SCIENTIFIC AMERICAN

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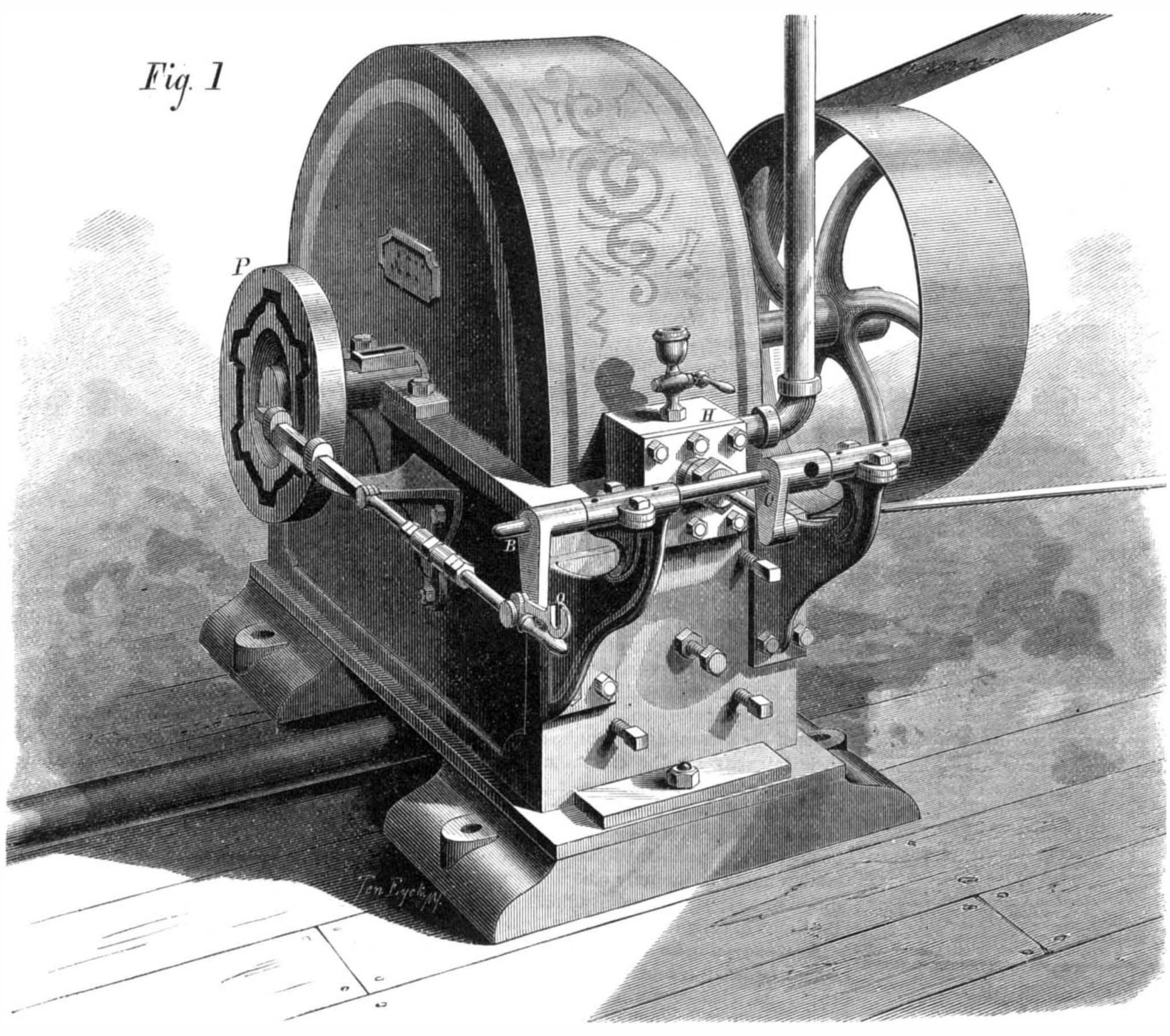
IMPROVED STEAM WHEEL.

We illustrate herewith a novel form of steam engine, to which the inventor has given the above title. While outwardly resembling a machine of the rotary type, it will be seen that, though allied nearest to that class, it is not a true rotary engine in the sense of one in which the steam follows the piston around the circle; for here the impulsive power is communicated only over a segment of the entire periphery. The advantages claimed are, besides simplicity of construction, the working of the steam at the same leverage at all points of the circle, and its use expansively "from boiler pressure down to atmospheric pressure in place of exhausting it under high pressure." The machine is intended to run slowly, and hence friction is reduced, while it is further claimed to move uniformly without back lashing, to be free from the accidents peculiar to reciprocating engines, and to save a large percentage of fuel.

Fig. 1 is an exterior perspective view, and from Fig. 2 the working parts will be understood. The wheel, the shaft of which rotates in bearings in the case, has ring flanges on the edges of its face, making a wide and deep channel thereon. Six or more arms connect the rim to the hub, midway between which and on the face of the wheel are formed deep transverse recesses, in which work the radial pistons, A. To the inner edge of each piston is attached two or more rods, B, which pass through stuffing boxes, so as to prevent any steam from leaking around them into the interior of the wheel. These rods are secured to boxes in which are placed bars, C, said bars being held out by springs. As the bars pass through slots in the ends of the boxes, the pistons are thus allowed a little play, while the springs also serve to hold them against packing, noted further on. At D are radial bars attached to the rim and the hub of the wheel. In guide slots in these the ends of bars, D, enter, and they also pass through holes in the long arms of levers, E, which are pivoted to the wheel arms. To the short arms of said levers are pivoted bars, F, which slide in keepers on the wheel rim, and have pins on their ends. These pins carry friction rollers which move in guide slots, G, in the sides of the case. The object of the jogs in said slots is to throw the pistons, A, out to receive steam, and to draw them in at the exhaust ports.

Fig. 1



THOMAS' STEAM WHEEL.

Fig. 1 is the steam chest, resting upon the upper edge of the case and fastened to packing, I, Fig. 2, which is curved upon the arc of the circumference of the wheel, and has abutments, J, to fit into the space between the rim flanges. These abutments are beveled as shown, and are provided with brasses held out against the rim by springs. The brasses have arms which, in similar manner, are pressed against the inner side of the wheel flanges. They are also so constructed that they may be expanded and contracted longitudinally to allow of nice adjustment to the wheel. On their inner side, a plate is provided, acted on by springs to prevent steam from passing between their parts when they are expanded. The packing, I, rests on a concaved block, K, which may be moved forward and back by the screw, L; it may be adjusted so as to cause the packing to bear squarely against the face of the wheel, by four set screws. The block is held down by flanges, one of which enters a keeper in the case, and the other passes out through an aperture in the end of the same. The latter flange is slotted to receive a screw for further securing. M is the exhaust port.

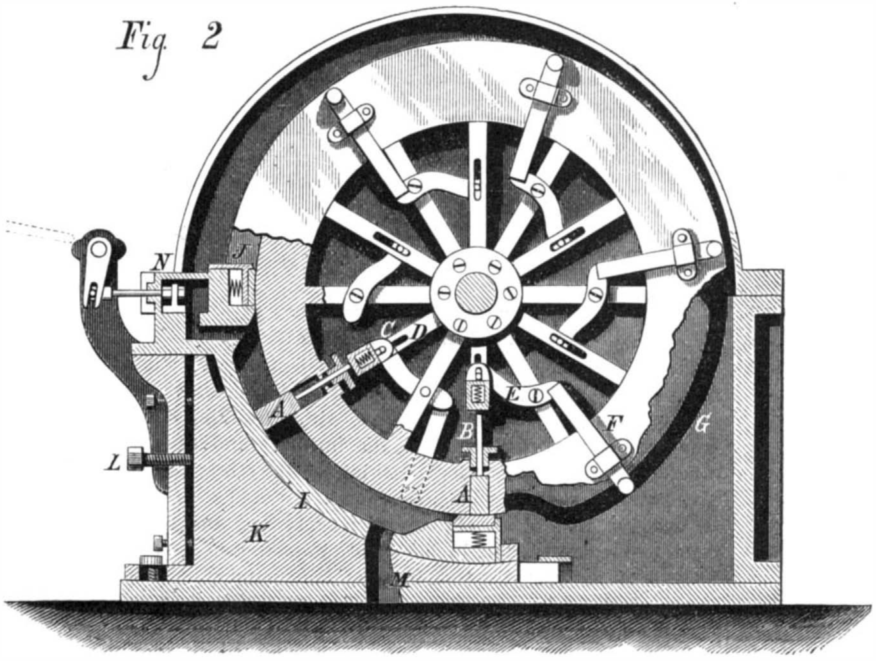
The entrance of steam through the inlet port is regulated by the valve, N, the stem of which is pivoted to an arm on the rock shaft, B, Fig. 1. A crank arm on this shaft receives a notch on the connecting rod, which is guided in a bracket on the case. A pin on the rod enters a groove in the side of wheel, P. This groove has as many offsets as there are pistons, A, and these are in such positions as to operate the valve to admit steam as each piston passes the inlet port, the length of the curve regulating the length of time in which the valve is held open.

