needed reform.

Little Falls, N. Y. CHARLES OYSTON.

### Sir Titus Salt and Saltaire.

The example of one such man as Sir Titus Salt, the great manufacturer and inventor who recently died in England, is worth more, as a means of pointing out wherein a just and equitable solution of the labor problem lies, than all the results of the strikes and lockouts that ever agitated the industrial world. He has shown us how the inexorable laws of demand and supply may be covered with a broad mantle of charity and philanthropy; how a great and complex business may be conducted to the mutual benefit of employer and employed without involving other than those simple relations, free from entangling co-operative or profit-sharing alliances; and above all, he has unmistakably proved that the employer in no wise serves his own interests better than in promoting the welfare of those dependent upon him. Many men have died and left monuments of liberality wherein their wealth has nobly been devoted to the public good; but as a rule, such dispositions have been the means chosen of investing riches already acquired in pursuits not necessarily connected with the object of the outlay. Few men have, like Sir Titus Salt, combined their business with their philanthropic enterprises, and thus while benefiting themselves have doubly benefited society by their wise munificence.

Titus Salt was the son of a Yorkshire wool stapler. In early life he became a farmer, but subsequently entered into partnership with his father, and as the business extended started alone as a wool spinner. At this time immense quantities of alpaca wool were stored in Liverpool, finding no purchasers because no one knew how to utilize it. It occurred to Salt that it would spin out good yarn. He privately tested it, produced an excellent fabric and at once bought up all of the material that he could find. This was the first manufacture of alpaca, and likewise the basis of Salt's colossal fortune. For twenty years he labored on as a wool spinner, always thrifty and industrious, until, having completed his fiftieth year, he concluded to retire upon the competency he had amassed. But the necessity of providing for his five sons and the desire to carry out the philanthropic plans which he had long meditated induced him to change his mind. The locality where he was located was already overcrowded, and hence he determined upon the gigantic scheme of founding a new town—a working man's Arcadia.

Accordingly he purchased a large plot in the beautiful valley of the Aire, contiguous to a railway and a canal, and thus well provided with shipment facilities. Here he erected buildings covering six and a half acres, including roomy factories and abundant dwellings for the work people. On the opening day of the village of Saltaire, says Smiles, three thousand five hundred people dined in the combing shed; and the founder then said "that nothing is to be spared to render the dwellings of the operatives a pattern to the country: and if my life is spared by Divine Providence, I hope to see satisfaction, contentment, and happiness around me."

This was no empty wish, as circumstances soon proved. A church was added, then a literary and philosophical institution. Large schools for children of all ages were erected; cricket grounds, croquet lawns, and abundant pleasure grounds were provided; and a large dining hall, baths and wash houses, a dispensary, and almshouses for pensioners were built. For the accommodation of the three thousand workmen, seven hundred and fifty-six houses were constructed of stone and brick. Each has gas and water supply and separate enclosures. The rents vary from 58 cents to $1.80 per week.

Besides taking part in musical performances—for which even the necessary instructors are provided by the firm—a large number of the skilled workmen (we quote from Mr. Smiles' "Thrift") "devote their leisure hours to various scientific amusements, such as natural history, taxidermy, the making of philosophical instruments, such as air pumps, models of working machinery, steam engines, and articles of domestic comfort, while some have even manufactured organs and other musical instruments." There is no drinking house in Saltaire; so that the vices and diseases associated with drunkenness, as well as those peculiar to poverty, are unknown. Every sanitary measure—drainage, cleansing, and ventilation—is attended to. The work people are also thrifty. They invest their savings in banks provided for them and in lucrative ventures. "With every convenience and necessity as well as every proper pleasure provided for them; with comfortable homes and every inducement to stay at home; with fishing clubs, boating clubs, and cricket clubs; with school rooms, literary institutions, lecture hall, museum, class rooms, and churches established in their midst, there is no wonder that Saltaire has obtained a name, and that Sir Titus Salt will be remembered as one of the wisest of popular benefactors."

### Color Ghosts.

Some years ago a book was published in this country—we cannot recall its exact title—the purpose of which was the production of ghosts. On its pages were various representations of spectral shapes, printed in extremely brilliant colors on a white ground. Directions were given to fix the eyes intently on these for some moments, and then turn them suddenly to a white wall or screen, when the "ghost" would appear in the form depicted in the book, but of an entirely different color. If the picture was red, the specter on the wall would be green; if the former was yellow, the latter would be blue; and so on.

A similar illusion may be produced by any of our readers in a much simpler way. Cut a small disk out of white paper and lay it on a black surface. Look at it steadily for a quarter of a minute or so, and then direct the eye to a white, or, better, to a gray surface, as a sheet of gray paper; and you will see a dark image of the shape and size of the white disk. If a colored disk is used, the after-image, as it is called, will be colored, but of the hue complementary to that of the disk; that is, if the one is green the other will be purple, if the one is yellow or orange the other will be of a darker or lighter blue, etc. Complementary colors, as most of our readers probably know, are those which, if mixed, will produce white.

If the surface is of the same color as the disk, the after-image will be faint and whitish; if it is of the color complementary to that of the disk, the image will appear of the same color intensified. Thus, if the disk is bluish green, and the gaze is turned from it to a red ground, we shall see a "ghost" of a deeper and more brilliant red. If we look upon a colored surface of any other than the complementary hue, the color of the after-image will blend with that of the surface. For instance, if the object is green and the surface blue, the image will be violet.

These phenomena admit of a very simple explanation. When the retina of the eye has been exposed to a continued impression of one color, it is wearied and becomes less sensitive to that color. If now it is exposed to the impression of white light, it will respond more readily to the other colors that make up white, that is, to those which produce the complementary hue. Quite likely some of our readers who have occasion to use red ink have observed that if, after writing with it for some minutes, they change directly to black ink, the latter will at first appear of a distinct green color. Some eyes are more sensitive than others to these delusive impressions, but any person can see the complementary color if he has looked at the other long enough to tire the eye.

Dr. Bezold, in his "Theory of Colors," among many curious things connected with this subject, illustrates the fact that, while if a black object be seen against a colored ground (as black print on red paper), the black, when viewed intently, will show a slight tinge of the complementary color, the effect is greatly heightened by laying thin white tissue paper over the surface; showing that "an admixture of white light is favorable to the production of contrast." He also notes the singular fact that the various colors which may be given to the ground differ greatly in their capability of calling forth the contrasting colors. "Green, blue, and violet—in fact, all the so-called cold colors—will originate very vivid contrasting colors, while this is the case to a much lower degree with red, yellow, and yellowish green." The colored plates in Dr. Bezold's book illustrate this very vividly, but the reader can produce a similar effect by putting a disk or figure cut out of black paper or cloth on a bright colored surface—red, yellow, green, blue, or purple—and spreading the white tissue paper over the whole. The variety of hues which the black assumes is very striking, and tends decidedly to shake one's faith in the popular proverb that "seeing is believing." We know that the black is black, but we cannot see it as black, however earnestly we may endeavor to reason ourselves out of the illusion.—*Boston Journal of Chemistry.*

### An English Editor on American Railways.

Mr. Walter, of the London *Times*, has been interviewed by a New York paper. The report says: "Mr. Walter did not feel himself competent to judge of the comfort of ordinary American railway travelling. He had ridden so luxuriously in the special Pullman car which had been placed at his disposal that he was unable to form an idea of the way in which other people travelled. 'The palace car,' he exclaimed enthusiastically, 'is fit for the Queen to ride in! In fact, it is much handsomer than the one she uses.' The liberality with which railroad directors carried him to and fro over the land was a cause of great astonishment to Mr. Walter. It was a courtesy entirely unknown in England. The Queen herself was obliged to pay immense sums every year for railway conveyance, and no railroad company in all England would think of offering a coach for the free use of any gentleman, public or private. The American car, in Mr. Walter's estimation, was far superior to the English carriage. The possibility of being shut in with thieves or madmen (it had fallen to his own lot to be shut in with a madman); the close, cramped quarters which, in their very nature, stifled all the comfort out of the unhappy traveller; the partitioning a man from the sight and society of his fellow-creatures; and, above all, the shortness of the carriages, which caused them to sway and jerk about so violently that conversation became a torture and reading an impossibility—all these things combine to render a journey in an English railway carriage a matter of something worse than unpleasantness. The 'permanent way,' or road bed, of the English railroad was much more substantial than that of the American; but the English carriages could not be compared with the American cars."

### Gold Mining in China.

Mr. Adkins, the British Consul at Newchwang, gives an account of the valley of Chia T'i Kou, some 30 miles long, in which there are rich diggings about five or six days' journey east by south from Kirin and Newchwang. The veins of quartz in the hill sides are very numerous. The quartz, when dug, is roasted, then crushed, and then washed on a cradle or "slip;" and so rude and imperfect is the operation that it usually pays to wash the quartz two or three times. The quantity of gold found in a ton of quartz varies; but a Chinese miner, who showed the Consul a slab of quartz brought from these diggings, assured him that less than $230 worth of gold per ton is considered a poor yield. The miners in this locality are said to be a lawless set, and to have a very peculiar social organization. A man named Han pays an annual tribute of 20,000 thaels to the Chinese Government and governs absolutely within the limits of his concession, and no official writ runs there without his permission. He has an armed following, and a number of miners and workmen in his pay. Those who are not in his employ pay a royalty for permission to mine. The community under his rule is said to number about a thousand, and is principally Chinese, but a number of Coreans have recently found their way into the territory and are working with considerable success.

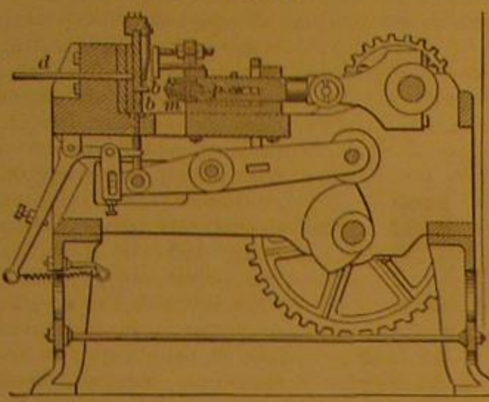
### A Magazine Gun Invented in 1775.

A writer in *La Nature* states that in 1775, one Charrière, a gunmaker of Paris, devised a musket capable of being discharged "ten times in a minute." The description is preserved in the archives of the French Navy, whence it appears that after trials the gun was rejected as dangerous. The cartridges were all placed in the single bore and separated by movable partitions so that but one could explode at a time.

## RIVETS AND RIVETING.

Rivets are made, usually, by special machinery, such as we shall describe further on, from the most tough and ductile iron, having an ultimate tenacity of at least 60,000 lbs. per square inch. In practice, their ordinary dimensions are estimated by the following rules: Diameter of a rivet for plates less than half an inch thick, about double the thickness of the plate; for plates of half an inch thick and upwards, about once and a half the thickness of the plate. The length of a rivet before clinching, measuring from the head, should equal the sum of the thicknesses of the plates to be connected added to 2½ times the diameter of the rivet.

Fig. 1.

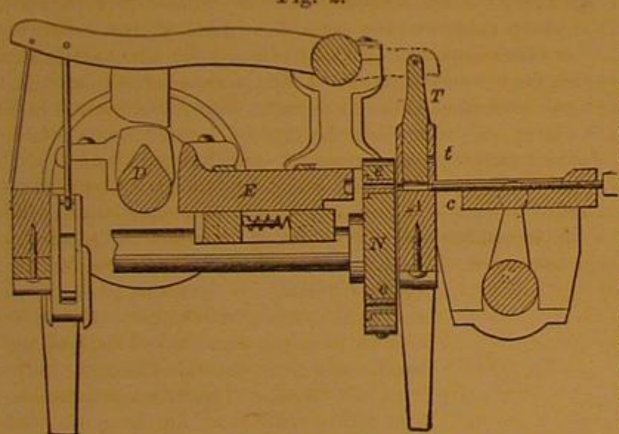


The longitudinal compression to which a rivet is subjected during the operation of clinching, whether by hand or machinery, tends to make it fit the hole tightly, and thus to produce uniform distribution of the stress; but as such uniformity cannot be expected always to be realized, it is usual to assume, in practice, that there is a deviation from uniformity of shearing stress sufficient to neutralize the difference of the toughness of the metal in the rivets and that in the plates which they connect; and therefore, the distance apart of the rivets used to connect two pieces of metal plate together is regulated by the rule that the joint sectional area of the rivets shall be equal to the sectional area of plate left after punching the rivet holes.

### STRENGTH OF RIVETED JOINTS.

The tenacity of good wrought iron boiler plates is about 50,000 lbs. per square inch. Professor Rankine states that that of a double riveted joint per square inch of the iron left between the rivet holes (if drilled, and not punched) is the same; that of a single riveted joint somewhat less, as the

Fig. 2.



tension is not uniformly distributed. In practice, it is convenient to state the tenacity of riveted joints in lbs. per square inch of the entire plate, and it is so stated in the following formula: The joints of plate iron boilers are single riveted; but from the manner in which the plates break joint, the ultimate tenacity of such boilers is considered to approach more nearly to that of a double riveted joint than to that of a single riveted joint.

The forces required to burst asunder iron plates, riveted and other, are as follows:

Wrought iron plate joints, double riveted, the diameter of each hole being $\frac{7}{16}$ of the pitch or distance from center to

Fig. 3.

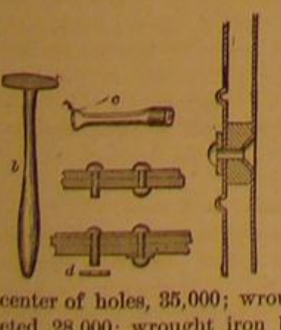
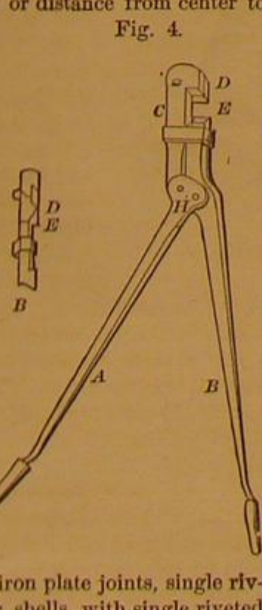


Fig. 4.



center of holes, 35,000; wrought iron plate joints, single riveted, 28,000; wrought iron boiler shells, with single riveted joints properly crossed, 34,000; wrought iron retort, with welded joint, 30,750; cast iron boilers, cylinders, and pipes (average), 16,500; malleable cast iron cylinders, 48,000: all in lbs. per square inch.

### THE MANUFACTURE OF RIVETS

is accomplished by special machines, such as are exhibited in Figs. 1 and 2 (which, with the other engravings here given, we select from Knight's *Mechanical Dictionary*).* In the apparatus shown in Fig. 1, the rod, *d*, is fed through a guide plate into movable dies, *b b*, the length of the blank being regulated by a stop. The movable dies have reciprocating motion, and they cut off the rod fed into the machine, carry the blank in front of the heading die, and finally serve as the die in which the head of the bolt is formed. As they descend, they cut off the length of rod against the face of the guide plate, and carry it in front of a hollow die, *m*, that has a horizontal motion, the interior of the die corresponding to the intended form of the shank of the rivet. The stub end of the rivet is formed against the plunger, B, which also serves to eject it when finished.