By suitable construction, the connecting rod may be regulated to govern the throw of the valve; and by engaging the hook, Q, on the protruding end of the shaft above, the notch in the rod is raised from the crank, so that the valve may be operated to start the wheel regardless of the position of the same. The hole shown in the rock shaft is for a hand lever, so that the valve may be operated by hand for starting the wheel.

The inventor states that he has experimented on this engine for two years, and that he is satisfied that probably a saving of fifty per cent of the fuel expended in using the common forms of steam engines may be effected by using the steam wheel here illustrated.

Patented through the Scientific American Patent Agency, January 30, 1877. For further information relative to purchase of patent rights, etc., address the inventor, Mr. J. C. Thomas, Carlinville, Macoupin county, Ill.

Fig. 2



THOMAS' STEAM WHEEL.

A New Life-Saving Rocket.

Captain F. F. Atkinson, of the British army, is soon to conduct a series of experiments at Sandy Hook on a new life-saving rocket. The invention has already, we learn, been adopted by the English Board of Trade. It consists of a long cylinder, in which there are four tubes filled with powder; the end of the tube is closed by a plate of iron, in which are four holes, corresponding to the four tubes; firmly fixed on the plate, so that it cannot revolve, is a four-bladed screw. When the fuse is ignited the gas generated by the combustion of the powder rushes violently against the helicoidal surfaces and imparts to the rocket a rotary motion, which gives it a steadiness similar to that of a conical rifle bullet. The war rockets have a shell head, which is filled with Greek fire, nitroglycerin, or any other explosive or inflammatory substance. In the life-saving rocket this shell may be omitted, or a magnesium light can be placed there for the double purpose of a danger signal and of showing the position of a wreck. The line is made fast to a short chain, attached to the rocket by a double swivel, thus preventing the destruction of the line by fire. The rocket is discharged from a V-shaped steel slide mounted on wheels. In the early part of December, the inventor, Mr. J. Singleton Hooper, drove six rockets a distance of 350 yards, over a vessel 60 feet in length, each rocket falling with great accuracy.

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(Illustrated articles are marked with an asterisk.)

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New subscriptions will be entered from the time the order is received; but the back numbers of either the SCIENTIFIC AMERICAN or the SCIENTIFIC AMERICAN SUPPLEMENT will be sent from January when desired. In this case, the subscription will date from the commencement of the volume, and the latter will be complete for preservation or binding.

THE PRESERVATION OF LEARNING.

Printing has been aptly styled the art conservative of all the arts. But what shall conserve the products of the art of printing?

As was shown in our recent suggestion "For Posterity," books and papers as they are now printed are exceedingly short-lived; and the chance that any existing print will be preserved a thousand years, if matters take their ordinary course, is slight indeed. Even of the writings that have been considered most sacred, and have been guarded most religiously, perfect copies a thousand years old are extremely rare. And when we take into account the vicissitudes of five, ten, or fifty thousand years, the likelihood that our remote posterity will retain any literary record of these days, or any exact knowledge of the civilization we enjoy, is too slight to be entertained for a moment. Yet it is certain that, whatever may be the condition of mankind at any future epoch far remote from us, such a record would be of inestimable value. Our suggestion, therefore, was that an effort be made to put into imperishable form some of the more valuable of the representative works of modern civilization, and store them away in some secure place for the benefit of future ages.

A correspondent, who favors the idea, suggests that the cost of imperishable stereotype plates might be saved by the use of gum copal. The fact that this substance has withstood the elements for such a considerable period, as is indicated by the conditions under which it is found, is ample proof of its durability under ordinary circumstances; and all that would have to be specially guarded against would be its possible exposure to fire.

The plan proposed is briefly this: To varnish on both sides the printed sheets to be preserved, and then by the application of heat and pressure mould them into solid blocks. This done, the blocks might be placed in earthen vessels and covered with melted copal. Thus, like flies in amber, the ideas of the present age might be fossilized and laid away in their integrity for the entertainment or enlightenment of times to come. Buried under public buildings, or other structures likely to remain in some form to challenge the curiosity of explorers—geologists, maybe, of some distant geological era—such fossilized records of our day and generation might be the only clue to the mental and moral condition of a type of humanity that had long since passed to the limbo of forgotten existences.

As we urged before, the cost of such a legacy to posterity would be small compared with the benefits it would carry. If the amended suggestion should be adopted, the relative cost would be infinitesimal. Before, we merely threw out a suggestion; now we would make a serious proposition. It is this:

In a few years one of the grandest monuments of the age will be erected in or near this city—the magnificent gift of France in commemoration of our Centennial year. When we are building the tower on which to set the colossal statue of Liberty giving Light to the World, let us make room in the foundation, or elsewhere, for a legacy of intellectual light to remote posterity. Without weakening the structure in the least, spaces might be left for storing our more precious and instructive volumes, duly embalmed in copal or otherwise, to remain undisturbed until the celebration of our tenth centennial year, or longer, in case the preservation of ordinary books and records should be more satisfactory than we have anticipated. This would simply be carrying out in a more scientific and comprehensive way the common practice of depositing newspapers and transient matter in corner stones. A more favorable opportunity for setting a signal example to the civilized world touching this matter is not likely soon to occur than in connection with the light-bearing statue of Liberty; nor a more appropriate opportunity. Let it be done!

THE BLUE GLASS EPIDEMIC.

The blue glass epidemic continues its silent progress; it is now quite common along our streets and avenues to see frames of the azure crystals hanging within dwelling house windows; while, on sunny days, the invalid grandfather or other patient, may be noticed basking in the ethereal rays, his countenance filled with hope, though streaked with blue. In one case, that of an old lady of seventy-four, that lately came to our knowledge, in her desire to secure the coveted benefits of the blue, she took her seat before the glass after the sun had nearly gone down, and in a short time declared that the blue glass had thrown her into a perspiration. This suggests the possibility that the blue glass may be used to better advantage, upon some persons, in the absence of sunshine, and perhaps in the absence of light.

The proprietor of an extensive medical bath-house informs us that, in deference to the demands of his patrons, he has placed blue glass in his windows; but the only practical effect thus far perceived is to make his premises dark and gloomy, especially on cloudy days. He states as the result of his observations, extending over several years, that patients derive the most benefit from air baths in pure sunshine, without the interposition of any glass whatever.

Upon what basis or evidence does the supposed power of blue glass upon the animal economy rest? Upon no other, apparently, than the ludicrous inferences and whimsicalities of good old General Pleasonton, whose ideas of science and mathematics seem to be sadly mixed. Being requested, by the President of the Philadelphia Society for Promoting Agriculture, to explain to that body the nature and facts of his discovery, he gave the following as its original experimental basis: On the 3d of November, A.D., 1869, he imprisoned three sows and a barrow pig, all weighing 203 lbs., in a common sty; and on the same day, three other sows and a barrow pig, all weighing 167½ lbs., in a blue glass sty. On the 4th day of March, 1870, the animals were weighed, and it was found that the common sty pigs weighed 537 lbs., the blue glass pigs 522½ lbs. Allowing for the original difference in weight, this showed a gain for the blue glass pigs of 21 lbs., or 5¼ lbs. each pig, in four months' time. From these and other comparisons the General infers that "it seems obvious that the influence of the violet-colored glass was very marked." He, however, states that the barrow pig in the common pen increased 151 lbs., while the barrow pig in the blue glass pen only increased 124½ lbs. Here is a gain of 26½ lbs. in a single animal in the common sty over a single animal confined in a blue glass sty. The General explains this by saying that the common sty pig was a strong fellow who stole more food from his companions than well behaved swine are expected to take. But any person not a blue glass believer would naturally infer that the reason why the common sty pig gained 26½ lbs. over the blue glass pig was that, for barrow pigs at least, the blue glass was a damage rather than a benefit. After mentioning these pig experiments and that of a calf, the General proceeds to explain to his hearers that it is electricity evolved by blue glass that makes it so powerful; it is electricity, he says, that produces the sparks that we sometimes see when a horse's shoe strikes the pavement; electricity, he says, ignites the hydrogen gas which is evolved when two sticks of wood are rubbed together until fire is produced. But here the General's science is as lacking in weight as his blue glass barrow pig. It is the affinity of oxygen for the heated particles of iron or wood that causes the spark and the combustion he mentions, not the evolution of hydrogen or electricity.

It is well known that Dr. Crookes' admirable little instrument, the radiometer, is very sensitive to electricity; and if, as the General supposes, the blue glass rays have superior electrical or other power, the vanes of the instrument should rotate faster under blue glass than under common glass. But a friend of ours, who lately tried the experiment, reports that, while his radiometer made 135 turns per minute in the sunlight, behind ordinary window glass, it fell to only 60 turns a minute when placed behind a sheet of General Pleasonton's blue glass. If, then, we designate 135° as the indicated power of common light in this experiment, we lose 75° of power by the use of the General's blue glass; which corresponds relatively, to some extent at least, with the loss of pork power experienced by the General in the use of his famous blue glass experiment upon the barrow pig.

A CURIOUS HISTORY OF AN OLD INVENTOR.

A queer bit of history concerning an inventor has recently been unearthed in England, which may well serve as a com panion piece to the interesting article on Papin's achievements, which Professor Joy recently contributed to our columns. Solomon De Caus was engineer and architect to Louis XIII., King of France; and he stands fourth in chronological order on that list of the original discoverers of steam power, which is headed by Hero of Alexandria. In 1615, De Caus published a book quaintly entitled the "Causes of moving forces, with divers machines useful as well as pleasant," in which he states that "water will, by the aid of fire, mount higher than its level;" and he describes a globe filled with water and an attached vertical pipe, through which the water was elevated by the expansion of the steam generated by heating the vessel. This is the sum and substance of De Caus' discovery, but it is obviously one of importance; and even in the early period when it was produced, it attracted the attention of scientific men, and among others that of the Marquis of Worcester. That noble inventor seems to have appropriated De Caus' idea, and many years later he described in his "Century of Invention" a substantially sim ilar device to De Caus', which he constructed and operated, and on which his fame as another original inventor of the steam engine is founded.

So much for fact and for De Caus' work, and by way of preamble to his history. That record, as usually met with, is to the effect that Solomon one day suddenly vanished, that he fell a victim to royal jealousy, and that he was imprisoned for being ahead of his time. Subsequently he went mad, and was shut up in an asylum, and there he was visited, says the chronicle, by the Marquis of Worcester, who, during a lucid interval of the unhappy inventor, obtained from him the secret of his discovery. All this makes a very tragic story, which the world has credited for about forty years, and which has placed Solomon de Caus in popular estimation in a high place among the "martyrs of Science."

The difficulty is, however, that the statements are pure fiction; and that the inventor's reputation was manufactured for him by the brilliant imagination of a not over-conscientious editor, is the substance of the story which our English contemporary now vouches for as truth. In 1834, there existed in France a journal called the *Musée des Familles*, which was addicted to blood-curdling romances, after the fashion of many of our present periodicals. The editor, wanting an illustration of a maniac in a cell to illustrate some harrowing recital, ordered a suitable engraving. But the engraver failed to finish his work in time, and the cut was not received until after the paper was published. The economical editor, not wishing to lose his picture, thereupon set to work to write up a story appropriate to that engraving, and he accordingly took down a "Universal Biography" to find a fitting historical personage to serve as his crazy hero. Solomon de Caus' name was the first one he saw; and it occurred to him that Solomon's genius might have driven him mad, even if it actually did not. Consequently he made the inventor into a maniac; and to give an air of truth to the romance, the editor put his story in the form of a letter written by a court lady who had seen De Caus in prison, in which letter the visit of the Marquis of Worcester was incidentally described. When the romance was published, it created an unlooked-for sensation; people accepted the story so completely that, even when the editor acknowledged that it was wholly imaginary, he was not believed, and learned antiquaries insisted that it was genuine. Consequently, ever since, Solomon de Caus has been regarded as a wretched lunatic who perished miserably; while the truth is that he never was imprisoned, never went mad, but lived a learned and honorable life, and, on dying, received special funereal honors from his king.

To those excellent readers of ours who occasionally lecture us in their letters on the responsibilities of editors—and of scientific editors in particular—we commend the above story as a text for future admonitions.

ON KEEPING AN INDEX.

The recent production of several books on scientific subjects, in which the authors all state that the work originated in casual notes gathered during the study or active practice of their various professions, will suggest to many the advantages of keeping an index or memorandum of facts met with in reading or observation. A well known engineer of this city lately showed us a huge volume, constructed in a way well suited to this purpose, in which, for several years, he has noted down, indexing as he proceeded, all the useful articles and hints relating to engineering or mechanical subjects which had appeared in the various publications which he deemed worth remembering. He did not of course copy the articles entire, but simply jotted down a sentence or two embodying their gist, and an accurate reference to the source of information—often merely the latter. By practice he had acquired the habit of making these rough notes on the spot, wherever he might be. Once a month or so he gathers his scraps into his book and posts his index; an hour or two's work at the most. The result is that he now has a fund of information at hand, acquired with very little trouble, the value of which can hardly be overestimated.

This is only one instance of others within our knowledge, and we would strongly commend the extension of the practice. An enormous amount of the most useful material never finds its way into books. We would not confine our notes to newspaper articles alone, but include in them all facts likely to be of future use which come under personal observation or are obtained in conversation with others. And the earlier this habit is acquired the better. An apprentice in almost any shop is sure to see the older workmen doing work after a fashion of their own. He may not know why one man who produces particularly good castings—rams his mould, for instance, in a certain way—or hammers an iron plate to straighten it after a certain manner peculiar to himself; yet he can use his eyes and ask questions, and put down what he sees and is told. In after years, he may turn back to his notes and find in them aid which is of money value. In the same way, the student will find a college course far more useful to him if he will watch for "points" in his various studies. Many a professor has a short way of his own for working this or that problem, or a neat explanation or illustration of a knotty fact, or a short cut around some technical difficulty, by which he secures his pupils' more rapid advancement.

We once heard an old housewife say that she saved all the stray bits of carpet, broken furniture, and other apparent trash, because it was, according to her experience, "sure to come useful sometime within seven years." We do not adhere to the mystical number seven; but doubtless she was substantially right, and the same rule will hold good regarding the odd scraps of information gathered. We would more especially commend the above to readers of this journal. If all our one hundred thousand readers, in their great variety of callings, would keep such records, and each one would once in a while favor us with a few lines therefrom regarding interesting facts which had been noted, an immense fund of valuable suggestions could be given to the world, and useful thoughts thus be rapidly interchanged. Besides, the effect would be to spare us the necessity of inserting that paragraph which heads our query column every week, wherein we inform A. B., for perhaps the twentieth time, that a recipe for dissolving rubber or bronzing gun barrels will be found on page so and so, this or that volume, etc. As we said in the beginning, many valuable books are prepared from notes thus made, and these become a source of considerable returns to the compiler.

Such books, moreover, are generally exceptionally good because they relate to pure practice and what has been done, and are free from speculations, mere theories, and second-hand statements. It is well to remember also that the necessity of keeping indices or notebooks is a growing one. The tendency of every profession, every trade, every calling, is toward differentiation. People are becoming specialists by force of circumstances. No one now pretends to know any one science or trade thoroughly: certainly not in this country, where the progress of invention is so rapid, or in this age, when new discoveries are of almost daily occurrence. The greatest portion of any man's knowledge must remain in the condition of an index; he may not remember the details of a subject, but he can know where he can place his hand on a source whence he can derive all the information; and to this last species of knowledge the well maintained notebook is a most important aid.