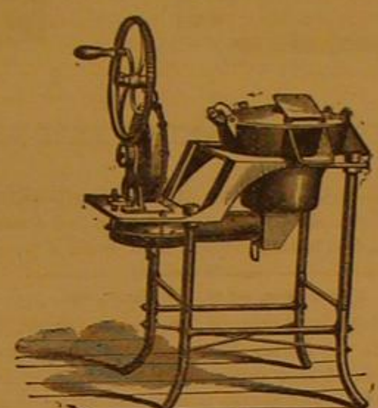
In Fig. 2, the rod is fed into the feed plate, A, through an aperture, *t*. A blank is cut off by the downward motion of the plunger, T, which holds and guides it while being forced into one of the openings, *e*, in the die wheel, N, by the reciprocating rod, *c*, where it is subjected to the action of the header, E, operated by the same compound cam, D, that actuates the lever carrying the plunger, T.

### RIVETING TOOLS.

Riveted joints are shown in Fig. 3.

In riveting the plates composing the skin of iron ships, it is necessary that the outer end of the rivet should be flush with the plate. A countersink is, accordingly, formed in this side. The operation of riveting is performed by three

Fig. 5.



men and a boy. The latter brings it from the furnace with a pair of tongs and passes it to the holder up, who receives it in a short pair of tongs and inserts it into the rivet hole from the inside. He then presses against it with a hammer or with a tool called a dolly, *c*, Fig. 3, having its end indented to receive the head of the rivet, while the two men, on the outside, hammer the other end down so as to fill the countersink

For cutting off flush the stub ends of rivets or bolts, the tool shown in Fig. 4 is used. The handle, A H, is pivoted to the handle, B, and piece, C, so that the jaws, D E, are brought together as the handles are compressed.

Fig. 6.

The portable riveting forge, Fig. 5, has a pot, Fig. 6, rotatable by gearing and having three doors, so as to employ three operatives. It contains a grate-like basket, which allows the blast from the tuyere to pass through. At the bottom of the basket is a grate and a comb raker, operated from the outside. Beneath the grate is the tuyere box. A fan is provided for creating a blast.

The first application of steam to

### RIVETING MACHINERY

is due to Sir Willam Fairbairn. He states that it was contrived when he had a large number of orders on hand for his double flued boilers, and the men struck. "In this dilemma I was driven to the necessity of supplying the place of the riveters by a passive and unerring workman, which, from that day to this, has never complained, and did as much work in one day as was formerly accomplished by twelve of our best riveters and assistants in the same time. I desired the foreman to reverse the action of the punching machine, and with proper dies to rivet the plates instead of punching them. In six weeks from that date we had the riveting machines at work, making tighter joints and executing the work with greater perfection than could possibly be done by the hammer."

The machine, illustrated in Fig. 6, is set in motion by a band on the pulley, *a*; on the axis of the latter is a pinion gearing into a large spur wheel, *b*, on whose axis is a cam, *c* operating the riveting lever, *d*, the face of the cam being steeled, and the end of the lever having a roller to diminish the friction. The riveting lever has a fulcrum in the frame, and acts by its face upon the riveting rod, *e*, when punching, and by a link connection with the tool when retracting, the tool sliding in a socket fixed in the side frames.

The anvil post, *f*, rises from the foundation, and has a riveting block of the shape of a frustum of a cone. The sections of boiler are lowered from above, by means of tackle, *g*, the point at which the rivet is to be placed being adjusted between the punch and the anvil block. The rivet is placed in the punched holes, the band slipped on to the fast pulley, and the upward motion of the cam raises the lever and swages the rivet.

Fig. 7.

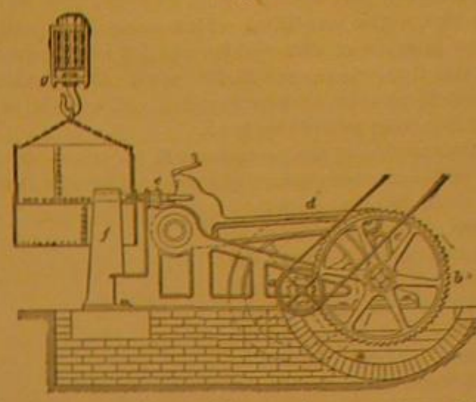
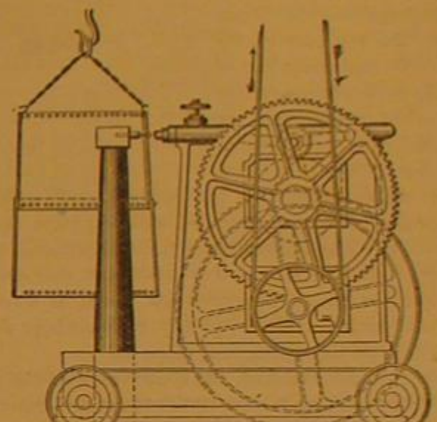


Fig. 8 is a portable machine on the same plan. Not being intended for such heavy work, its frame is less massive than that of the foregoing, and the construction and arrangement of its details are slightly different.

In Tweddel's machine (Fig. 9), the distance between the punch, *a*, and the anvil, *b*, is regulated, according to the thickness of the plate, etc., by screws, *c c'*, and links, *d*. The whole apparatus is mounted on a truck, and the pressure applied by a hydraulic accumulator operated by a portable engine.

Fig. 8.



In Adt's machine (Fig. 10), the work is supported on the table, *a*; the punch is reciprocated by a pitman, *b*, having a universal joint connection with the spindle, *c*, and actuated by an eccentric on the pulley shaft, *d*; the punch spindle is at the same time revolved by a belt on the shaft of the fly wheel, *e*, imparting motion to the pulley, *f*, through two small change pulleys, one of which is seen at *g*.

Fig. 9.

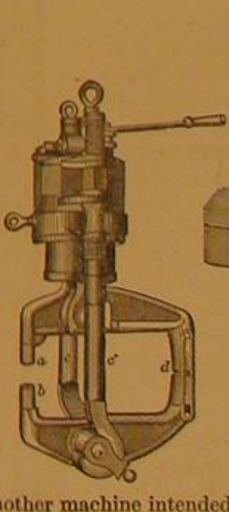
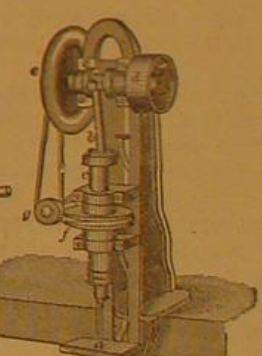


Fig. 10.



In another machine intended for heading caster and hinge pintles, etc., the spring hammers strike the opposite ends of the pintles at once. The working parts are adjustable.

Fig. 11.

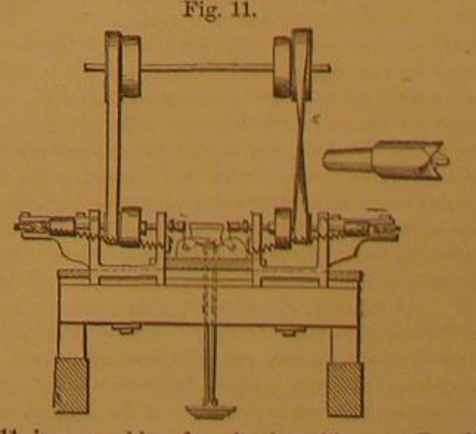


Fig. 11 is a machine for riveting hinges. Peculiarly shaped revolving milling tools spread the pintle when forced against it, and form the head.

*Published by Hurd & Houghton, New York city.

## IMPROVED SELF-OILING AXLE BOX.

We illustrate herewith a new self-oiling axle box for railroad cars, which is claimed to prevent overflow of the oil, to exclude all dust and dirt, to insure thorough lubrication, and to necessitate the use of a remarkably small amount of lubricant in proportion to the distance run. The inventor submits a report of a competitive trial of the device on the Bombay, Baroda, and Central India Railway, from which it appears that a box was filled with 3 pints of oil and not opened or in any way disturbed for a period of four months. During this time, the car ran 35,498 miles. On opening the box, about 2¼ pints of oil were found to still remain and to be quite free from grit of any kind.

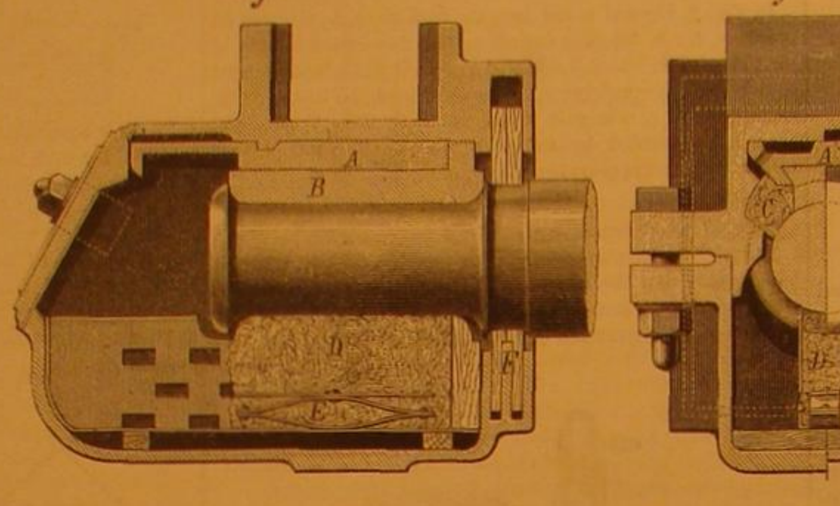
The construction of the invention will be understood from the two sectional views given herewith. The new features consist, first, in the improved iron keep, A, which is fitted to the axle box so as to secure the brass bearing, B, in its proper place, and at the same time to admit of the easy removal of the latter when desired. It will be observed from Fig. 2 that the brass bearing forms a kind of dovetail joint with the keep. This arrangement is calculated to save much of the superfluous metal now used only for holding the brasses, and which cannot in any way be brought into contact as surface bearing.

Another improvement lies in the stuffing boxes. These are found at C, Fig. 2, one on each side of the brass bearing. They are cast in the top part of the axle box. No cushion plate or other appliance is necessary for the purpose of supporting or keeping the pads in position. Each receives a pad of felt extending the whole length of the journal, and which, by capillary action, becomes supplied with oil from the surface of the axle. The lubricating box, D, is situated in the oil reservoir of the axle box, and is partitioned therefrom by plates of metal, in which apertures are made, as shown in Fig. 1. This box is also filled with felt, which is kept pressed against the axle by the spring and plate, E.

In order to prevent overflow, the contrivance of the wooden washer, in connection with a center tongue of iron cast in the groove in which it is fitted, as shown at F, Fig. 1, is used. This center tongue projects higher than the outer flanges, so that it, on one hand, prevents rain drift from entering the boxes, and the consequent overflow of oil; and on the other, it prevents escape of oil from within. It also serves to exclude dust and grit. The two parts of the wooden washer are caused to fit closely on the axle by means of a small steel camber spring (not shown), fixed to the outer edge of each half of the washer, which forces the parts together. There is a slight clearance at the lap joint for wear of the washer; as the latter becomes gradually worn by the axle, this clearance is closed up by the springs.

For further particulars, address Mr. J. B. Tomlinson, care of G. L. Kelty, 80 and 82 White street, New York city, or Wm. Knifton, Black Hawk, Gilpin county, Col.

*Fig. 1* *Fig. 2*



TOMLINSON'S SELF-OILING AXLE BOX.

## USEFUL KIT OF SCREW-CUTTING TOOLS.

We illustrate herewith a set of screw-cutting implements, neatly encased, which is designed more particularly for carriage makers or other mechanics who frequently have crooked work to cut. There are five taps, a similar number of dies and wrenches, a die plate, and also a holder whereby the dies may be held in a bit stock.

The dies and taps, we have illustrated some time ago under the name of the "Lightning Screw Plate;" but latterly the construction of the dies has been materially improved by the addition of a guide to each, which insures the straight presentation to the teeth of the object to be threaded. Any mechanic who has attempted to fit together untrue screws and nuts is conversant with the difficulties encountered, and hence will appreciate the advantages of the above simple improvement. The guide serves also another useful purpose, as a holder for the two parts of the die, which formerly were inclosed in a collet. The latter is now done away with, and the die is fastened to the guide by a square-headed screw (which serves as a hinge) and a wedge-headed screw, by moving the latter of which, the parts may be adjusted so as to compensate for wear. In this way, the dies keep the exact size of the tap, and the nuts and bolts always correspond without trying or fitting. The threads are perfectly finished at a single cut. A worn-out die is readily removed from the guide, and the latter lasts indefinitely.

In the side of the guide, as shown in the illustration, there are a couple of notches. These receive lugs made on the inside of the screw plate, and are thereby prevented from turning. The dies are firmly held in the plate by the clamp screw shown.

In a suitable receptacle on the right of the tool case will be seen a device for holding the die, which may be inserted in the ordinary bit stock. The die is *simply* dropped into the open end and clamped by a single screw, as in the plate already described. The wrenches, which are shown in the front part of the box, are disks of metal having recesses to fit nuts of different sizes, either square or hexagonal. Being in shape similar to the dies, they are readily inserted and secured in the holder above noted, so that the power can be applied by the brace. The tap is of course secured in a vise.

The whole kit is one which will meet with favor from workmen generally. The tools, thus neatly put up, are manufactured by the Wiley & Russell Manufacturing Company, Greenfield, Mass., and may be obtained from Messrs. Frasse & Co., 62 Chatham street, New York city.


THE WILEY & RUSSELL COMPANY'S SCREW-CUTTING TOOLS.

### Corrosion of Sheet Zinc, etc.

Herr Frischen, Inspector of Telegraphs, states, in a communication to the Berlin Polytechnic Society, that the destruction of sheet zinc may often be referred to iron nails employed with it, and also to particles of charcoal falling on to it in the neighborhood of chimneys, owing to the galvanic action developed. For the same reason copper tubes soldered with zinc require renewal of the joints every few years, and gas and water pipes become leaky on account of the lead employed in joining them. Copper strips used as lightning conductors, fastened with iron nails, corrode rapidly; and the ends of lightning rods embedded in charcoal, as generally recommended, are rapidly destroyed in the same way. In the combination of cast and wrought iron in a system of pipes, a decided current of electricity can be detected, indicating that more attention should be paid to this fact in laying them. It has also been noticed that zinc corrodes readily in contact with lime.

### Tomatoes Preserved in Water.

Choose fine ripe tomatoes free from spots or bruises, says M. Bazin in *Les Mondes*, wipe them carefully with flannel and place them in a large-mouthed vase, until the vessel is full to within an inch and a half of the top. Pour on clear filtered water until the tomatoes are just covered, and then paste a sheet of paper over the mouth of the jar. It is absolutely necessary that the tomatoes be free from any spot or bruise whatever, and care must be taken to remove from the water any which in course of time show signs of injury.