No one, we believe, has ever imputed the gift of prophecy to that great satirist and poet, Alexander Pope. We are inclined to think him in a most prophetic mood, however, when he penned the couplet—far more true in our days than in his:

"For index learning turns no student pale,
Yet holds the eel of Science by the tail."

AMERICAN INVENTIVE PROGRESS.

The future historian of the inventive progress of this country will find that the record of the same naturally divides itself into two distinct parts, each marking a separate era. These may be termed respectively the period of conception and the period of development. During the former most of the great American inventions were first originated; during the second, which includes the present time, the tendency of inventors has been more towards seeking new applications for established principles or improving upon earlier embodiments of the same.

The first era begins with the labors of Franklin, Rittenhouse, Hare, Evans, and their contemporaries. It terminates with the end of the year 1849. Inspection of the records of the Patent Office shows quite clearly the substantial basis for the division we have suggested. The first patent granted by the United States was dated July 31, 1790, and was issued to Samuel Hopkins for a process of making pot and pearl ashes. During that year, the total number of patents was but 3; the following year it amounted to 33, and then for sixteen years the aggregate fluctuated, falling as low as 11 and reaching as high as 99. For the seventeen years following the variations were between 100 and 300, the last-mentioned number not being exceeded until 1825. The increase subsequently was more rapid; and by August, 1836, when the present system of numbering the patents began (it appears with those of Thomas Blanchard, for turning irregular forms), the total had reached 10,041; or, for the period of sixty years comprised in the first era, the aggregate amounted to 17,447. Yet in this small number are included Whitney's cotton gin, McKean's first steam saw mill, Whittemore's wool and cotton card-making machine, Hare's oxy-hydrogen blowpipe, Blanchard's tack machine, Fulton's steamboats, Hall's breech-loading fire-arms, Perkins' steel engraving, Stevens' tubular boiler and screw propeller, Lowell's power loom, Burden's horseshoe and spike machinery, Mott's stoves for small coal, Saxton's magneto-electric machine, Bogardus' ring flyer for cotton spinning and the long category of other important devices of that wonderfully prolific inventor, Professor Henry's splendid electro-magnetic discoveries, Morse's telegraph, Guthrie's discovery of chloroform, Boyden's patent leather, Baldwin's improvements in the locomotive, Howe's pin machine, McCormick's reaper, Colt's revolvers, Wells' hat body machine, Goodyear's vulcanization of india rubber, Bigelow's carpet loom, Howe's sewing machine, Sickel's cut-off, Morton's discovery of the anæsthetic qualities of chloroform, Rodman's hollow casting of ordnance, House's printing telegraph, and Ericsson's steam fire engine.

To show with what rapidity inventors made improvements on inventions embodying original principles, it may be noted that in the early days of the sewing machine 116 patents were granted for improvements thereon in a single year; and out of the 2,910 patents issued in the year 1857, 152 were for improved cotton gins and presses, 164 for improvements in the steam engine, and 198 for novel devices relating to railroads and improvements in the rolling stock. In the year 1848, three years after the publication of this paper was commenced, but 660 patents were granted; but under the stimulus of publishing those inventions as they were patented, ten years later, in 1858, the number had increased sixfold, reaching 3,710, while up to January 1, 1850, as already stated, the aggregate of patents issued amounted to 17,447; since that time and up to the present the total is 181,015.

Curiosity here leads us to review our own work, extending back for, say, twenty years, or to 1857, a period during which 170,745 patents have been issued. We find, by actual count, that 62,662 applications have been made through the Scientific American Patent Agency for patents in the United States and abroad. This averages almost ten applications per day, Sundays excluded, over the entire period, and bears the relation of more than one quarter to the total number of patents issued in this country up to the time of writing.

We might indulge in some pardonable egotism in claiming to have done no small share toward aiding the development of the inventive genius of our country, and thus advancing our national prosperity—the above statistics would seem to justify it—but this we forego, or better, leave it to be done by the editor of the SCIENTIFIC AMERICAN a century hence. He will have a larger story to tell, and likely, be less modest than the editor of to-day.

EXHIBITION OF MICROSCOPES.

The *soirée* of the American Microscopical Society was held in the large hall of Kurtz' photographic establishment, 23d street, New York city, on the evening of March 6. The exhibits were admirably arranged by Dr. Rich, the President. On each of twenty tables were four instruments, illuminated by one or two student's lamps, so that about eighty instruments were exhibited, representing thirty or forty exhibitors. Various kinds of microscopes were shown, from the most elaborate and expensive to the simplest: while some were noticeable for originality and special adaptation. No inferior instrument was to be found in the collection.

Dr. Rich exhibited six microscopes, a Beck grand binocular, a Zentmayer grand, a Curtis mounting microscope, two Wales and Hawkins improved, and a Beck "popular." Special mention must be made of Dr. E. Curtis' invention, which, in regard to convenience in use, originality of design, and capability of diverse applications, stands foremost; it is undoubtedly the best dissecting microscope, it may be used as a binocular, and is simple as well as compound. The stage and illuminator are not attached to the microscope, but consist of an oblong rectangular box which stands on the table under the objective lenses, and the whole arrangement is evidently the result of the experience of a hardworking professional microscopist. Dr. Rich exhibited under these instruments most beautiful specimens of the wing cover of the West Indian beetle, and also some remarkable arrangements of diatoms, first produced several years ago by a lady in London: they were for a long time a profound mystery, until the German scientist Müller, in Holstein, produced them for the trade. The diatoms are on slides containing 100, 400, or 600 specimens each, all classified in species according to an accompanying catalogue.

Among the appendages shown was the improved section cutter of Dr. E. Curtis, in which the knife is inclosed in a frame moving over a plate of glass, in the center of which the object to be cut is screwed upward through a hole, and may be made to project a distance as small as one thousandth of an inch or thereabout.

Mr. Rutherford exhibited a microscope by the famous Italian maker Amici, which was presented to him by Amici, when in Italy thirty years ago. The connoisseurs present all agreed that Amici was far ahead of his time; and his instrument, so far as optical effects are concerned, compares favorably with many of the best imported microscopes of the present day. Professor Julien, of the School of Mines, Columbia College, showed five sections of various stones, such as granite, agate, etc., by means of two Power and Leland grand binoculars, which have an ingenious arrangement for swinging the polarizer in and out of the tube. Dr. Vander Weyde exhibited four instruments: one by Andrew Ross, to which various attachments had been made to change it into a single dissecting microscope, an inverted chemical microscope, a horizontal microscope, especially adapted for drawing, and an instrument to which had been attached an eyepiece for two observers, the invention of the exhibitor. In this device, one observer sees the object under polarized light and the other under unpolarized. Dr. Vander Weyde also showed a large inverted microscope of his own invention, with a colossal eyepiece and a large field (this was illustrated and described in the "Record of Scientific Progress" for 1865, published by MUNN & Co.); and also a new polarizing instrument for observing the colored rings around the axes of crystals, whereby the system to which they belong may be determined. The same inventor also showed several little contrivances, which he explained to those interested in practical microscopy: such as new methods of illumination, a new finder, and a micrometer of new and peculiar construction. His most remarkable exhibit consisted of the muscles of the human eye, which contract and dilate the pupil: these muscles can only be revealed by the use of polarized light.

Want of space prevents our mentioning in detail all the exhibits, although many of them deserve honorable mention; but Zentmayer's improved stand, with rotating and centering stage, an arrangement which causes the mirror to work in the optical axis, McAllister's four microscopes, and those of George Wales and Pike, may be specially mentioned. Crouch, of London, was represented by eight splendid instruments, all provided with his own objectives. Woolman exhibited some fine instruments by Queen of Philadelphia, and four London ones, three by Beck and one by Crouch.

The visitors were all much interested in the exhibition, which will doubtless do much to popularize the fascinating study of microscopy.

Steam in the Streets of Philadelphia.

Seven steam street cars were placed upon the Market Street Railway, Philadelphia, on March 21. A small boiler incased in wood is placed in front of the car, and by an ingenious contrivance the whole power of the engine can be concentrated on the brakes. The trial trips were very successful, the cars being stopped in a few seconds, even when going at high speed, heavy grades not causing as much trouble as had been anticipated. The engines were noiseless, and horses were not frightened.

NEW FRENCH WOODWORKING MACHINES.

In the annexed engravings, we illustrate four new woodworking machines, invented and extensively manufactured by M. Ferdinand Arbey, of Paris, France, which were patented through the Scientific American Patent Agency on January 30 last. They were exhibited, with others from the same manufactory, at the Centennial Exposition, and there attracted considerable attention owing to their difference from the machines for similar purposes here in use and from the perfection of their finish.

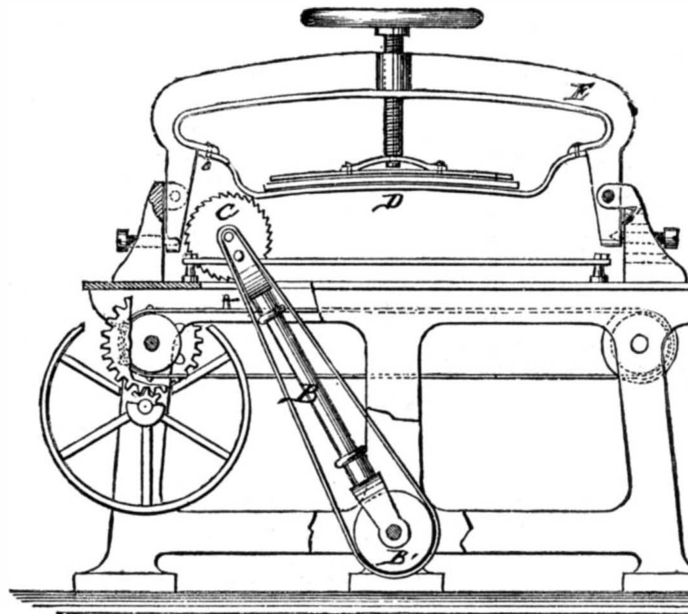


Fig. 1.—STAVE-JOINTING MACHINE.

Fig. 1 is a machine for jointing staves so as to produce an exact fitting of the joints, according to the curvature and diameter of the barrel. Its main object, however, is to form the staves so that barrels may be made of staves of varying widths, and wood thus economized. The staves are clamped, at D, in a longitudinal arc-shaped frame, E, which is pivoted to the side standards of the lathe, A. By means of the center pins, *b*, the stave and its clamps, D, are adjustable to a greater or less diameter of the barrel, said pins forming the axis of the barrel and being adjustable up or down in the standards. The swing of the frame on its pivots is limited by the set screws, *f*, Fig. 2. For a greater width of staves, the set screws are placed at a greater distance from the center line and *vice versa*. When the frame is thus adjusted to the radius of the barrel and width of the staves, the circular saw, C, which is placed at the end of the vibrating arm, B, and rotated by a belt from the driving shaft, B', is passed along one side of the stave. Then the frame is swung over, and the saw cuts the opposite side. In this way, the edges are cut true, and those of any two staves will fit together, regardless of the size of the staves.

In Figs. 3 and 4 is represented an exceedingly simple lathe for turning irregular forms, such as sword handles, gun stocks, etc. The tool used is a V-shaped cutter, *e*, which is secured to a pivoted lever, D, the latter being pointed, by a link, *f*, to a second pivoted lever, D'. Lever D' swings therefore parallel to lever D, and of course transversely to

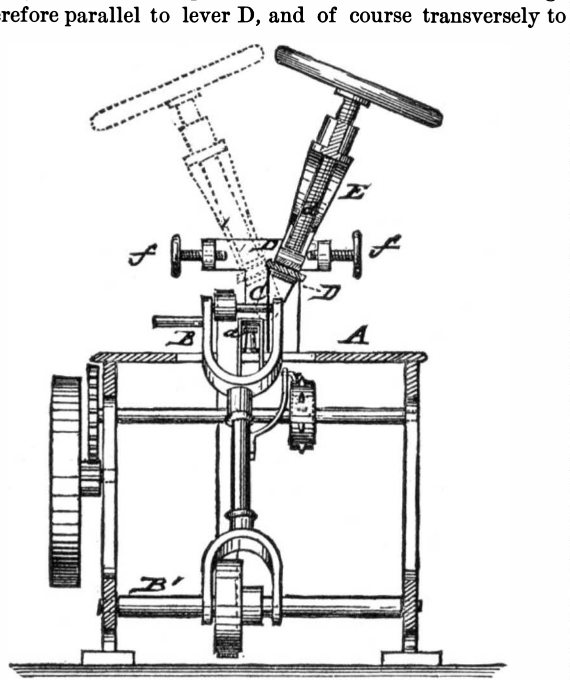


Fig. 2.—STAVE-JOINTING MACHINE.

the longitudinal axis of the lathe. By means of a handle on lever, D, the tool is removed from the wood as desired; while it is pressed up to its work by the action of the power-

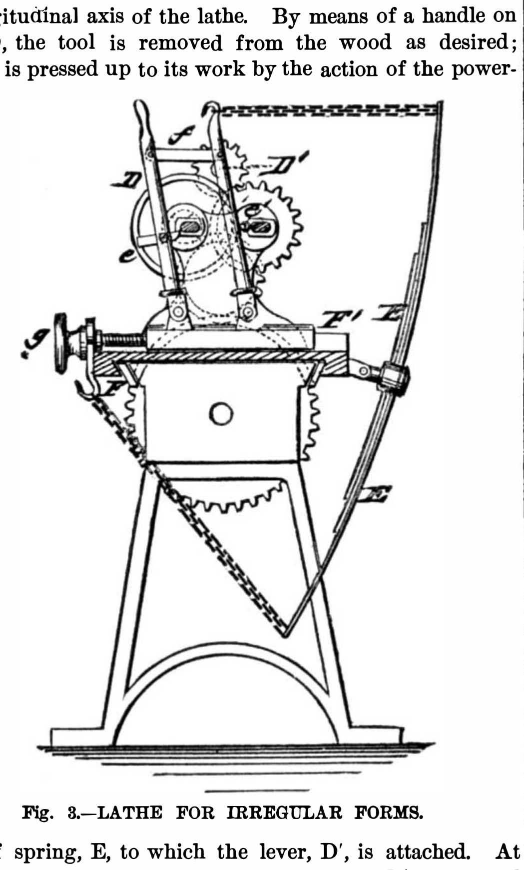


Fig. 3.—LATHE FOR IRREGULAR FORMS.

ful leaf spring, E, to which the lever, D', is attached. At the same time a blunt guide tool, on lever, D', is pressed against a model, *e'*, the shape of which is to be copied. The pivot levers are attached to a laterally adjustable part of the carriage, F, which travels automatically forward and backward. The joint motion of the cutter tool, produced longitudinally by the carriage travel and laterally by the power of the spring which presses both guide and tool against the bodies, accomplishes in the blank an exact reproduction of the model.

Fig. 5 represents a new carving attachment for common lathes, for the purpose of grooving, channeling, pearling, and ornamenting balusters, table legs, and other articles of irregular shape, which are fastened in the lathe centers. The cutting tool is attached to a shaft, B, which revolves in bearings at the ends of swinging counter-weighted arms, C. The latter are pivoted in a hollow standard, D, which is secured to the carriage. The mode of rotating the cutter shaft and tool is clearly exhibited in the engraving. The tool passes longitudinally along the object and works out channels in the same, the dividing disk, F, being turned for the distance of one subdivision after each channel is made to produce the next channel by the return motion of the carriage. By slowly rotating the work in the lathe, helicoidal grooves are made.

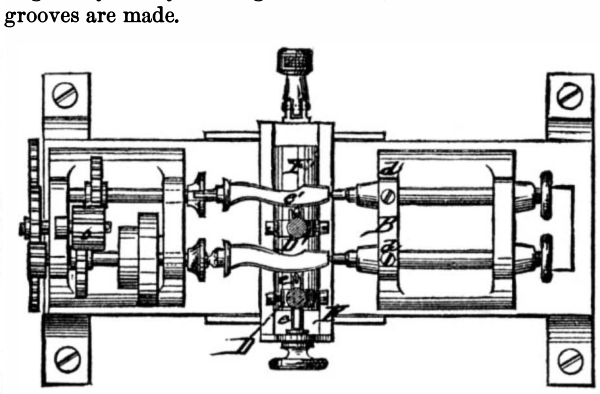


Fig. 4.—LATHE FOR IRREGULAR FORMS.