### What Becomes of Old Greenbacks?

About two years ago it was customary to destroy the immense amount of mutilated and dirty paper currency, which was redeemed in new bills by the Treasury Department in Washington, by burning it. This plan is now superseded by a much more effective and economical operation. A new subdepartment has been added to the Treasury called the Macerating Department, and here the literally filthy lucre is made into pulp ready to be transformed into clean fresh paper. The following interesting description of the operation we clip from the *Washington Chronicle.*

In the first place the fractional currency is subjected to a most rigid scrutiny, and counted for the purpose of detecting counterfeits, and *then it is turned over* to men who, with a machine, cancel each note so effectually that by no possibility could it ever be used again; another count is then gone through with for the purpose of checking the operators of the machine, and preventing them from appropriating any of the condemned money. After the canceling the money is next cut in half, and once more the separate halves are counted, and when ascertained to be all right are placed in boxes for the purpose of removing them to the macerating building before alluded to. These boxes are securely locked while in transit from the Treasury to the macerating establishment, where they are opened in the presence of three representatives of the Treasury, one acting in behalf of the Secretary, another for the Treasurer, and the last for the Register, and each batch is usually accompanied by a quantity of bonds. From the boxes the bonds, which are cut and canceled thoroughly, and the fractional currency are emptied into the macerating cylinder, which is also locked with three separate locks, the keys of which are held respectively by the officers named above. The process of macerating is very simple. The macerating cylinder is revolved by a sixty horse power engine, and at the same time jets of steam are injected into it, which speedily soften the mass of paper. The moistened paper by its own gravity keeps dropping, and is reduced to a pulp by the sharp ridges which form the inside of the cylinder. After being subjected to this treatment for about thirty-six hours the cylinder is unlocked by the three officials and the pulp is then allowed to fall on an elevator, which conveys it to a large tub, where it is thoroughly cleansed, and all fatty matter removed by the agency of quicklime and soda.

The washing of the pulp completes the process, and it is finally dumped in a heap to lie until purchased. Recently about $4,500,000 worth of fractional currency was placed in the macerater. This was an unusually large batch, the average "burnings," as the macerations are called, being much less. There is now an immense quantity of the pulp on hand, probably several hundred tons. This will be sold to paper manufacturers. The rate usually paid for the pulp is in the vicinity of $5 per ton, and the principal purchaser manufactures from it a very nice article of paper. An approximate estimate of the quantity of pulp annually made out of the fractional currency or bonds at this establishment is 650 tons. The proceeds resulting from the sale of this may be counted as a net gain over the old method, as the burning of the money or bonds required the expenditure of as much labor as does the present macerating system, and consumed a great deal more coal.

The National Bank notes are converted into pulp by the centrifugal process inside the Treasury building, the method adopted being almost in every respect similar to that pursued with the fractional currency and bonds, as described above. The improvement on the burning plan is too obvious to need extended mention. Extraordinary precautions were required to keep the destroyed money from flying out of the furnace chimney, and the odor of the burned money was an intolerable nuisance, and was very injurious to the health of those residing in the neighborhood of the place where it was carried on. This last reason would have been a sufficient one for changing the method, if the additional one of making an absolute saving to the Government did not suggest itself.

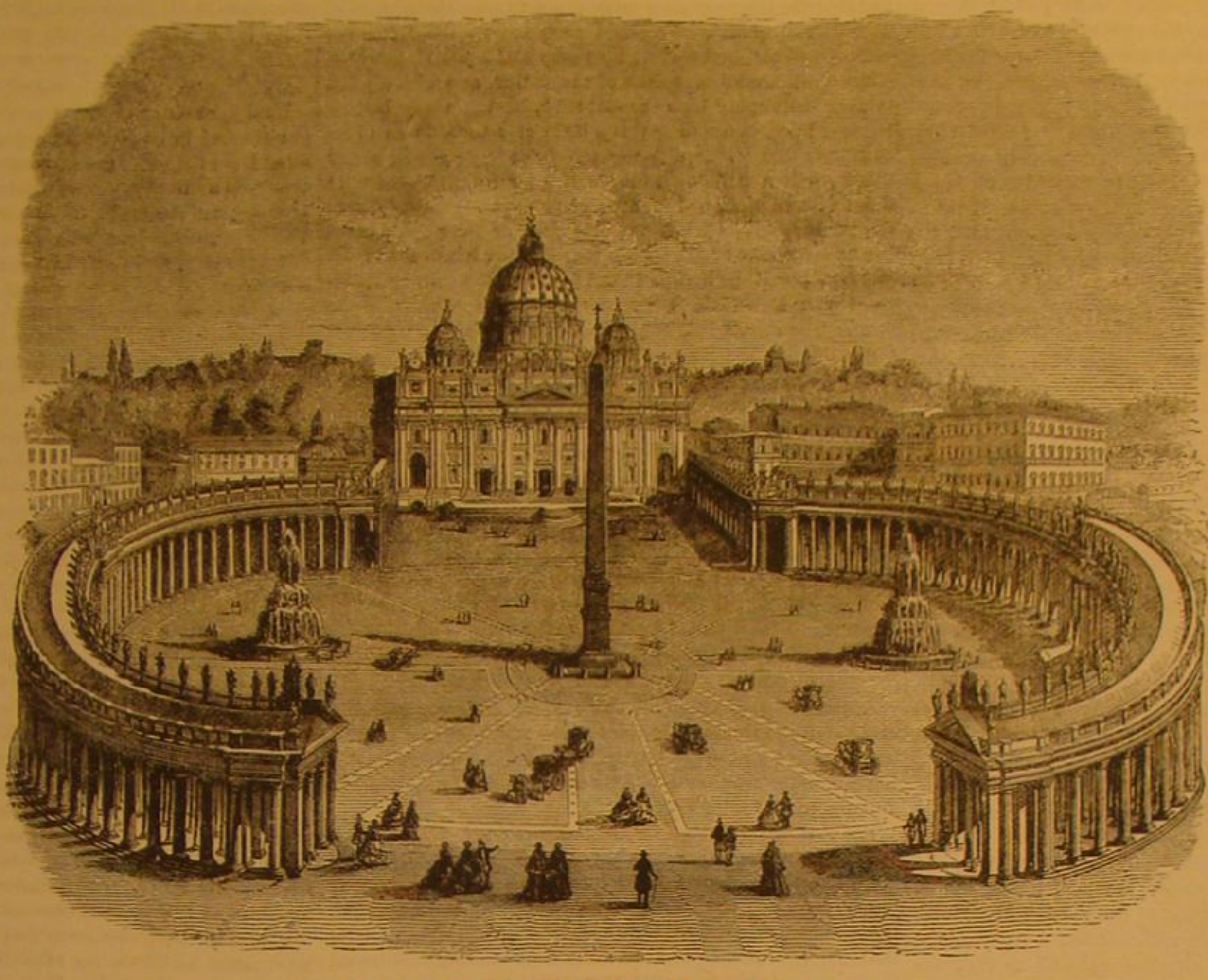
LEATHER belts when new are not quite of the heaviness of water—say about 60 lbs. per cubic foot; but after having been for some time in use, they become thinner and denser by compression, and are then about as heavy as water. The weight of single belting may be approximately estimated at 0·068 lbs. per foot length and inch breadth.—*Rankine.*

### THE BASILICA OF ST. PETER'S, ROME.

No one ever viewed the interior of the great Cathedral of St. Peter's in Rome otherwise than with a feeling of disappointment. At this first sight begins that series of ocular deceptions which pursue one throughout the vast edifice. The illusion is sedulously enhanced by the architectural construction. The size of objects that are at a distance above the eye is clearly increased in far more than may be called the just proportion of their remoteness; where the vault of the nave springs from the side piers, the upward lines are broken by a heavy cornice and by a broad transverse architrave; and further to baffle and expel all possibility of continuity with the marbled and fluted pilasters, the ceiling is composed of small richly gilded panels. In fact, without entering into further details of the interior, the whole illusive architectural effect depends on every line, whether straight or curved, being broken at every available point, on exaggerated dimensions of remote objects, and on the wonderful finish even of the minutest details.

With this brief reference to the optical puzzle of the interior, we may turn to some other wonders of the great structure. It was three centuries and a half in building, it was superintended by forty-three popes, and its cost was $49,840,000.

The shape of the church is that of a Greek cross 720 feet long, 510 feet broad, and about 500 feet high to the summit of the cross over the dome. The dome is double, and was thus constructed as an expedient to satisfy views from within and without. Looking up from within, were there but the outer dome, the proportion would be bad; similarly, viewing from without, were the dome reduced to suit the interior aspect, the effect would again be disproportionate. Hence the two domes, one covering the other, and the outer one 159 feet high above the roof.



ST. PETER'S AND THE VATICAN, ROME.

To ascend to the roof is like visiting an aerial village. The high parapets conceal all view of the Roman streets below; while at every hand are the dwellings of workmen who are constantly repairing the stonework. From the midst of the small houses rises the vast dome, larger than an ordinary church; for it is 405 feet in diameter. Entering the intermediate space between the outer and inner domes, the visitor traverses a gradually narrowing and winding staircase until finally he emerges in the golden ball below the cross. Here sixteen persons may find room; and from the loopholes there is a view, of broad Campagna, and sea, and purple mountains, such as none but poets can describe. Within, Saint Peter's is finished in exquisite marbles, and in the mosaics for which Roman artificers are famous. Outside, gigantic statues abound. There are 192 figures, each twelve feet high, over the porch alone. On the Piazza are two equestrian figures of Constantine and Charlemagne, and in the center is the famous obelisk brought from Egypt. It was in the erection of this stone that a great engineering blunder was brought to a successful result by a timely thought of a bystander. There was a great crowd on the Piazza, watching the slow ascent of the stone as it gradually was lifted to its place. Suddenly its movement stopped. Somebody had miscalculated, the ropes had stretched, and there the great mass hung within an inch or so of its destination. It was impossible to move it further with the apparatus at hand. The engineers were despairing, when a sailor amid the crowd shouted: "Wet the ropes!" This was at once done, the cables contracted, and Nature lifted the stone the rest of the way.

Our second engraving represents the villa and garden of the famous Medici family of Rome, remarkable for the magnificent statues with which the grounds are adorned, and the many art treasures of its interior. It is now occupied by the French Academy of art students.

GARDENS OF THE VILLA MEDICI, ROME.

### Finishing Lace and other Fabrics.

A correspondent having asked us several questions on this subject, we have pleasure in stating that cotton lace, after going through the processes of gassing, or the passing it with the requisite velocity over flames, so as to remove the slight exterior fibres, has acquired a much darker color than is natural; but bleaching restores the article to a perfect whiteness. A piece is often returned soundly bleached within twenty-four hours after delivery. In Nottingham we have seen a machine by which, instead of being wrung or pressed and hung up in a hot room to dry, as is the mode, the article was wrapped round in a kind of coil between two copper cylinders, the outer one of which is perforated with holes. The apparatus is made to rotate perhaps a thousand times in a minute, so that by the centrifugal force thus obtained the damp is quickly driven off. The dressing of lace, so as fully to extend the meshes to their proper shape, and by stiffening the fabric prevent its collapse, is a most important operation, and of course requires care and experience on the part of the class known as dressers, of whom there are almost forty having extensive premises in or near Nottingham. It is performed, first, by passing the bleached or dyed and purified lace through a hot mixture of gum and starch and other materials, and then submitting the lace to the action of revolving cylinders, which squeeze out the surplus stiffening fluid. Next, the piece, in a wet and heavy mass, is taken to the stretching room, which extends from 40 to 120 yards in length, and is wide enough usually to allow of two frames being placed at a sufficient distance to be worked side by side. The heat required is seldom under eighty degrees, and often much more. By means of the side of the frame receding, the lace is gradually extended to its full width; the utmost care being taken not to disturb the mesh either in length or width. On this point will absolutely depend the quality and salable value of the article. Attention has to be paid to the amount of dress in regard to stiffness and weight for single, double, treble, or even quadruple stiffness; and also as to color, clearness, crispness, and elasticity, on which particulars, together with the peculiar ingredients used, depended the preference so long given French over English dressing of plain black silk. Then, to secure freedom from small blotches of stiffening and impurities clinging to the meshes, the pieces are lightly and carefully rubbed with flannels to equalize the stiffening, and then beaten by switches and rods as they are distending; and to promote rapid drying, and consequent clean face and elasticity in hand of the dressed article, the piece, when fully dressed, is fanned with broad, spade-like implements, which produce powerful currents of air. When finished, each is carefully rolled up and folded, preparatory to its being sent to the finishing warehouse, where, the selvedges having been placed exactly even in rolling off the dressing frame, it will, if a wide, plain piece, be cut off, without unrolling, into suitable widths for sale.

The business in chemicals and dyestuffs for bleachers and dyers, in starch, gum, and other materials used for dressing, has necessarily become very large. A piece of cotton net weighing, in an unbleached state, 15 lbs., will increase in proportion to the dress required, so that, if "Paris" dressed it will become 60 lbs. weight, and the edges will cut through the skin like a saw. All nets for foundations of articles of female attire are thus weighted and stiffened. They have been in large request as foundations for bonnets and similar purposes, but are subject to the fluctuations of fashion, or the rise of the materials used, and consequent advances in price, which may lessen or destroy consumption. The mere disuse of a trifling attachment to bonnets lowered the returns of one lace-finishing house some tens of thousands of pounds in one year.—*Textile Manufacturer.*

### The Mediterranean Coast of France.

A contemporary, speaking of the geological changes which have taken place in parts of Southern France since the time of the Romans, says: "The French shore of the Mediterranean divides into two distinct parts, which offer a strange contrast to each other. From Genoa to Marseilles all is life and beauty; all the world goes there for pleasure or health. From Marseilles to the coast of Spain, one finds everywhere solitude and desolation. The latter region was at one time highly prosperous, but it has been entirely changed by the immense quantities of sand and mud brought down by the rivers. Narbonne, in the time of the Romans, communicated directly with the sea. It had its lagoon, like Venice, and a deep canal afforded passage to heavy merchant ships and the triremes of the imperial fleet. The lagoon is now blocked up, and the commerce, wealth, and activity are all gone. Arles was another very important city; it had two ports, like Alexandria, and was so rich and powerful that a poet of the fourth century spoke of it as the Rome of the Gauls. The Rhone, with its annual 22,236,000 cubic yards of sediments, has been its ruin. So with other cities; but while they have become separated from the sea, agriculture is gradually taking possession of the land won from the water, and the vine and olive may yet restore a part of the ancient prosperity."

### Winter Dressing Fruit Trees.

Even a tyro in gardening, says a correspondent to the *Journal of Horticulture* knows that the brown or peach aphis is active upon the shoots of the peach and nectarine during the winter as the summer months; that brown scale remains through the winter upon shoots which it has obtained a footing upon during the summer; that mussel scale holds tenaciously to the bark of apple and pear trees; that mealy bug and spider, when plants they infest become leafless, seek out the rough parts of the bark, beneath which they creep, shielded alike from cold and wet; that the whole tribe of aphides is more or less active during the winter months; and that the thrips are not more given to pass the winter in obscurity than slugs. Against such insects the following recipes will be found useful: Soft soap half a pound, to which add a wineglassful of spirits of turpentine, and with a stick mixing thoroughly with the soft soap, having ready boiling tobacco juice, and adding this a little at a time, so as to incorporate the whole, the tobacco juice that is to be added being a half a gallon. This small quantity will suffice to dress a dozen vines or four average sized peach trees. Apply the mixture with a brush to every part of the trees, after it becomes cooled to 120°, taking care to brush it into the angles and crevices of the bark, and not to injure the eyes or dislocate the buds, which, however, should be coated with the stuff. The sooner it is applied after the leaves have fallen the better, as the pests remain as long as possible before retiring for the winter. The mixture is only applicable to ligneous plants, and to those only when at rest.