Fig. 6 represents a novel tenoning and mortising machine, in which the work represented by the dotted lines is first fed to a pair of horizontal saws, and then to a pair of vertically cutting saws, which produce the recesses at both sides of the tenon. The work is fixed to the sliding table, B, and moved up by the lever, B'. The saws are adjustable as to their distances apart, and the upper saw shaft may be moved laterally by the handle, D[4]. Tenons and mortises of different angles are produced by placing the saw bearings on swinging plates of the carriages, and securing the plates by clamp screws, after giving the required degree of inclination. The apparatus may also be used as an ordinary circular sawing machine.

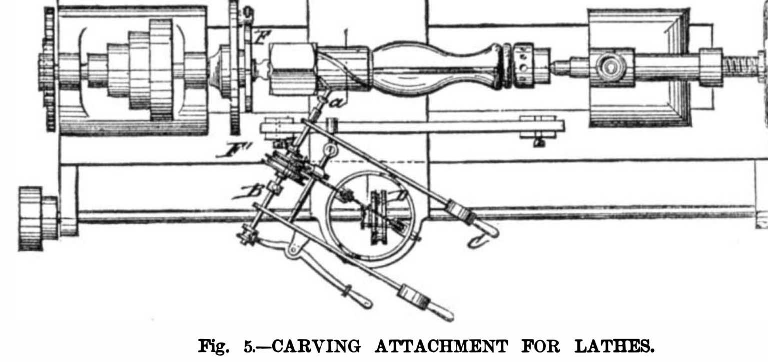


Fig. 5.—CARVING ATTACHMENT FOR LATHES.

Another Soda Ash Process.

Scherbascheff, of Charkow, is using a new and important modification of the ammonia soda process. Instead of producing the bicarbonate, as Solvay's process does, the monocarbonate is formed at once. Ordinary sal soda, which crystallizes with 10 molecules of water, when dissolved in water and heated to over 95° Fah., cannot take up more than 7 molecules of water, and at a still higher temperature it loses by dissociation more water and only retains 1 molecule of water. The higher the temperature of the solution, the more potent this dissociation, and in the presence of common salt the reaction is still more energetic. Consequently when common salt and carbonate of ammonia are dissolved together in one vessel at a high temperature, a double decomposition results, and mono-carbonate of soda is formed with 1 molecule of water, which salt is almost insoluble in water. The reaction is as follows:

$$2\ NaCl + (NH_4)_2\ CO_3 = Na_2\ CO_3 + 2\ NH_4\ Cl.$$

As carbonate of ammonia is also dissociated at a high temperature into carbonic acid and ammonia, the solution should not be heated above 140° or 158° Fah. At a higher temperature the reaction is reversed.

In Scherbascheff's works, a large vat is half filled with brine, which is heated to 140°, and in it is suspended a basket of common salt, and another of carbonate of ammonia. As they dissolve they react on each other; the crystalline, almost insoluble, carbonate of soda is precipitated, while the chloride of ammonia remains in solution. The vat has a cover provided with pipes for conducting the liberated carbonic acid and ammonia gases into the brine of the adjoining vat. The operation is finished when the liquid in the vat becomes saturated with ammonia salt. The baskets of carbonate of soda and salt are at once transferred to the next vat, but a temperature of 140° to 160° is kept up in the first vat for a while until all the soda is precipitated. The solution of sal ammoniac is now drawn off, and the soda shoveled out and dried in a centrifugal apparatus, after being washed with a boiling solution of soda to remove any sal ammoniac or common salt that may be mixed with it. It is now pure enough to put at once on the market.

A New Hydrostatic Safety Lamp.

We recently commented upon the danger of explosion in kerosene lamps, due to the ignition of the vapor which forms in the space above the oil when the latter runs low. This ignition is liable to take place directly from the wick, especially when the latter is too short. A new lamp has recently been exhibited to us, which seems to be wholly free from possibility of explosion from the above cause. It is so constructed that water placed in a central reservoir constantly tends to lift the oil up a tube to the wick. In this way the oil is kept at a level at a short distance below the burner until it is wholly burned away; and at no time can any large space be formed wherein inflammable vapor can accumulate. The lamp is known as Kendall's "Hydrostatic Safety Lamp," and is manufactured by the Union Machine Company, 89 Liberty street, New York.

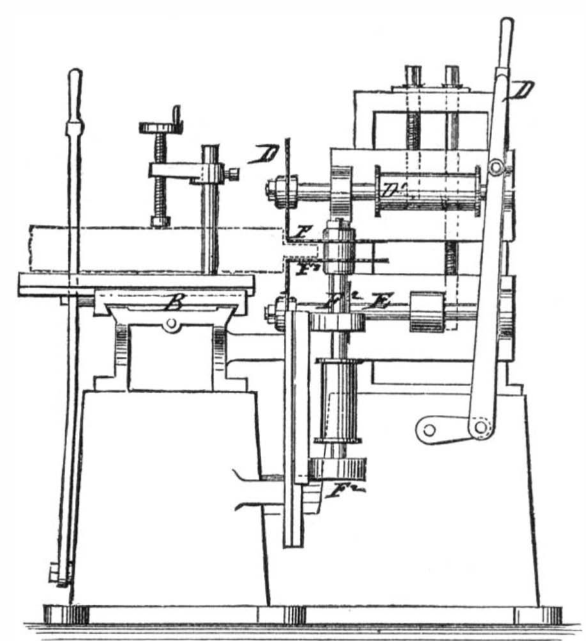


Fig. 6.—TENONING AND MORTISING MACHINE.

Evolution of the Brain.

In a recent lecture at Glasgow on "Evolution of the Brain," Professor Allen Thompson stated that we have no direct evidence from anatomy, physiology, or pathology, of any mental act being performed apart from the brain; and as to the question whether the human brain had been directly formed, and was constantly maintained by an act of creative wisdom, or whether, according to the Darwinian view, it had gradually assumed its complex structure and lofty powers exhibited in presently existing man, he preferred the latter view, because it was the one which was most consistent with all that was known of the coincident development of the mental powers and the cerebral organization.

STRAIGHTENING METAL PLATES.

No. III.

We now come to straightening as effected by pening, a process usually applied to straighten or, if necessary, to bend bars, rods, beams, frames, and other thin pieces of wrought iron which, from being too heavy or from their positions, cannot be straightened upon an anvil.

The principle involved in the process of pening is that of stretching the skin of the metal, and thus producing a surface strain that holds, by tension, the rest of the surrounding metal out of its natural shape. Suppose, for example, that Fig. 15 represents a rod of iron which it is required to straighten. It is obvious that if we stretch the skin on the hollow side by hammering it all over (as shown at A, in Fig. 15, by the hammer marks denoted by the small circles), the face on that side will be stretched; and becoming in consequence longer, it straightens out. The hammer used for pening is shown in Fig. 16. It usually weighs about ½ lb. The ball end, A, is employed to deliver the stretching blows, that shape being preferred because, by delivering the force of the blow upon a small area, the effect of the blow is greater; then again the indentations made by the hammer, being dish-shaped, do not disfigure the plate so much, especially as the blows are light and the hammer marks so close together as to contact or partially cover one another. The flat face is used in cases where much pening has been done, to efface as much as possible the marks left by the ball pene end of the hammer. In many cases, however, this is unnecessary. While pening a piece of metal, it will greatly assist the operation if a pressure is placed upon the work in the direction in which the work is required to go or set; and for this purpose clamps are often used. Suppose, for example, that a strap such as is shown in Fig. 17 requires to be made narrower at A. We may rest it upon the bench, E, in the position shown, press down the end of the jaw, B, and deliver the blows denoted by the marks shown on the round corner, C. In this case, the effect of the hammer blows will be sufficient, if the flat face of the hammer is used. If, however, the strap

Fig. 15.