For destroying white or brown scale and mealy bug upon growing plants, mix 8 ozs. of soft soap with a wineglassful of spirits of turpentine, adding gradually half a gallon of boiling water, stirring so as to thoroughly incorporate. Apply with a brush to the parts infected, or with sponge to leaves, at a temperature not exceeding 120°. The plants must be syringed with water immediately after they have been dressed with the solution, taking care not to allow the mixture to run down the stems in full strength to the roots.

### The Manufacture of Milk Sugar.

A. Sauter, in a communication to the *Schweizerische Wochenschrift für Pharmacie*, gives an account of a visit to Marbach, in the canton of Luzern, Switzerland, where half a dozen refiners are said to make a handsome income from the manufacture of milk sugar.

The raw material used for the recrystallization comes from the neighboring Alps, in the cantons of Luzern, Berne, Schwyz, etc.; a considerable quantity is supplied also by Gruyères. It is the so-called *Schottensand* or *Zuckersand*, the French *déchet de lait*, obtained by simple evaporation of the whey after cheese making. Notwithstanding a continual rise in the price, consequent upon the demand and the increased cost of labor and fuel, the manufacture continually expands, and now amounts to 1,800 to 2,000 cwts. yearly, corresponding to a gross value of about $60,000, certainly a handsome sum for a small mountain village with but few inhabitants.

The manufacture is only carried on in the higher mountains, because there the material can no longer be used profitably for the fattening of swine, which are found chiefly in the valleys; and the wood required for the evaporating process is cheaper in the highlands.

The crude material is sent to the manufacturer, or refiner, in sacks containing one or two hundredweights. It is washed in copper vessels, and dissolved to saturation at the boiling temperature over a fire; and the yellow brown liquor, after straining, is allowed to stand in copper-lined tubs or long troughs to crystallize. The sugar crystals form in clusters on immersed chips of wood, and these are the most pure, and therefore of rather greater commercial value than the milk sugar in plates which is deposited on the sides of the vessels.

In ten to fourteen days the process of crystallization has ended, and the milk sugar has finished growing. The crystals are then washed with cold water, afterwards dried in a cauldron over a fire, and packed in casks holding four to five hundredweights.

As the *Schottensand* can only be obtained in the summer, the recrystallization is not carried on in the winter, hence a popular saying that the milk sugar does not grow in the winter. The entire manipulation is carried on in a very primitive manner, it being a matter of astonishment to find a specific gravity instrument in any place. The author is of opinion that with a more rational method of working a whiter and finer quality of sugar could be produced.

### Effect of Heat on Carriage Woodwork at the Centennial.

The *Carriage Monthly*, a most excellent publication, calls attention to the failure of many of the foreign carriages exhibited at the Centennial to withstand the excessive heat of last summer. Our contemporary states that, after careful examination, it found a large number of carriages in which not only the grain showed, but in which the work generally exhibited signs of shrinkage and coming to pieces. Panels were checked and shrunk, joints opened, parts had warped out of square, spokes were loose, and in fact the vehicles seemed to need prompt relegation to the shop and a thorough overhauling.

On the other hand, it is gratifying to learn that these deficiencies were confined to foreign carriages, and that the wagons of American make withstood the trial perfectly. One *coupé* was exhibited destitute of paint or priming, and yet, after the six months' subjection to heat and damp, every joint was solid and firm. The journal we quote from, which, it should be remembered, is published in the interest of our carriage manufacturers, and therefore its statements may be taken with a grain of allowance, adds: "The Americans have gained a well earned victory over European makers, both in quality of stock and in workmanship, and we shall not be surprised to see orders in large numbers received for American carriages, to be shipped to all parts of the world; also an increased demand for American woods, which enter into the construction of bodies, wheels, and gears. The American poplar and basswood are superior to the mahogany and cedar used by the French and English for panels, while our wheel stock is acknowledged by all to be the only timber suitable for wear and lasting qualities."

### Kaolin.

Kaolin, or china clay, is a product of the decomposition of granite, and in its preparation for commerce has to be separated from the other constituents—quartz and mica. If this occurs on a hill side, stopes will be cut in the hill, and a stream of water will be made to flow over the face of the stope. The water, aided by a little work with a broad pick, breaks down the clay, and carries forward the kaolin and the mica, but very soon drops the quartz or gravel. This gravel is partly thrown away, partly used for the floor of the evaporating pans to be referred to. The great point is to do as much work as possible with water, and to save manual labor. The water then passes into a number of small pits, where it is brought almost to stagnation; and as it passes slowly along backwards and forwards it deposits the mica, and is then taken into the collecting pit. From this it is allowed to run into a number of evaporating pans, where it is left slowly to evaporate, leaving behind a deposit of pure white kaolin, free from silica and mica. When the sediment in these pits has accumulated to a depth of 8 or 10 inches, it is dug out before it hardens, and is then the china clay of commerce. For the purpose of expelling a great deal of the water, it is placed under sheds in the dry season, and in later years it has been dried artificially by means of heated pipes. The selling price is only from $5.00 to $10.00 per ton, yet under favorable circumstances, plenty of water, etc., it can be manufactured at such a rate as to be very profitable.—*Professor Smyth.*

### The Man of Business and the Business Man.

The man of business and the business man both have business to do; but the business man is the one who does it. The business man thinks, moves, acts, and makes himself felt in the world. If a thought comes into his head, it is one of breadth and compass—it does not center on self and its narrow world. It reaches away and embraces others. It has a wide range, and does not stop till it touches and affects for good the interests of all. Nor are the thoughts of such men immobile. They became acting, living realities in the wide and busy world. The authors of them make of these business thoughts actualities, give them "local habitation and a name," and steamboats are built, and ocean is navigated, and distant climes and nations brought together; an electric telegraph springs into being as by enchantment, and lightning becomes garrulous and voluble, and thought out-travels the winged winds; and in a twinkling the bands and shackles of trade are loosened. Such are the workings produced by the business man. He awakens the drowsy and helpless multitudes, puts life and thought, energy and action, into them, and makes the world leap rejoicing along the path of ages. Where its step before was but a single year, now it strides by scores and fifties.

> "Men of thought, men of action,
> Clear the way."

And they do clear the way—their thoughts become tangible, moving, demolishing forces, that break down and crush all opposing barriers, opening a pathway of progress, into which the more sluggish and timid portion of humanity may securely travel.

But the man of business is emphatically what the name indicates. His business is always on his hands. He does not do it. He does not know how to go to work in the right way. His thoughts are all measured and slow. He weighs self-made doubts and supposed contingencies, and before he moves the business man gets up and runs away from him and wins the race. The man of business won't go ahead, he only eddies round and round—he does not progress—his path is a circle. He does not find himself at night many miles on his journey's way, but, like the hour hand of a clock, just where he started. He is not clear and decided in what he does, but often stands hesitating and puzzled. He ventures and falls back: has a stout heart in fancy, but none in fact.

### A New Source of Illumination.

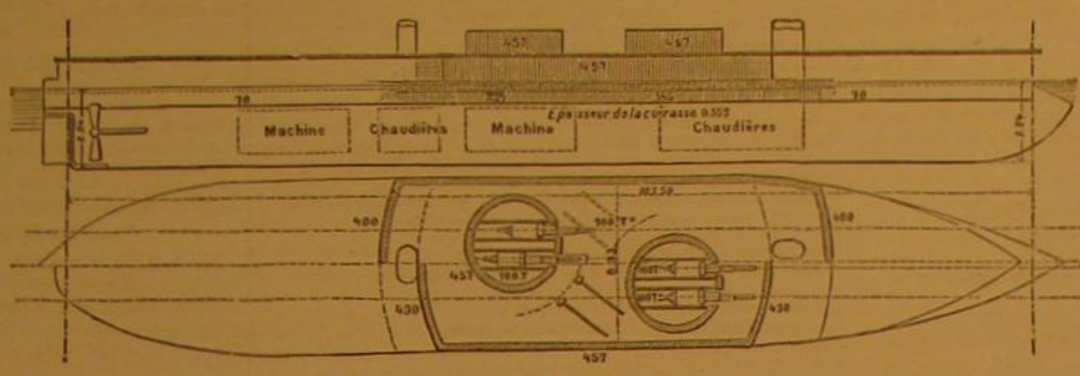
Between Bordeaux and Bayonne, in France, there is a large stretch of sandy desert, whereon there is little vegetation save here and there patches of pine trees. From these trees there runs a resinous matter, which is collected and sold by the inhabitants of the region. This substance has recently been studied by M. Guillemare, and he now announces, to the French Academy of Sciences, that he has produced three kinds of oil from the material, all rich in carbon containing respectively 80, 90 and 92 per cent. of that element. The light yielded on burning the oils is remarkable for its whiteness and steadiness and is said to be suitable for lighthouse illumination and even for photography.

### Whitewash your Shops.

An exchange offers the very sensible suggestion that a little water applied to factory windows, and some of the same liquid mixed with lime and applied to walls and ceilings, will not cost much: while at the same time, during these murky winter days, it will render workshops lighter, conduce to the health and comfort of operatives, and perhaps save some gas bills.

THE STRONGEST WAR VESSEL IN THE WORLD.

The most powerful ironclad vessel at present in existence is the Duilio, which was recently constructed by the Italian government. She is not yet entirely completed, and but one of the four 100-ton Armstrong guns has been delivered. The general design of the vessel will be understood from the accompanying engraving. Her length is 331·2 feet, breadth at water line 58·4 feet, and depth of hold 25·2 feet. She has two turrets, which, instead of being in the center line of the ship, are placed toward the sides, so as to get a clear fore and aft fire from each turret. The inside diameter of each is about 26 feet, and the outside 32½ feet, while the two turrets, with the armor plating and the two guns, will weigh about 6,720 tuns. Each turret makes one complete revolution in a minute, and when in position for firing is stopped by hydraulic locking bolts. The vessel is built in compartments, and is provided with a novel system of pumps, which discharge water from her in case her skin is pierced by a shot. There are no masts, and all the machinery and the rudder are entirely under water, so that the vessel exposes no vulnerable portion.




THE ITALIAN IRONCLAD DUILIO.

The immense guns are loaded by hydraulic apparatus. Upon opening a valve, the ram head capped by a sponge advances rapidly into the bore of the gun, the latter being suitably depressed and the sponge rising at an angle from beneath the deck. When the sponge reaches the bottom of the bore, a valve in the head is opened, and a powerful jet of water is brought to play in the powder chamber: thus at the same time aiding in cleaning the bore, and preventing any possibility of fire being left therein. After the sponge is withdrawn, the cartridge and shot are in turn raised by an hydraulic cylinder to their proper position in front, and on a line with the muzzle, this and the remaining operation being performed by one man without his moving from his seat beside the levers. Lastly the ram head advances and drives the shot home. Without machinery, it requires, in the United States navy, 24 men to manage an 11-inch Dahlgren gun, the shell fired by which weighs 135 lbs. With the hydraulic mechanism described, four men can serve a weapon which throws a shell weighing 2,000 lbs., or a shot weighing 2,500 lbs.

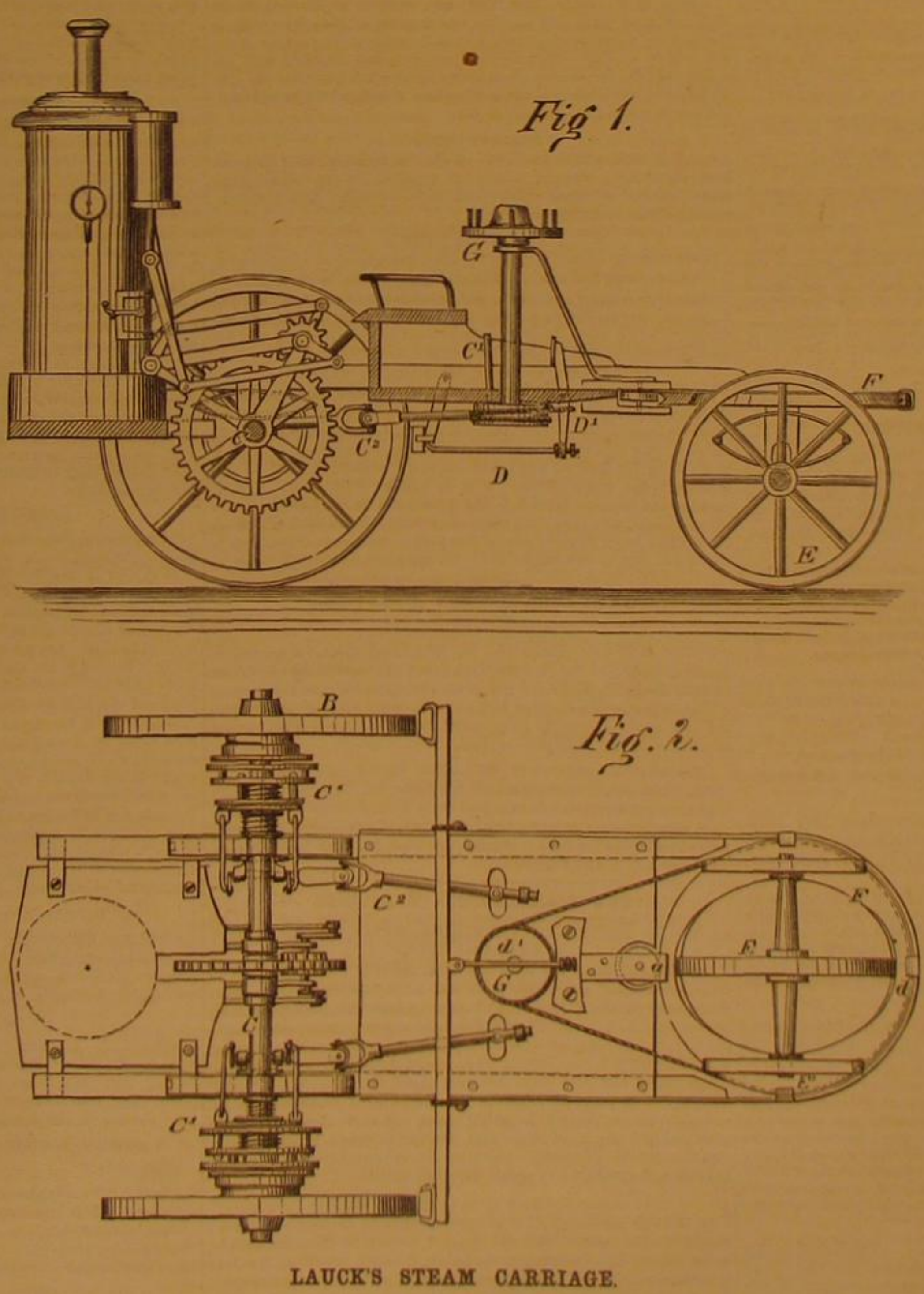
It has been calculated that the work developed by the immense projectile is equal to about 39,000 foot tuns; so that, if all four of the Duilio's guns were fired at once, her effective power would be equal to that exerted in raising 156,000 tuns one foot high per minute.

A NEW STEAM CARRIAGE.

The novel steam carriage herewith illustrated is provided with improved mechanism which enables it to be readily steered and conducted around curves. Fig. 1 is an elevation and Fig. 2 a view from beneath. The hind axle is revolved by a suitable steam or other motor, that is secured to the supporting platform, and connected by transmitting mechanism to the axle. The hind wheels are placed loosely on the axle, and secured rigidly thereto by clutches, C¹, that are forced by suitable springs into hub plates of the wheels. The clutch mechanism, C¹, of each wheel may be readily withdrawn by a lever and swivel connection, C², operated by levers arranged near the driver's seat. On turning ordinary curves in roads the clutch mechanism is arranged to allow the outer wheel to make a greater number of revolutions than the inner one. On turning very short curves, by withdrawing the clutch from the inner wheel all the power is thrown on the outer wheel, and thereby the carriage allowed to turn easily on a space a little larger than its own length. The guide wheel, E, at the front part of frame, A, is connected by its axle, supports, and springs, with a horizontal turn table, F. The turn table has a circumferential groove, and is connected by a belt with a pulley, *d'*, and steering wheel, G, in front of the driver's seat. The hind wheels are further provided with suitable brakes, worked by a treadle.

The carriage, it is claimed, may be propelled at considerable speed, steered with facility, and carried readily around curves.

Patented through the Scientific American Patent Agency, October 10, 1876, by Mr. Jacob M. Lauck, West Milford, W. Va.




LAUCK'S STEAM CARRIAGE.

The Decrease of the Petroleum Supply.

There has been a marked diminution in the oil product of Pennsylvania of late. It is reported that, for some months past, the supply has not exceeded 28,000 barrels per day, while not more than two years ago the daily average was 40,000 barrels. The price also has more than doubled. The decrease of the supply is attributed to the cessation of flowing wells; and the fact that most of the pumping wells, refineries, and railroad lines are controlled by a single company which exacts high profits has probably much to do with the increase in the price.

MOST persons have an idea that the Atlantic telegraph cable is a ponderous affair, while in fact its circumference is that of a five cent piece.

Lead Poison in Sewing Silk.

Invention and discovery have their evil no less than their beneficent aspects. A French contemporary, the *Moniteur d'Hygiène*, startles its readers with the revelation of an ingenious fraud, not generally known, but likely to be in the long run very dangerous to the health of tailors, sempstresses, and others who use silk thread in sewing. Nothing is more pernicious to the system than lead, and yet it may be constantly introduced into the stomach by those who use sewing silk. According to our French authority, certain manufacturers have adopted the plan of soaking their silk thread, of all colors, in acetate or sugar of lead, and exposing it, after drying, to the action of sulphurous vapor, which vapor, it is said, transforms the acetate into sulphate of lead, increasing the weight of the silk. The resulting gain may be imagined when we state that sugar of lead is worth considerably less than 25 cents a lb., whilst silk thread fetches from $10.00 to $11.00 a lb. in the market. It is alleged that some samples of silk have been proved to contain as much as twenty-three per cent. of sulphate of lead.

There is some mistake in the mode of stating the case, says the *Sewing Machine Gazette*, as the fumes of sulphur would certainly not convert the acetate of lead into the sulphate. Nevertheless, on mentioning the statement to our tailor, he at once declared that the fact of lead impregnation in silk is well known; indeed, he said that the sugar of lead can be detected by the smell in some samples, and not only in silk, but also in other thread, which is also sold by weight. Some adulteration, then, is practised, various matters being used to give weight to the articles; and, as a consequence, all thread rapidly deterioriates on exposure to the air. On this account the best sewing silk is usually well wrapped in wash leather.

It is easy enough to detect the adulteration by chemical process, and, although the result is not conclusive as to the presence of lead (as stated by the French writer), it proves, at any rate, the presence of some metal. Put a few pieces of silk thread at the top of a test tube filled with water containing a few drops of acetic acid or vinegar. As soon as the silk gets moistened, let fall into the test tube a few drops of a solution of iodide of potassium. Then, if the silk contain lead or other metal, an iodide of the metal will be formed, sinking with a violet tint into the tube.

We have tested several samples of silk thread in this manner. With the exception of one sample, all the fine sewing silk was proved to be free from lead or other metal. But we found metal very abundant in what is called "tailor's twist" and "hatter's twist," especially the latter.

The fact is important if lead be the metal used for giving weight to silk. Lead acts very surreptitiously on the system; it is essentially "a slow poison," and it is very difficult to combat its effects. It acts on the teeth and on the intestines, in which it produces paralysis, frequently followed by death. "We have seen," says the writer in the *Moniteur d'Hygiène*, "among other cases, that of a lady who keeps a large sewing establishment, who, by the use of such silk thread, was, together with her workwomen, attacked by lead colic, some of them losing their teeth—the result of the habit of putting the ends of the silk into the mouth before passing it through the eye of the needle. Such is the way in which the lead poison is directly absorbed, whilst, by continually handling the silk, the fingers may retain a portion of the lead, to be indirectly introduced into the system with the food that may be touched by the hand. The poison may be avoided by refraining from putting the silk into the mouth—dipping it in gummed water instead—but perhaps the best remedy will be found by the large dealers refusing to buy silk thread by weight unless it is proved to be free from metallic adulteration.

According to a recent writer in the London *Times*, the "French dyers have attained such extraordinary skill, that they can color up inferior qualities of silk so as to make them look far better than they are. In some cases they are able to charge the silk with lead and iron, which adds as much as one hundred or one hundred and fifty per cent. to the weight of it! All such artificial additions disappear when the tissue is exposed to any wear, however slight, and sometimes even when it is only exposed to the atmosphere. Let us admire and beware. Never have tissues looked so lovely as now; they charm the eye. But, also, never was beauty more deceitful; and, if our women cannot resist the temptation of lovely tints, let them at least take care to buy new silks from houses which are thoroughly to be trusted." If silk for dresses is open to this grave suspicion, how much more probable is the adulteration of sewing silk which is always sold by weight, although done up in skeins, or on bobbins and reels.

## DECISIONS OF THE COURTS.

### United States Circuit Court—Western District of Pennsylvania.

PAPER ROOFING.—JAMES HOWARD *vs.* ROBERT CHRISTY.

[No. 8, May Term, 1870.—At Law.—Decided November 13, 1876.—Before McKennan, C. J.]

The plaintiff was the first and original inventor of the inventions described and claimed in his patents No. 91,133, June 8, 1869, for method of preparing paper for roofing purposes, and No. 95,689, October 12, 1869, for a machine for carrying out such method. The original application was filed March 1, 1850, rejected April 9, 1850, withdrawn May 4, 1850, and afterward repeatedly renewed with the allowance of the patent No. 91,133. The plaintiff did not intend to and did not in fact abandon his said invention to the public. Nor was it in public use or on sale with his consent and allowance for two years before his original application.

MCKENNAN, C. J.:

This is an action at law for the infringement of two patents granted to James Howard, the plaintiff, as follows:

1. Patent No. 91,133, dated June 8, 1869, in which the invention claimed is—

The method described (in the specification) for preparing paper for roofing purposes—to wit, by passing the paper through liquid asphaltum, heated to that degree which will cause the paper and the asphaltum on it to dry as fast as it is drawn from the reservoir of liquid asphaltum.

2. Patent No. 95,689, dated October 12, 1869, in which the invention claimed is—

The arrangement of the reservoir A, windlasses B and C, adjustable rollers D, scrapers *i* and *h*, and rollers *e* and *f*, constructed, arranged, and operating substantially as described in the specification and for the purposes therein set forth.

The parties have stipulated to waive a jury, and that the issues of fact in the case be tried and determined by the court, and the evidence on both sides has been taken in writing and submitted to the court.

Upon the evidence thus submitted the following facts are found:

1. The inventions described and claimed in said patents are novel and useful.
2. The plaintiff was the first and original inventor thereof, and the date of his invention is referable to the date of his original application for a patent—to wit, the sixth of December, 1849.
3. This application was filed in the Patent Office March 1, 1850, accompanied by a specification and by a model on March 5, 1850, was rejected April 9, 1850, and was withdrawn May 4, 1850.
4. It was afterward repeatedly renewed, (when does not appear,) and resulted in the allowance of the patent aforesaid.
5. During the interval between the date of his application and the allowance of the patent, the plaintiff did not intend to, and did not in point of fact, abandon his said invention to the public.
6. The said inventions were not in public use or on sale with the consent and allowance of the plaintiff for a period of two years before his original application for a patent.
7. The defendant has practised the method described and claimed in Letters Patent 91,133 on a machine of similar construction to that described in Letters Patent 95,689, and is, therefore, an infringer.

These findings embraced all the material issues of fact raised by the pleadings.

Several questions of law have been suggested touching the alleged defectiveness of the specifications, and the presumptive abandonment of the invention from delay in the procurement of patents, but as the objections to the plaintiff's title on these grounds have no warrant in the well-settled principles of the law of patents it is only necessary to say that they are unsustained.

Upon the whole case the court is of the opinion that the plaintiff is entitled to recover, and, as the damages have been assessed by stipulation at $100, judgment will, therefore, be entered upon the findings in favor of the plaintiff for that sum.

[*James J. Johnston* and *George H. Christy*, for plaintiff.
*Joseph M. Gazzam*, for defendant.]

## NEW BOOKS AND PUBLICATIONS.

BRYANT'S BOOK-KEEPING: a Treatise on the Science of Accounts, Elementary and Practical, containing a Thorough Explanation of the Principles and Practice of Double Entry Book-Keeping, adapted to the Use of Universities, Business Colleges, etc. Price $3. Buffalo, N. Y.: Published by the Author.

Mr. Bryant's long experience as a teacher of the science of commercial accounts has enabled him to compile a work of the highest value for simplicity and practical value. The book is a thorough and complete treatise, written with clearness and illustrated with numerous specimen pages of account books. We recommend it to all young men desirous of acquiring a knowledge of the useful and indeed indispensable art of book-keeping.

RURAL HYDRAULICS, A PRACTICAL TREATISE ON RURAL HOUSEHOLD WATER SUPPLY: giving a full Description of Springs and Wells, Pumps, Hydraulics, etc. By W. W. Grier. Price 75 cents, free by mail. Philadelphia, Pa.: Henry Carey Baird & Co., 810 Walnut street.

A practical little work on an important subject, free from technical and abstruse phraseology.

NOTES ON LIFE INSURANCE. WITH APPENDIX. By Gustavus W. Smith, late Insurance Commissioner of Kentucky. Price $2.00. New York city: D. Van Nostrand, 23 Murray street.

The subject of this volume is an inexplicable mystery to many, and we think that the book will meet a great necessity. The author is evidently a gentleman of great skill and knowledge, and the wise principles he lays down so clearly will enable persons of limited education to acquire sufficient knowledge to judge for themselves as to the trustworthiness of the multitude of insurance companies which are now claiming the confidence of the public.

ELEMENTARY ARCHITECTURAL DRAWING. Edited by Charles Babcock, Professor of Architecture in the Cornell University, Ithaca, N. Y. Nos. 1 to 8. New York city: D. Appleton & Co., 549 and 551 Broadway.

Messrs. Appleton are now publishing Krusi's courses of examples in free hand and mechanical drawing. Six series are announced, each edited by a professor of well known ability and reputation. The eight parts of the architectural series, now before us, comprise an extended course of examples of great variety and excellence, calculated to form the taste as well as train the hand and eye of the student. The occasional use of free hand work in depicting the various building materials is singularly effective and correct.

THE QUARTERLY JOURNAL OF INEBRIETY. Published under the auspices of the American Association for the Cure of Inebriates. T. D. Crochers, M. D., Secretary, Binghampton, N. Y. Subscription $3.00 per year.

The name of this new comer in the field of periodicals is rather puzzling. By a parity of reasoning, a paper printed by a prison association might be called a journal of petty larceny—or bigamy—which would startle people. This aside, the new magazine is an excellent and useful publication, and, we have no doubt, will do great good in disseminating correct and scientific views regarding the sad disease of drunkenness and its best mode of cure. The first number contains Dr. Beard's excellent address on the Causes of Inebriety, which we have already reviewed in full. There are besides the proceedings of the Association above named, beside clinical notes and other interesting articles.

## Inventions Patented in England by Americans.

From November 21 to December 21, 1876, inclusive.

AERATING CHURN.—T. Simmons, Hartford, Conn.
AIR PUMP.—W. F. Garrison, Brooklyn, N. Y.
ARTIFICIAL STONE.—L. L. Leathers, Oakland, Cal.
BOX COVER, ETC.—W. L. Hubbell, New York city.
CAR BRAKE, ETC.—L. O. Rost, East Minneapolis, Minn.
CAR COUPLING.—H. G. Russell *et al.*, Lincoln, Ill.
CLEANSING CARPETS.—G. S. Norris (of Baltimore, Md.), London, England.
CLEANSING FABRICS.—W. Maynard, New York city.
EMBROIDERER.—A. Mason, New York city.
EXPLOSIVE.—E. Judson, San Francisco, Cal.
FLEXIBLE TUBING.—H. Wakeman, New York city.
FRYING PAN.—J. E. Bardell *et al.*, New York city.
GRAINING WOOD.—J. R. Cross, Cleveland, Ohio.
HARVESTER RAKE.—W. A. Wood, Albany, N. Y.
INKSTAND BASE, ETC.—Rosenfeld & Co., New York city.
LAMP WICK, ETC.—H. C. Scott, Clinton, Iowa.
LOADING HAY, ETC.—J. W. Foust *et al.*, Meadville, Pa.
LOCK AND KEY.—M. Runkel, New York city.
MAKING ICE, ETC.—C. L. Riker, New York city.
MAKING NUT BLANKS.—S. S. Townsend, Philadelphia, Pa.
MAKING OZONE, ETC.—H. Milsom, Buffalo, N. Y.
MAKING SCREWS.—American Screw Company, Providence, R. I.
MAKING TUBES.—American Tube Works, Boston, Mass.
NAIL FEEDING DEVICE.—W. H. Field, Taunton, Mass.
PIPE COUPLING.—L. Richardson, Brooklyn, N. Y.
PRESERVING MEAT, ETC.—A. Montgomery, New York city.
RAILROAD TIE.—D. S. Whittenhall, Chicago, Ill.
REDUCING ORES.—T. S. Blair, Pittsburgh, Pa.
REVERSING VALVE.—H. S. Maxim, New York city.
SCOURING GRAIN, ETC.—W. P. Clifford, Elmore, Ill.
SCOURING HIDES, ETC.—B. F. Larrabee, Lynn, Mass.
SPRING MATTRESS.—Howe Spring Bed Company, New York city.
SPRING MOTOR.—R. Rhett, Baltimore, Md.
STOWING COTTON, ETC.—M. J. Walsh, New York city.
STRAIGHTENING WIRE, ETC.—W. H. Paine, Brooklyn, N. Y.
TUYERE, ETC.—A. J. Haws, Johnstown, Pa.
UMBRELLA, ETC.—A. A. Valentine *et al.*, New York city.
UNLOADING GRAIN.—G. Milsom, Buffalo, N. Y.
VALVE.—N. C. Locke *et al.*, Salem, Mass.
VALVE, ETC.—E. Purvis, New York city.
VENTILATION, ETC.—J. S. Linsley, New York city.
WATER GAUGE, ETC.—W. Andrews, Lisbon, Me.