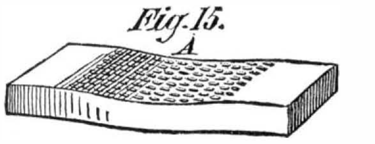
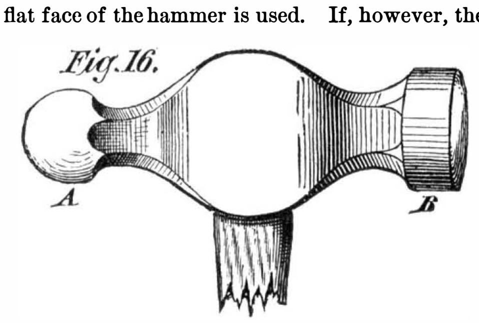
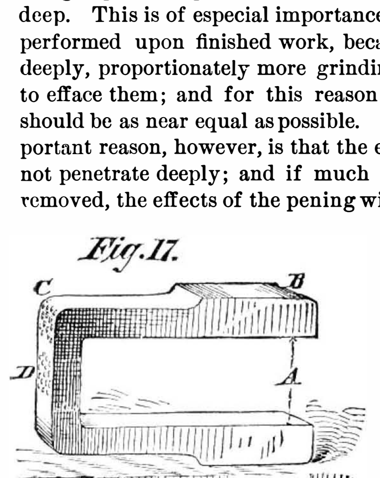


Fig. 16.



had a sharp corner, it would be necessary to rest the two ends of the strap jaws on the bench, and, using the ball pene, deliver the blows shown by the marks at D. In either case, the effect will be to close the distance between the jaws at A. The reason in the latter case for pening the strap in the middle is that, since the pening will tend to round the face lengthways, the filing out the pening marks will tend to straighten that face, and may be more quickly performed; for, if we were to pene the face in two places, the filing out of the marks would aid the pening to round the face. It is obvious that, were the jaws too narrow at A, pening the inside crown face of the strap would widen them. The blows should fall dead—that is, the hammer should fall, to a great extent, by its own weight, the number rather than the force of the blows being depended upon; hence the hammer marks will not be deep. This is of especial importance when pening has to be performed upon finished work, because, if the marks sink deeply, proportionately more grinding or filing is required to efface them; and for this reason the force of the blows should be as near equal as possible. Another and a more important reason, however, is that the effect of the pening does not penetrate deeply; and if much of the pened surface is removed, the effects of the pening will be also removed: for, as a rule, the immediate effects of the blows do not penetrate deeper than about $\frac{1}{32}$ inch. While the work is being pened, it should be rested upon a wood or a lead block, and held so that the part struck is supported as much as possible by the block. In no case should it be rested upon an iron or any hard metal block, as that would tend to stretch the underneath face, and partially nullify the effects of the pening.

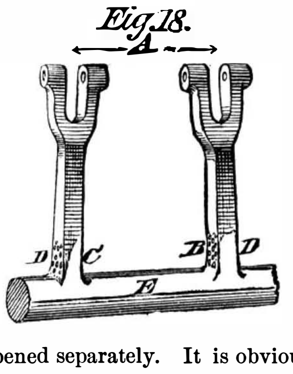
Fig. 17.



Wrought iron shafts of considerable thickness may be straightened by getting them red hot, and suddenly cooling the high side until it assumes a black color, then reheating the shaft again and repeating the cooling process, which should be performed as quickly as possible. This process, repeated a sufficient number of times, will inevitably straighten the shaft. The principle involved in this manipulation is as follows: When the shaft is red hot all over, it is also expanded all over, and the cooling contracts the spot or side cooled, which shrinks, creating a strain which draws the hot side out of its natural shape, so as to accommodate the shape of the contracted side.

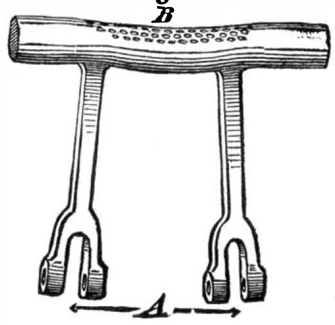
In straightening work of cast iron, pening bears an important part, especially in the case of iron patterns or light iron castings. Suppose, for example, that Fig. 18 represents an iron casting, and that the distance, A, from the center of one double eye to that of the other was too short: by pening the arms on the faces denoted by B, C, and in the place denoted by B, the distance, A, could easily be made correct. If the width at A were too great, similar pening at D D would be required. If, however, the shaft itself should be out of straight and does not require to be turned up in the lathe, it becomes a consideration whether two evils cannot be remedied by one pening operation.

Fig. 18.



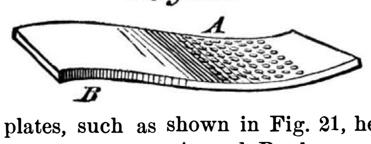
In Fig. 19, for instance, is a casting that, by warping in the shaft, has thrown the arms out of parallel, making the distance at A too great. It follows that, by delivering the pening blows as shown upon the shaft, the effect will be to straighten it, and at the same time bring the arms into line. If, after the shaft is straightened, the arms require adjusting, they may be pened separately. It is obvious, however, that, if the shaft must be pened, it must be operated upon first. As an example of straightening cast iron plates by pening, let Fig. 20 represent a warped plate. The pening marks shown at A, and similar blows delivered upon the other side in the hollow at B, would straighten it; or, in Fig. 21, if the tongues, A, B, were warped so as to stand up too high, pening at C and D would straighten them.

Fig. 19.



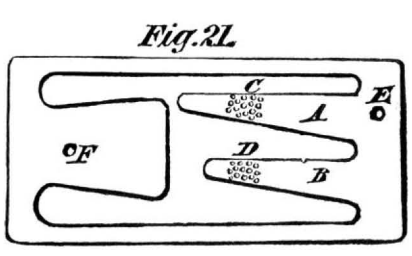
Patterns for plate castings often become warped in time from the rapping of the pattern: for example, in Fig. 21 are two holes, E and F. Into these holes pieces of stout wire are placed; the moulder then strikes the wires on all sides to loosen the pattern in the sand or mould. In course of time, the metal around these holes becomes bulged, and there is created a local tension apt to distort the pattern, so that it requires pening to straighten it.

Fig. 20.



A skillful moulder will often straighten plates in the moulding process. For example, suppose that, having cast a number of plates, such as shown in Fig. 21, he finds that the points of the tongues, A and B, always curl up in the mould to about ¼ inch too high. He will then pene the pattern so that the tongues stand ¼ inch too low, and thus save a great deal, if not all, of the pening. Another plan adopted by moulders to straighten castings is to uncover the parts

Fig. 21.



that are apt to sink in the sand. If any part of a casting has the sand removed from its upper surface while it is still red hot, that part cools the quickest and lifts up; and of this fact the moulder takes advantage, uncovering the part which experience has shown him requires to be lifted. The cause of the cooled part lifting appears to be as follows: The part cooled contracts the quickest; and to sink in the mould, it would require to compress the bed sand or else to raise the other part of the casting. The whole weight of the sand in the cope, as the top part of the mould is called, tends to keep the casting down; and when that weight is removed at any part by removing the sand, the contracted part naturally rises, because there is less resistance offered to its rising than there would be to its falling. In many cases, this cooling process is aided by the application of water, which much increases its effect; and it is astonishing, under skillful manipulation, how much a plate or casting can be shaped at will, by water judiciously employed, without causing it to crack.

Iridiated Glass—Possible Rediscovery of a Lost Art.

It is well known that, under the influence of moist air and in the course of great lengths of time, certain kinds of glass lose their transparency and become covered with opalescent layers, which are easily cracked off. This occurs most frequently with glass that has been long buried in the earth. In the collection of ancient relics exhumed at Cyprus by General Di Cesnola, there are abundant examples of glass bottles, cups, vases, etc., which are as brilliantly iridescent as is carved from the pearl shell. The reason for this change, as we have already explained, is that the alkaline base in the glass combines with the carbonic acid of the air, setting free the silicic acid of the material. Then the alkaline carbonate so formed is washed away by water, and in place of the glass we have nearly pure silicic acid. This has been proved to be the fact by actual analysis of some of General Di Cesnola's specimens.

But there is good cause to believe that the ancients were in possession of processes for producing this iridiated glass in brief periods of time; and it also appears that the glass-workers of China and Burmah have like knowledge. In April of last year, we noted the fact that specimens of the Chinese glass had been sent to M. Clemendot, a noted French chemist, for examination. We now find in the report of a recent meeting of the French Academy of Sciences that, in conjunction with M. Frémy, the above scientist has succeeded in reproducing the iridiated glass, and that numerous fine specimens have been exhibited before the aforesaid society.

The process, which is said to be certain in its results, consists simply in submitting ordinary glass for six or seven hours to the action of water containing 15 per cent of hydrochloric acid at a pressure of from 2 to 3 atmospheres, corresponding to a temperature of about 248° Fah. The beautiful glass thus quickly produced will doubtless find many ornamental applications.