# Recent American and Foreign Patents.

## NEW HOUSEHOLD INVENTIONS.

### IMPROVED CENTER SLIDING GASALIER.

Samuel B. H. Vance, New York city, assignor to Mitchell, Vance & Co., of same place.—By suitable construction, as the center light is drawn down, a cord unwinds from a drum L, which turns the said drum, and coils up a spring. The tension of the spring and the weights of the square tube and its attachments so nearly balance each other that the center light will be sustained in any position into which it may be adjusted, but may be raised and lowered with ease.

### IMPROVED DESK.

Ernest N. Döring, New York city.—When the lid of the table is thrown back pigeon holes attached thereto are exposed. To the lowest pigeon hole a desk leaf is hinged which when the lid is opened falls into an inclined position, ready for use.

### IMPROVED LAMP.

David Dickson, Raglan, Ontario, Canada.—The object of this invention is to do away with that portion of the chimney which is most liable to fracture from unequal expansion, and substitute therefor a metallic top, which may also answer the purpose of a reflector. The top shuts a small distance over the top of the glass cylinder, and is retained in place by the spiral springs, fastened to tubes which support the wick tube.

### IMPROVED GAS OVEN OR SUMMER RANGE.

Benjamin Shourds, Philadelphia, Pa.—This embodies improvements in that class of ovens or summer ranges commonly known as gas ovens, because the draught, coal gas, etc., from the fire can be caused to pass through the oven when the lids in the bottom plate thereof are removed. The side thirds of the top plate are inclined at an angle of about 45°, and its central third is flat, and is provided with an angular brick work. Upright openings and dampers formed in the upper parts of the side plates of a summer range, above the lower edges of the inclined side parts of the top plate; and a flue is formed upon the rear plate. Dampers are provided in connection with an opening formed in the upper part of the back plate.

## NEW AGRICULTURAL INVENTIONS.

### IMPROVED CULTIVATOR.

William B. Sturgis, Shelbyville, Ill.—The crank axles are secured in place adjustably in a bar, that is arched, so that the machine may be drawn over tall plants. There are also new devices to enable the plow to be readily guided, to prevent the standard being broken when striking an obstruction and also to support the plows away from the ground when turning around and passing from place to place.

### IMPROVED GUIDE FOR BUILDING RICKS AND STACKS.

John Murdock and Henry Murdock, Poseyville, Ind.—This relates mainly to gates which travel on a vertical post being hoisted as the stack is built up to them by means of a windlass. They are so constructed as to contract as the top of the stack is reached, and when the latter is nearly complete they may be altogether removed.

## NEW MISCELLANEOUS INVENTIONS.

### IMPROVED PROCESS OF PREPARING METAL SURFACES FOR PRINTING UPON.

Joseph T. Commoss, New York city.—The object of this invention is to form such a surface upon metal plates that it may be printed upon direct, without any transfer process, and which will enable the plates, after being printed upon, to be struck up with dies, and otherwise manipulated without cracking, chipping, or otherwise injuring said surface. A mixture of pale boiled oil, Benguela varnish, turpentine, and white lead ground in oil is first applied hot. The plates are then placed in an oven heated to 125° Fah., after which they are powdered with a mixture of magnesia and soapstone, and are then ready to be printed upon. We have seen some of the most beautiful samples of metal card printing in colors, by this process that have ever been executed. The work closely resembles chromo picture printing in the perfection in which the colors are laid.

### IMPROVED QUILTING FRAME.

Ira M. Hope, Morocco, Ind.—The quilt is fastened to muslin strips attached to rollers, at two sides, and secured to bars at the other sides by cords. As the quilt is wound on the rollers, the cords stretching it to bars are disconnected. When thus wound sufficiently the bars are altogether detached, and the rollers are put into benches and held by ratchet wheels and pawls to stretch the quilt between them, while the hooks stretch it in the other direction.

### IMPROVED WATCH PROTECTOR.

Henry A. Rosenthal, Brooklyn, N. Y.—This is an improved device for connecting a watchchain and watch with each other, so constructed that it may be set to prevent the watch from being withdrawn from the watch pocket by a thief. In a short tube, the upper end of which is closed, and the lower end of which is flared, is fitted a block, which slides up and down within it. The movement of the block is limited by a screw, inserted in it, and which passes through a longitudinal slot, formed in the side of the tube. The slot at its upper end is extended at right angles with the length of the tube, so that by turning the tube so as to bring the screw into the lateral arm of the slot the block will be locked in the upper end of the said tube. When the tube has been pushed down to the cap and turned so as to bring the screw into the lateral arm of the slot the watch may be drawn from the pocket as readily as if the device were not there; but to guard against having the watch drawn from the pocket by a thief, the tube is turned to bring the screw into the upper end of the longitudinal arm of the slot; then, if the watchchain is drawn upon, the tube is drawn upward upon the block, and springs force four or more or less hooks outward, which catch upon the sides of the pocket and prevent the watch from being withdrawn from said pocket.

## NEW MECHANICAL AND ENGINEERING INVENTIONS.

### IMPROVED WATER WHEEL.

Lewis A. Struble, Salt River, Mich.—This water wheel is provided with hinged buckets supported radially to the axis of the hub by projections that extend beyond their pivots and rest on the revolving hub. The buckets are claimed to work always in a position radial to the hub, and thus to secure the greatest effect from the water.

### IMPROVED MIDDLINGS SEPARATOR.

John J. Haller, Ripley, N. Y., assignor to himself and John W. Baker, of same place.—In connection with the beating and screening cylinder a fan blower is arranged with air inlets at its head and a narrow longitudinal slit at the side for spreading the blast in a thin sheet. Adjustable deflectors and a divider are provided, the latter serving to the floor that falls from the screen separate from the lighter particles that fall to the front of the case.

### IMPROVED COMPENSATING PENDULUM.

Eben M. Corwin, Barry, Ill.—In this invention the variations of the length of the pendulum wire, due to different temperatures, are compensated by placing between the ball and its supporting and regulating nut a piece of hard rubber, which, being secured to the ball by a screw at one end, and resting upon the regulating nut at the other, keeps the center of gravity of the ball at a uniform distance from the point of suspension.

### IMPROVED GAS METER.

Julian I. Alexander, Baltimore, Md., administrator of John H. Alexander, deceased.—This is an improved device that is claimed to measure the gas accurately as it passes from the service pipe to the pipe leading to the burners. It consists in an improved gas meter formed by the combination of a box, a tubular armed wheel, a spindle, and a register. In the rear side of the outer end of each of the arms of the wheel is formed a small hole, through which the gas escapes, and, by its reaction against the gas in the box, revolves the wheel, the number of revolutions of said wheel being recorded by the register, so that by calculating the quantity of gas that escapes at each revolution, and recording the number of revolutions of said wheel, the quantity of gas that passes through the machine can be accurately known. It is very simple in construction.

### IMPROVED METAL CAR FRAME.

Frederick J. Kimball, Philadelphia, Pa.—This is a novel and simple construction of a car frame of channel bars, angle bars, iron and wood corner pieces, and wood beams, whereby great strength is secured without excessive weight, and with economy in the cost. The side and end pieces of the bed frame are of channel iron, with the channel arranged outside and filled with wood, except at the corners, where metal knee filling pieces are used to make string joints by riveting or bolting the bars to them. The back of one of the bars is also extended along the back of the other, and secured to it. Through these metal corner pieces longitudinal and transverse tension rods or bolts are arranged, for straining the frame up tight. The wood filling serves for nailing the siding to, as well as for stiffening the channel bars. Other channel bars are slightly curved outward, extending through the middle portion of the bed frame from end to end, and are attached thereto by flanges and riveted to the end pieces, and supported at suitable intervals. The latter bars are curved in a horizontal plane, because the shock which occurs when the cars come together comes mainly upon the middle stringers, and when the strain is too great for the rods that pass through the thimbles the said bars will readily spread, and can be afterward easily drawn back into place. If not curved, they might bend upward or downward, so that they could not be straightened without removal from the car frame.

### IMPROVED AUTOMATIC BRAKE.

Hugh McCalip, Hope, Bartholomew county, assignor to himself and Norton R. Champion, Shelbyville, Ind.—This invention is so constructed as to be applied by the momentum of the cars as they run together when the traction power is checked, and to be withdrawn as the traction power is again applied. By pressing on the bumper the brakes will be applied on one set of wheels as long as the bumper meets with resistance on the forward motion. During this time the opposite brake wheels are held firmly in the straps, but motionless, while the axle revolves in them, the pawls being off. When it is desired to change the direction of the car, the inner end of a push bar is changed from one lever to the other. When the pulling power of the engine is checked, the brakes are automatically applied to one set of wheels and the train is stopped. The reversal of the engine now will produce no effect upon the position of the brakes; but the change in the direction of the rotation on of the axle releases the pawls from one set of wheels and causes them to take hold on the opposite ones, when the train may be backed without further obstruction, the brakes remaining open as long as the pushing continues. When the pushing power of the engine is checked, the momentum carries the train away from it and the slack motion of bumper applies the brakes to the opposite wheels, thus braking backward as well as forward.

### IMPROVED RADIAL DRILLING MACHINE.

Alfred Box, Philadelphia, Penn.—This is a contrivance of the devices comprising a radial drill, whereby the power is transmitted to the drill in whatever position it may occupy by a belt in the place of the bevel gears and shafting heretofore employed.

### IMPROVED BALING PRESS.

William B. Duncan, Huntingdon, Tenn., assignor to himself and A. F. Estes, of same place.—This is a new press for bailing cotton, hay, and other articles requiring to be compressed into bales. The improvements are mainly in the construction of a novel pawl and ratchet mechanism in connection with the follower.

### IMPROVED COUPON NIPPER AND TICKET PUNCH.

Frank Walker, Santa Barbara, Cal.—The operation of this device is as follows: A coupon is placed in an aperture when a motion of the handle detaches it. It is then forced against fingers, causing a tumbler to turn until the coupon slips from between the fingers into a receptacle. The tumbler being liberated, a spring returns it to its normal position, at the same time causing a hammer to strike the bell.

### IMPROVED OILER FOR CAMS.

John Henry Beal, Canton, Mass.—This consists in the combination of a piece of oil-saturated felt, and its spring holder, with a cam. The elasticity of the spring holds the saturated felt always pressed against the cam, and thus keeps the said cam constantly oiled.

### IMPROVED COMBINED ANVIL AND VISE.

William E. Canedy, Rochester, Minn.—This is a combined anvil and vise for the use of harness makers, tinners, farmers, and others. The vise is secured to the anvil between projecting side guides by a fastening screw, and bears, by a lateral shoulder, on the top of tne anvil.

### Artificial Butter.

*To the Editor of the Scientific American:*

Owing to the receipt of much correspondence concerning my article on artificial butter, which appeared in the SCIENTIFIC AMERICAN SUPPLEMENT, N. Y., Nos. 48 and 49, I wish to state that I own no patent on the process. The only patent held is Mage's, which is owned by the United States Dairy Company, 6 New Church street. All letters, therefore, should be forwarded to that address. The process I described in my article is simply an elaboration of that patented by Mege, and cannot be used without infringing on the United States Dairy Company's patent. HENRY A. MOTT, Jr., E. M., PH. D.
New York City.

## Business and Personal.

*The Charge for Insertion under this head is One Dollar a line for each insertion. If the Notice exceeds four lines, One Dollar and a Half per line will be charged.*



## Notes & Queries

C. A. B. will find directions for bleaching beeswax chemically on p. 299, vol. 31.—M. F. will find a description of the glacier theory on p. 90, vol. 31.—A. K. will find directions for lining casks with a waterproof tasteless compound on p. 11, vol. 34.—C. J. W. will find a description of the Solvay soda process on p. 404, vol. 34.—A. F. C. and others are informed that Mr. Seth Green's address is Rochester, N. Y.—A. L. M. will find on p. 360, vol. 34, directions for renovating clothing.—R. C. will find an explanation of the effect of the moon on the tides on p. 64, vol. 28.—A. J. B., J. K., B. L., H. K., C. F. S., N. J. W., H. A. T., B. M. S., and others who ask us to recommend books on industrial and scientific subjects, should address the booksellers who advertise in our columns, all of whom are trustworthy firms, for catalogues.

(1) R. D. L. T., of Uddevalla, Sweden, asks: Please explain the principle of Bourdon's manometer. Why does the tube straighten when the pressure rises? A. When pressure is applied to the interior of a tube having an elliptical or flat section, the tube tends to become circular. In thus changing its form, the outer portion is drawn away from the original center of the curve of the tube, and the inner portion is drawn nearer to the original center. The effect of this is to move the center of the curve, or to straighten the tube.

(2) B. R. T. says: We have a new feather bed that smells badly. Is there any remedy except renovating by steam? A. Steam renovation is the best and surest method. The feathers have been placed in the bedding while yet green. The objectionable odor may be got rid of by removing the feathers from the bed, sprinkling them with a little dilute solution of salicylic acid, and allowing them to dry in a warm room, or in strong sunlight in dry air.

(3) J. H. S. asks: What kind of ink or other substance could be used on tin (and not rub or wash off) with a rubber stamp? And what substance could be used in the same manner on porcelain or opal gas shades? A. Try a well triturated paste of dark-colored gum animé, ivory black, and turpentine. This should be prepared at a gentle temperature over a water bath.

I have tried, as you recommended, leather hose on a small force pump for pumping petroleum and its products through, and I find that the fluid penetrates the hose so freely as to render it useless. What could I use to close the pores of the leather? A. We do not know of anything that will answer these requirements. Can you not use a small leaden conduit? This would be impervious to the oil, and flexible to some extent.

(4) R. W. T. says: Please give me a recipe for waterproofing cotton rope, so that the rope can be used constantly under water, and yet impart no unpleasant taste or smell to the water? A. Saturate the materials of the rope with a strong solution of alum, drypass through a bath of dilute alkali (aqueous solution), and wash repeatedly in hot water.

How can I fasten galvanized iron balls or cylinders, with holes through the centers, on galvanized wire rope? A. If we understand you, a small screw provided with a set nut will answer; or you can make small knobs with wire, above and below the cylinder, on the wire rope.

(5) C. W. McM. says: The author of an engineer's pocket book, after giving the theoretical, gives the practical, amount of atmospheric air necessary for the combustion of 1 lb. bituminous coal as 891·18 cubic feet; and he then states, as the necessary area for the escape of this volume at the bridge wall, that it will be advantageous to make that area 2 square inches for every 13 lbs. of coal consumed, per hour, and so on in proportion. Am I correct in thus figuring: Given grate bar surface 4 feet long × 4 feet wide = 16 feet? Consuming 208 lbs. coal per hour, this gives 13 lbs. per foot square per hour. Multiplied by 2 square inches, the necessary area given, this shows 32 square inches. Is this correct? A. By the rule as given, the requisite area is $2 \times 13 = 26$ square inches; but the apparent meaning of the rule is to multiply the pounds of coal burned per hour by 2, to get the area in square inches. Of course we do not know positively what the author intended; but this is our understanding of his meaning. If you make the area between 2½ and 3 square feet, and the other parts are properly proportioned, we think you will secure satisfactory results.

(6) A. Y. McD. says: I have an upright tubular boiler; the grate is 2 feet below the flue sheet. Would it make steam more quickly if I raise the grate 8 or 10 inches? I cannot see how any heat can be lost, and yet I am told by a practical boiler maker that the nearer the fire is to the flue sheet the more economical is the boiler in full. A. If there is sufficient air space below you will not be likely to gain anything by the change.

(7) R. W. says: A 28 inch water wheel is put in under a 13 feet head; it makes 464 revolutions per minute, and drives one run of wheat stones and the necessary machinery, grinding 8 bushels per hour with ½ gate. An 18 inch wheel, under the same head, is constructed similarly in every particular, but it only makes 365 revolutions. I cannot find a satisfactory solution of the difficulty. Is there a way of calculating the speed derivable from any wheel? A. From the data sent we are not able to throw much light on your questions. If the first wheel is underloaded, and the second has an excess of work, the difference in revolutions is easily accounted for. It is quite possible, too, that the difference is due to design, and is intentional. It is not generally true that, of two wheels, the one that runs the fastest is the best. The best wheel is the one that gives the greatest effect from the water passing through it. For a given case, it can be shown that each wheel has a speed at which it will give the best effect; and manufacturers of successful wheels make use of this fact in perfecting their designs.

(8) A. C. asks: Is the shrinkage equal from middle to each end, in making a long iron casting on end? A. No; it is most at the top of the casting.

(9) C. T. McC. asks: What would be the power of a double engine connected at a right angle, 3 feet by 3 feet, cut-off half stroke, running at 120 revolutions, with 120 lbs. pressure? A. About 3,000 horse power. 2. What power would be exerted at the rim of a pulley 10 feet in diameter. A. Force at periphery of pulley about 25,000 lbs. 3. What size should a multitubular boiler be for such an engine? A. Boiler should have from 12 to 15 square feet of heating surface for each horse power of engine.

(10) T. H. Y. asks: Can you give me a recipe for checking, permanently, fermentation in wine and cider, that will not leave any flavor, as sulphite of lime does? A. Bottle the liquor, and immerse a number of the bottles, with the mouths only projecting, in a large vessel of water. Loosen the stoppers and heat the water until of a uniform temperature of 180° Fah.; then remove the bottles, stopper and seal them tightly, and place in an inverted position.

(11) T. O. M. asks: For a stern wheel boat, high pressure, what size boiler and engine do you recommend? The boat is 60 feet long, 18 feet wide, and 3½ feet deep. A. If you use a single engine, attached directly to the wheel, you may make it from 10 to 12 inches in diameter, and of 30 inches stroke. Use a locomotive boiler 40 inches diameter, 12 feet long, with from 400 to 450 square feet of heating surface in fire-box and tubes.

(12) J. F. E. asks: Can you give me a good recipe for making spirit copal varnish? A. Fuse 12 lbs. of colorless gum copal mixed with clean sand in a strong iron vessel capable of being closed airtight, and provided with a suitable stirring apparatus; close the vessel, and while the resin is still in the fused condition pump into the vessel a mixture consisting of 1½ gallons of strongest alcohol, 1 gallon oil of turpentine, and 1 quart of ether; heat for some time with constant stirring. The varnish is clarified by decantation, or, for the finest quality, by filtration through a tall column of granular animal charcoal (bone black).

(13) F. N. B. says: You say, as to winding magnets for telegraph sounders, "wind the magnet with No. 30 silk covered wire." How many feet or what weight of wire shall I use on a magnet for from 1 to 12 miles line? A. About 900 feet or a little over ½ lb. of No. 28 wire in each helix will answer very well for a line 12 miles long. 2. What kind of iron shall I use for the magnet and armature? The blacksmith's say that iron called nailrod is the softest. Would that work? A. Any kind of soft iron will answer. 3. What difference should be made in winding a magnet for a wire a few feet in length and one 12 miles long? A. About 250 feet of No. 22 copper wire in each helix will make a good set of coils for a magnet to be used in a short circuit.

(14) J. C. asks: How is tetrachloride of carbon made, and what is it used for? A. It is made from chloroform, by acting upon it with a current of dry chlorine gas, or by saturating chlorine with vapor of carbon disulphide, and passing through a red hot tube filled with fragments of porcelain. The products are carbon tetrachloride and sulphur dichloride. The last named is removed by treatment with alkalies. The method first given is to be recommended. Tetrachloride of carbon is said to be obtained as a by product in several technical operations. We do not know to what important technical uses it is applied.

(15) C. K., J. B. M., and others: There is nothing that can be added to silver or nickel electro-plating baths to so influence the deposition of the metal as to obviate the necessity of subsequent burnishing. The whole success of the electro-plater's art lies, first, in producing a smooth and, if necessary, polished surface to the particle to be plated; second, in so freeing the prepared surface from all traces of oil, grease, or metallic oxides that the metal may have absolute contact with the electrolytic deposit; third, that the bath be in proper condition and free from all dissolved, mechanical, and surface impurities; fourth, that the surface of the anode be proportioned to the surface of the cathode or object to be plated. The anode must be of the same metal as that of which the bath is a solution; and the batteries must be constant, and neither too strong nor too weak. The work should be connected with the battery at the moment of or before immersion in the electrolyte. If the current is too strong, the work will be "burned" (the deposit blackened); if too weak, it may be crystalline and liable to scale off. If the conditions are properly fulfilled, the work on coming from the bath, and after having been dried with a little sawdust and a cloth, will present a clear, smooth, metallic appearance, the luster of which is heightened by burnishing.

(16) T. N. H. says: On November 22, at San Francisco, the barometer marked 30·15 inches, at Portland 30·28, and at Salt Lake 30·24. I believe that there is a corresponding decrease in the height of the column of mercury from sea level to different altitudes, and Salt Lake is upward of 4,000 feet above the ocean. I do not understand this report of the barometer. Two years ago I obtained a glass tube of 30 or more inches in length, and from the open end carefully filled it with pure quicksilver; and having previously filled a small bottle with quicksilver, I put my finger firmly over the end of the tube, inverted it, and carefully inserted it in the bottle. There is a vacuum of some 5 inches, and the average reading of the height of the column of quicksilver are 26·5 inches. But the variations do not correspond with my ideas. For instance, it will storm when the mercury marks 26·75, and there will also be fine weather. Again, when the mercury marks 25·75, there will be fine weather and also storm. Again there will be no change or fall in the mercury until some little time has elapsed after the commencement of a storm. The altitude of this place is about 2,500 feet above the sea. Have I properly constructed my barometer? A. We think, from your account, that your barometer is somewhat defective in its action on account of the imperfect removal of air in filling it. We could not do justice to the subject in these crowded columns; but there are several works published by the Smithsonian Institution that will give you considerable information, and in the reports of the weather bureau you will find many facts relating to changes as affected by weather.

(17) A. C. R. says: I have a lump of green vitriol (sulphate of iron). When I placed it on the shelf it was clean but now it is covered with white spots. Please tell me the cause, and also what the white substance is? A. When protosulphate of iron is exposed for any length of time to a dry atmosphere, it gradually loses its water of crystallization, and is converted superficially into a dry white (or greenish white) powder. This may be avoided in great part by covering the crystals with a suitable glass shade.

MINERALS, ETC.—Specimens have been received from the following correspondents, and examined, with the result stated:

C. H. A.—It is pyrolusite. If free from iron and clay, it is worth from $10 to $20 per ton in New York city.—G. A.—It is apparently a portion of the vertebræ of some large animal. It is much broken, and we cannot classify it. The resinous-looking body is bitumen.—S. B. W.—It is sulphide of iron. See p. 7, vol. 36.—M. G. P.—The berry has been examined by several dealers in spices as well as by professional experts; but none of them are able to identify it. Send us a larger sample.—A. G.—No. 1 is trap rock, and contains nothing valuable. No. 2 is limonite, or hydrous peroxide of iron. No. 3 is partially decomposed sulphide of iron. See p. 7, vol. 36.

### COMMUNICATIONS RECEIVED.

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

On Railroad Accidents. By J. M. L.
On the Hell-Bender, etc. By W. S. A.
On Porcelain. By S. W.
On Boats at the Centennial. By J. G. S.

Also inquiries and answers from the following:

H. H.—J. P.—J. N. H.—R. K. B.—J. F. P.—C. S. W.—C. N.—G. G.—R. D. C.—A. B. W.—S. H. L.

### HINTS TO CORRESPONDENTS.

Correspondents whose inquiries fail to appear should repeat them. If not then published, they may conclude that, for good reasons, the Editor declines them. The address of the writer should always be given.

Inquiries relating to patents, or to the patentability of inventions, assignments, etc., will not be published here. All such questions, when initials only are given, are thrown into the waste basket, as it would fill half of our paper to print them all; but we generally take pleasure in answering briefly by mail, if the writer's address is given.

Hundreds of inquiries analogous to the following are sent: "Who sells sail canvas suitable for ice boats? Who makes hardened glass tubes for water gauges? Who sells lactometers? Whose is the best electric engines? Who sells bisulphide of carbon?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

# INDEX OF INVENTIONS

FOR WHICH

**Letters Patent of the United States were Granted in the week Ending**

**December 19, 1876.**

**AND EACH BEARING THAT DATE.**

[Those marked (r) are reissued patents.]

A complete copy of any patent in the annexed list including both the specifications and drawings, will be furnished from this office for one dollar. In ordering, please state the number and date of the patent desired, and remit to Munn & Co., 37 Park Row, New York city.

Fuel into furnaces, powdered, G. K. Stevenson ... 185,592
Gang plow, L. Chapman ... 185,693
Gang plow, E. W. Walton ... 185,601
Gas apparatus, J. H. Eichholz ... 185,508
Grading machine, I. Coppock ... 185,500
Grain and stock rack, J. C. Wright ... 185,416
Grain drill, J. C. Daman (r) ... 7,434
Grain separator, E. H. Osborn (r) ... 7,441
Hand binder, G. H. Spaulding ... 185,459
Hand corn sheller, Pirrung & Zirbes ... 185,575
Harness saddle, E. B. Caboone ... 185,368
Harness saddle, J. H. Garrett ... 185,517
Hay elevator, J. A. Cross ... 185,432
Hay gatherer, Butner & Ray ... 185,498
Hay rack, D. Goff ... 185,524
Hedge plants, setting, C. R. Walter ... 185,602
Heel burnishing machine, M. V. B. Ethridge ... 185,509
Hinge C. E. L. Holmes (r) ... 7,439
Hoisting apparatus, J. F. Wolfrum ... 185,414
Horse collar, J. Fletcher ... 185,433
Horseshoe nails, making, D. Dodge (r) ... 7,435
Hose coupling, C. M. Chase ... 185,494
Hydrostatic hoist, L. C. Goodale (r) ... 7,438
Invalid chair, C. H. Hermann ... 185,444
Ironing board, W. H. Allison ... 185,422
Jack last, C. D. Bigelow ... 185,478
Keyhole guard for locks, C. H. Covell ... 185,502
Labeled tobacco plug, L. Lottier ... 185,558
Labels, etc., preparing, A. MacBrair ... 185,400
Lamp chimney cleaner, J. Collins ... 185,431
Land roller, N. N. Lord ... 185,557
Lead pipes, making, L. M. Rumsey ... 185,496
Leather, hammering, C. D. Bigelow ... 185,477
Lifting jack, J. Heuermann ... 185,530
Lightning rod, J. J. Cole ... 185,430
Liquid dropper for bottles, C. E. Davis ... 185,433
Liquid-forcing apparatus, W. Noll ... 185,565
Lock for machine guns, D. C. Farrington ... 185,510
Locomotive spring, J. Jenkins ... 185,542
Lubricator, Gageby & James ... 185,516
Lubricator, adjustable, J. Edson ... 185,392
Magazine fire arm, C. B. Hunt ... 185,539
Magazine fire arm, F. Vetterlin ... 185,509
Marsh shoe, Locke & Bashaw ... 185,378
Match plane, P. A. Gladwin ... 185,442
Measuring pump, L. R. Shell ... 185,583
Middlings separator, F. B. Harnish ... 185,526
Milk cooler, N. D. Ferguson ... 185,511
Moccasin, I. Gregory ... 185,522
Money drawer, S. Zimmerman ... 185,618
Mowing machine sharpener, W. C. Barker ... 185,424
Multiplex telegraph, G. Smith ... 185,589
Music stand and walking cane, W. Brand ... 185,425
Musical instruction, device for, R. S. Hill ... 185,532
Napkin holder, J. J. Ackerman ... 185,419
Nut lock, H. Simpson ... 185,585
Office slate, Chase & Harris ... 185,429
Oil cup, automatic, S. P. Donkel ... 185,505
Oil tank, S. D. Osborne ... 185,453
Opera chair, G. Floyd ... 185,512
Pan wiring machine, W. Foglesong ... 185,513
Paper bag, J. Arkell ... 185,409
Paper box, J. R. Van Vechten ... 185,598
Paper fastener, R. A. Shinn ... 185,457
Pavement, D. C. Heller ... 185,529
Pencil case, J. Monaghan ... 185,562
Petroleum cooking stove, F. Hilderbrandt ... 185,533
Plashed fence, W. Young ... 185,616
Plow, C. Billups ... 185,383
Plow, C. W. Flippen ... 185,437
Plow, C. Myers ... 185,450
Postal paper tablet, A. G. Buzby ... 185,489
Propelling vesses, H. F. Pardey ... 185,454
Pulley block, J. Weir (r) ... 7,444
Quadruplex telegraph, G. Smith ... 185,588
Radiator, J. Shackleton ... 185,582
Rake and tedder, combined, R. Wilson ... 185,612
Reciprocating churn, A. V. B. Orr ... 185,468
Recorder, M. Howie ... 185,537
Refrigerator, E. B. Smith ... 185,586
Registering ballot box, J. Powell ... 185,577
Return tubular boiler, R. Ehman ... 185,434
Revolving bookshelf, J. J. Bisel ... 185,365
Revolving stand, J. J. Bisel (r) ... 7,437
Rocking chair, W. E. Buser ... 185,487
Sad iron grinder, J. F. Bless ... 185,386
Sad iron heater, M. Little ... 185,556
Sash cord fastener, C. Hintzman ... 185,535
School desk hinge, A. A. Womack ... 185,415
Scrap book, F. Bowman ... 185,482
Screw driver, C. H. Bush ... 185,486
Screw propeller, J. Burson ... 185,485
Seat and back for chairs, etc., R. H. Plass ... 185,576
Seeding machine, E. E. Leach ... 185,397
Self-acting door bolt, W. J. Hinde ... 185,534
Sewing machine, T. A. Macaulay ... 185,399
Sewing machine table hinge, L. T. Jones ... 185,543
Shoe, J. Walden ... 185,463
Signal lantern, E. W. Gerrish ... 185,440
Sled, J. H. Brown ... 185,387
Sliding door, L. Conroy ... 185,490
Snap hook, A. H. Bell ... 185,475
Split keys, forming, W. Gibb ... 185,441
Spool silk cabinet, L. O. Smith ... 185,409
Spring bed bottom, Collins & Lillie ... 185,497
Spring curtain roller, E. B. Lake ... 185,549
Stalk and weed turner, Yaggy & Loop ... 185,417
Staples, making, W. Rennard ... 185,405
Steam pile driver, T. M. Skinner ... 185,458
Steam plow, G. F. Brott ... 185,483
Steam pump machinery, G. H. Corliss ... 185,391
Stockings, making, M. Marshall ... 185,564
Stone, artificial, L. L. Leathers ... 185,554
Stone, artificial, J. L. Rowland ... 185,456
Stove pipe damper, O. Poole ... 185,434
Stove pipe damper, J. Rhamy ... 185,579
Stove pipe thimble, S. Selden ... 185,581
Stuffing box, F. M. McMillan ... 185,401
Stump puller, J. Richter ... 185,580
Syringe, W. V. Wallace ... 185,464
Table hinge, F. R. Wolfinger ... 185,613
Tail nuts, making, Charles & McKain ... 185,495
Tailor's measure, W. Venner ... 185,412
Tent, J. H. Mapleson ... 185,559
Thill coupling, G. W. Haskell ... 185,528
Tilting chair, M. D. Connolly ... 185,501
Tin pail, T. Evans ... 185,435
Toe protector, boot, C. D. Bigelow ... 185,479
Toy money box, A. C. Gould ... 185,443
Trace holder, C. I. Calvert ... 185,490
Transit, slaughter house, Burness & Kincaid ... 185,427
Transportation package, N. Halsted ... 185,525
Trunk fastener, H. Ahrend ... 185,471
Turbine water wheel, Andrews & Brown ... 185,467
Type writer, W. H. Snider ... 185,590
Unloading vessels, W. Van Dusen ... 185,596
Vacuum brake, C. A. Boston ... 185,481
Valve for ice machines, T. L. Rankin ... 185,578
Valve seat, J. F. Cook ... 185,496
Velocipede, G. W. Marble ... 185,403
Ventilating cars, etc., J. C. Bates ... 185,474
Wash board, J. W. Latcher ... 185,552
Wash board, J. W. Latcher ... 185,553
Washing machine, T. L. Peirce ... 185,574
Water pipe, A. G. Haskell ... 185,396
Water wheel, A. Jamison ... 185,541
Weft knitting machine, Spencer & Pingree ... 185,411
Wheelbarrow, metal, J. Kidd ... 185,546
Whip and rein holder, J. W. Weddel ... 185,605
Wind wheel, E. H. Gregory ... 185,523
Winding paper, G. Howland ... 185,538
Windmill, L. D. Anderson ... 185,423
Winnowing machine, C. Haggenmacher ... 185,398
Wire bending machine, W. Foglesong ... 185,514

## DESIGNS PATENTED.

9,672.—RAILINGS.—W. Tweeddale, Brooklyn, N. Y.
9,673.—STOVES.—N. S. Veeder et al., Troy, N. Y.
9,674.—STOVES.—N. S. Veeder et al., Troy, N. Y.
9,675.—STOVES.—N. S. Veeder et al., Troy, N. Y.
9,676.—STOVES.—N. S. Veeder et al., Troy, N. Y.
9,677.—STOVES.—N. S. Veeder et al., Troy, N. Y.
9,678.—STOVES.—N. S. Veeder et al., Troy, N. Y.
9,679.—GLASSWARE.—J. B. Lyon, Pittsburgh, Pa.

### FOR THE WEEK ENDING DECEMBER 26

Abdominal supporter, R. T. Reed ... 185,792
Air chamber, water pipe, H. Pennie ... 185,645
Animal trap, Z. J. Anderson ... 185,620
Anti-friction journal box, Wilkes & Port ... 185,711
Atmospheric gas engine, J. Wertheim ... 185,709
Bed bottom, D. Pratt ... 185,780
Bed bottom, J. E. Praul ... 185,779
Blackboard eraser, C. J. Higgins ... 185,677
Blacking bottle, S. S. Newton ... 185,693
Blind stile boring machine, E. Cather ... 185,624
Boot and shoe, G. Stribley ... 185,797
Boot tip leather, A. Van Wagenen ... 185,803
Bottle cork fastener, D. G. Smith ... 185,793
Bottle stopper, S. S. Newton ... 185,694
Box nailing machine, G. H. Perkins ... 185,777
Breech loading fire arm, H. Borchardt ... 185,721
Brick from slag, C. Wood ... 185,712
Brick kiln, R. Carroll ... 185,668
Brush, L. Uttz ... 185,738
Buckboard wagon, R. P. & A. King ... 185,756
Burglar alarm, W. Fischer ... 185,738
Butter dish, W. E. Hawkins ... 185,746
Car brake, J. C. Wands ... 185,804
Car coupling, J. Philips ... 185,646
Car roof, W. C. Allison ... 185,715
Car starter, H. Schreiner ... 185,648
Carbon in metals, testing, C. M. Ryder ... 185,647
Carriage step, D. A. Kimbark ... 185,755
Carriage wheels, cleaning, R. S. Bacon ... 185,660
Centering device, W. P. Tullock ... 185,706
Chair, A. B. Stevens ... 185,796
Child's carriage, A. A. Winsor ... 185,655
Chimney, M. L. Ghirardini ... 185,741
Cigarette holder, C. Lammertz ... 185,641
Coffee pot, J. Cromwell ... 185,730
Corn drill, J. B. Farmer ... 185,735
Corn planter, J. R. Matlack ... 185,642
Corn planter, M. E. McVickers ... 185,771
Cotton sweep, H. C. Buhoup ... 185,722
Crimping machine, O. Noack ... 185,774
Cultivator, H. H. Pattee ... 185,775
Curtain fixtures, E. B. Lake ... 185,762, 185,763
Dental cavity cap, H. Weston ... 185,710
Dental disinfected floss silk, E. P. Brown ... 185,666
Dental engine attachment, J. E. Swallow ... 184,651
Dental rubber clamp, E. P. Brown ... 185,665
Desulphurizing ores, G. T. Lewis, (r) ... 7,448
Direct acting engine, J. B. Waring ... 185,805
Door latch, Matson, Phillips & Barmore ... 185,769
Door lock, J. H. Kinsman ... 185,759
Double acting pump, E. H. Perkins ... 185,776
Draft attachment, G. W. Wilson ... 185,809
Drawbar for railway cars, A. Milliken ... 185,643
Draw coupling for boats, etc., S. M. Fulton ... 185,634
Drier, G. A. Deitz ... 185,672
Dumping wagon, Bullock & Hanigan ... 185,767
Dyeing thread and yarn, W. Clark ... 185,625
Earth auger, F. D. Hubbard ... 185,638
Egg carrier, A. R. Sprout ... 185,794
Electro vapor bath, G. W. Brown ... 185,622
Envelope, J. Collins ... 185,727
Envelope machine, H. D. & D. W. Swift ... 185,798
Extension table, J. R. Shirley ... 185,649
Extension table slide, J. H. Ryder ... 185,701
Fastening for Bessemer converter, W. R. Jones ... 185,753
Feed, hot air furnace, W. J. Hallefas ... 185,745
Floor clamp, J. M. Wilson ... 185,810
Fly trap, H. Belmer ... 185,717
Fly trap, J. W. Bridwell ... 185,664
Fly trap, F. M. Carroll ... 185,724
Frame building, Morris & Slanser ... 185,690
Friction clutch, S. Peppard ... 185,636
Furnace, steam decomposing, A. Weber ... 185,806
Gas regulator, Fenn & Greeninger ... 185,736
Gas stove, J. Q. Birkey ... 185,720
Gate, T. F. Timby ... 185,801
Gate, J. S. Winsor, (r) ... 7,451
Gig harness saddle, J. Neill ... 185,692
Governor, J. M. Napier ... 185,691
Hair curler, C. A. Idler ... 185,751
Handle plate, door, etc., J. Collins ... 185,628
Harvester, J. F. Appleby ... 185,620
Harvester frame adjuster, King & Funk ... 185,683
Hat, J. P. Beatty ... 185,716
Hearth plate, R. J. King ... 185,757
Horse brush, Holmes & Laurence ... 185,749
Horse creeper, J. D. Rosenberger ... 185,700
Horse detacher, L. L. Fallis ... 185,734
Horse hay rake, E. Uson, (r) ... 7,447
Hydraulic cloth presser, W. B. Leachman ... 185,965
Hydro-sulphurous acid, making, W. D. Jones ... 185,640
Indicator, steam engine, Minor & Rae ... 185,773
Knitting machine, M. Landenberger, Jr. ... 185,764
Knitting machine kneedles, S. Woodward ... 185,718
Knob latch, C. S. Jennings ... 185,752
Knob latch, J. H. Kinsman ... 185,760
Label holder, S. A. Hughes ... 185,680
Labeling machine, J. Bigelow ... 185,719
Lamp burner, G. Chinnock, (r) ... 7,445
Lamp extinguisher, H. A. Chapin ... 185,726
Lamp wick, W. F. Hopkins ... 185,679
Lathe, metal turning, S. Johnson ... 185,682
Letter sheet and envelope, L. H. Rogers ... 185,785
Lock for doors, etc., J. H. Kinsman ... 185,761
Lock for trunks, etc., I. Ramsey ... 185,781
Locks, face plate for, F. W. Mix ... 185,689
Lozenge machine, T. Robertson ... 185,698
Lumber, etc., straightening, R. S. Gillespie ... 185,742
Marsh shoe, G. O. Bergland ... 185,718
Mash machine, brewers, J. Schafhans ... 185,702
Metal cap linings, tightening, C. Hope ... 185,637
Milk can, L. A. Sunderland, (r) ... 7,450
Nozzle for cans, S. R. Pinckney ... 185,697
Nut lock, S. D. Enochs ... 185,633
Nutmeg grater, I. Foote ... 185,675
Oil can, W. H. & W. J. Clark ... 185,626
Oil stove, S. M. Chamberlain ... 185,670
Ornamenting buttons, F. H. Goldthwait ... 185,635
Ornamenting book edges, F. E. Grady ... 185,743
Oven, F. Howes ... 185,750
Padlock, J. H. Kinsman ... 185,758
Paint can, P. Hickey ... 185,748
Paper ruling machine, W. O. Hickok ... 185,747
Paper vessel, A. Wuensch ... 185,812
Passenger register, J. W. Fowler ... 185,740
Pavement, Stamp & Haydon ... 185,795
Peat fuel, manufacturer of, D. Aikman ... 185,657
Percussion drop toy, A. M. Smith ... 185,650
Photograph surfaces, P. A. Despaquis ... 185,674
Piston rod packing, P. W. Richards ... 185,784
Plaiting machine, J. W. Cox ... 185,671
Postal cards, back for, L. Davis ... 185,630
Potato harvester, F. N. Cole ... 185,627
Propelling boats, A. Belz ... 185,662
Pump, W. Adair ... 185,619
Pump, F. Scholiar ... 185,787
Railroad tie, D. S. Whittenhall ... 185,808
Rawhide, treating, P. Sweeney ... 185,799
Reciprocating churn, D. P. Bliss ... 185,663
Reciprocating churn, Gum & Seawell ... 185,744
Reed organ stop action, J. S. Robinson ... 185,699
Roofing tile, G. Elbreg ... 185,632
Rotary churn, J. Joseph ... 185,754
Sad iron, W. H. Savery ... 185,785
Salt, making, A. T. Brown ... 185,667
Sawing and boring wood, etc., T. & J. O. Stevens ... 185,795
Screw threads, cutting, D. W. Burnham ... 185,723
Screws, making metal, A. W. Gifford, (r) ... 7,446
Self-acting steam trap, T. E. McNeill ... 185,770
Sewing machine, embroidering, J. Wood ... 185,811
Sewing machine needle holder, G. W. Levin ... 185,766
Shaving mug, J. W. Smith ... 185,791
Snap hook, L. J. Johnson ... 185,639
Sofa bedstead, F. W. Lammers ... 185,684
Sofa bedstead, A. Towski ... 185,802
Spikes, etc., making, J. H. Swett ... 185,652
Spinning spindle cap, C. Weller ... 185,807
Spraying tobacco, Smith & Messinger ... 185,790
Spring hinge, J. Spruce ... 185,794
Spring pillow, A. Underwood ... 185,797
Stave jointer, H. A. Crossley ... 185,629
Stave joining machine, E. W. Gillman ... 185,676
Steam boiler feeder, N. Yagn ... 185,656
Steam gauge, F. H. McIntosh ... 185,697
Stove, J. W. Elliott ... 185,674
Sulky plow, C. R. Conway ... 185,729
Suspension hook, L. W. Pennell ... 185,644
Tackle block, Simpson & Pope, (r) ... 7,449
Three horse equalizer, R. Hoadley ... 185,636
Toy, automatic, Maguire & Gallot ... 185,768
Toy blow gun, A. M. Smith ... 185,789
Traction engine, J. H. Swett ... 185,653
Triple furrower, Anderson, Higgins & Danner ... 185,658
Tuning pipe, W. G. Cook ... 185,728
Turbine water wheel, S. M. Smith ... 185,788
Turf and grubbing colter, S. M. Lovell ... 185,686
Type writer, R. T. P. Allen ... 185,714
Umbrella, J. P. Onderdonk ... 185,695
Umbrella, J. Willis ... 185,654
Underwaist, S. F. Follette ... 185,739
Vehicle hub, S. H. Thomas ... 185,800
Wagon body and top, F. H. Burnham ... 185,623
Wash bench, D. B. Pond ... 185,778
Wash boiler, W. H. Hopkins ... 185,678
Washing bristles, etc., T. J. Ferguson ... 185,737
Washing machine, J. Donaldson ... 185,631
Washing machine, Smith & Collison ... 185,792
Watch, safety pinion, Barnum & Ferguson ... 185,661
Water elevator, J. F. Long ... 185,685
Water elevator, T. J. Reid ... 185,783
Weighing scales, L. W. Cross ... 185,731
Wheel plow, C. F. Chambers ... 185,725
Wick attachment, lamp, J. C. Shopland ... 185,736
Window, G. W. Dickinson ... 185,732
Window screen, F. N. Johnson ... 185,681
Wire fence barb, J. C. Merrill ... 185,688
Wire frame for tile stands, G. D. Dudley ... 185,733
Wood coloring composition, J. G. Cashin ... 185,669
Wool combing machine, S. Metcalfe ... 185,772
Writing, device for secret, A. Berghold ... 185,621

## DESIGNS PATENTED.

9,680.—CARPET FABRIC.—A. Heald, Philadelphia, Pa.
9,681.—CHAIR FRAMES.—T. J. Palmer, New York city.
9,682.—SOFA FRAMES.—T. J. Palmer, New York city.
9,683.—BOTTLE STOPPER.—C. R. Steele, Waukegan, Ill.
9,684, 9,685.—STOVES.—N. S. Vedder et al., Troy, N. Y.

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| On issuing each original Patent | 20 |
| On appeal to Examiners-in Chief | 10 |
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| On application for Reissue | 30 |
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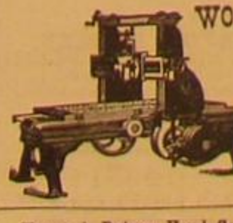

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