Influence of Pressure on Combustion.

Some interesting observations have been made by M. Wartha on the influence of pressure on combustion. He observed the burning of six stearine candles in free air, and in an iron case under a pressure of 1·95 atmospheres. They burned under the pressure with a flame 3½ to 4¾ inches long, and gave much smoke; their luminous power diminished, while the flame assumed a yellowish-red color. The decrease of weight after one hour of burning was found to be less than in burning in free air. This last result is opposed to the observations of Frankland, who has affirmed that the consumption of the burning material of a candle, or the like, is not perceptibly dependent on the pressure of the medium in which the combustion occurs. It is supposed that the difference of pressure in Frankland's experiments (on Mont Blanc and at Chamounix) was not sufficiently great to give a distinct difference in consumption of the burning matter. M. Wartha further put a candle to burn under an air pump receiver, with special apertures; and with increasing rarefaction, the flame was seen to enlarge, and its luminous power to diminish. At a pressure of 3½ inches, the greatest rarefaction produced, the luminous power was quite gone, and the flame, which had now assumed threefold size, appeared to consist of three parts, an inner bluish-green cone with a violet sheath and a weakly violet mantle. The diminution of the luminous power in this case Mr. Wartha explains by the fact that, under less pressure, less of the products of combustion are separated in the form of soot.—*Nature.*

Eucalyptus Globulus.

The Central Pacific Railroad Company has lately arranged to have 40,000 trees of the above species set out along the 500 miles of the right of way of the company. This is only the first instalment, as it will require about 800,000 of the trees for the 500 miles of valley where they are to be cultivated. The immediate object of the plan is to increase the humidity of the region, and lessen the liability to droughts. It is an established fact that the destruction of our forest trees over large tracts of the country is having a direct effect on the climate, and we are glad to know that this company is replacing, at least in part, the forests which have been destroyed.

The beneficial influence exerted by the foliage of the eucalyptus in malarial districts is well known. Experiments have proved eminently successful in this direction, notably that of the English Government at the Cape of Good Hope, and of the local government of a region in Belgium. The *eucalyptus globulus*, or blue gum, is supposed to be efficacious in marsh and other fevers, and is known in Spain as the "fever tree." The bark and leaves of the tree contain much tannin, which is extracted on a large scale in Australia for European markets. A new interest has lately been given to the genus by the discovery of a body in the leaves and bark closely resembling in its properties those of cinchona or Peruvian bark (the source of quinia), and much more abundant. Vaquelin obtained, in an analysis of the leaves, an essential oil containing eucalyptal or eucalypt camphor, and a resin closely resembling resin of cinchona. This extract yielded a substance capable of neutralizing the strong acids, and forming crystalline salts. The crystals of its sulphate are almost identical in form with the star-shaped crystals of sulphate of quinia or cinchona, and present the green coloration on the action of chlorine and ammonia, hitherto supposed to be peculiar to quinia. The dried and powdered leaves and bark, and even the wood, of this tree have found employment in medicine. The wood is close grained, heavy, and of a dark color, and may be used with advantage by the cabinet maker.

TOOLS and chisels for cutting French burr stones may be tempered by heating to a dark cherry red and quenching in the following solution: To 3 gallons water add 3 ozs. each spirit of niter, spirit of hartshorn, white vitriol, sal ammoniac, and alum, and 6 ozs. common salt, with a double handful of hoof parings.

Communications.

Lamp Explosions.

To the Editor of the Scientific American:

Many of the lamp explosions we are constantly hearing of are not oil explosions at all, but glass explosions, if "explosion" is the proper word, which I am inclined to doubt; and it may be that the so-called lamp explosion, referred to in an article on this subject, in No. 12 of your current volume, was of this class, as it was stated that there was no more noise heard than would result from the breaking and falling of a lamp chimney, and that the "explosion (?) did not throw any pieces of the lamp more than a few inches, and the oil was not scattered at all." This seems to show that the lamp did not explode, but simply "went to pieces," as your correspondent stated; whereas, if there had been any explosion sufficient to break the lamp, the oil would certainly have been scattered in every direction.

From some reason not fully understood, but believed to result from imperfect annealing, glass articles are liable to crack and fall to pieces without apparent cause. Glass vessels, when used for other purposes than lamps, do not cause any damage when they "explode," beyond the loss of the article and its contents, and, it may be, a stain or two on the clothing or carpets; and no one therefore pays any attention to this matter. But when a glass lamp falls in pieces in this manner, it generally spreads the warm oil over the surrounding objects, such as clothing, the table cloth, or the carpet, and these, being of a fibrous nature, act as wicks, causing the oil ignited from the burning lampwick to readily burn, and thus a disastrous fire is the result, and we hear of another "coal oil explosion." Coal oil has sins enough of its own to answer for, as every one knows; but it is a good servant when properly managed, and it is not fair that it should be credited—or rather discredited—with more than its proper share.

Glass is one of the most treacherous substances that we know of, and should not be depended on to contain such a dangerous material as the coal oil usually sold for illuminating purposes. Glass articles may be used for years in safety, and yet are liable at any time—to say nothing of the danger of breaking from an accidental blow or fall—to fly to pieces, causing (when used for oil receptacles for lamps) immense damage to property and frequently loss of life by the most horrible of deaths. The writer has known several instances of glass articles other than lamps breaking in this manner, one of which was a large fruit dish that broke into an immense number of small fragments.

Occasionally there may be seen, in closely examining glassware, a flaw or speck resembling a white stone, from one sixteenth to an eighth of an inch, or even more, in diameter, imbedded in the substance of the glass. This is believed to be a portion of the silica that has not properly combined with the other materials and is not therefore glass. It probably has a different rate of expansion from the glass with which it is surrounded; for it is found that glassware is extremely liable to crack at the place where such flaws are found, and some glassmakers say that such ware is sure to fly at some time under the varying degrees of temperature to which domestic utensils are subjected. In view of this, glass buyers should always avoid purchasing an article of this class, and particularly so if the object to be bought is a lamp.

Glass has its advantages over metal in some respects, being more easily kept clean, as it is not liable to oxidation, and, being a poor conductor of caloric, does not heat up the oil as quickly as metal; but its superiority in these respects is more than counterbalanced by the liability to fall to pieces without warning. Glass lamps can, however, be made safe if provided with metal oil receptacles inclosed in the glass, which would then form merely an ornamental stand or casing for the oil vessel. Several patents have been granted for lamps on this principle, some of which, I believe, have expired, and the inventions covered by them may be manufactured by any one who chooses to do so without fear of infringement.

Washington, D. C. OCCASIONAL.

On the Shape of the Earth.

To the Editor of the Scientific American:

In your paper of March 10 there is a communication on the above subject, in which the author maintains that the shape of the earth would be what it is at present even had it always existed as a solid mass. His reason is that, owing to the rotation of the earth, there would be a pressure at the poles, in excess of that at the equator, by an amount equal to the pressure of a column of iron thirteen miles high; and this, he thinks, would cause the poles to sink in. Let us assume for the present purpose that the highest mountain rises five miles above the level of the sea, and that the greatest sea depth known is three miles. Here is a variation from the form of equilibrium for a fluid globe of eight miles, and yet the earth is stable. Now it is a well known fact in physical geography that the highest mountains are in general contiguous to the deepest seas, or, more exactly, the largest mountain systems are contiguous to the largest oceans. Hence these changes of outline are much more abrupt than would be those in a globe of iron, where the variation from the form of equilibrium was gradual from the equator to the poles. Your correspondent loses sight of the fact that, in order to crush a solid, there must be an excess of pressure in some one direction equal to its crushing strength. A vertical column of any known solid five miles high would undoubtedly crush its base; but a mountain five miles high stands secure, simply because the vertical pressure at the center of its base which tends to crush out the material, is resisted by the lateral pressure of the surrounding material. So, were the earth solid and a perfect sphere, although it would be about twenty-six and a half miles above the outline of equilibrium for a fluid earth at the poles, it would still be able to maintain this figure, since there would nowhere exist in its interior an unbalanced stress capable of crushing its material.

Woburn, Mass. W. E. BUCK.

Icy Fringes Around the Stems of Plants.

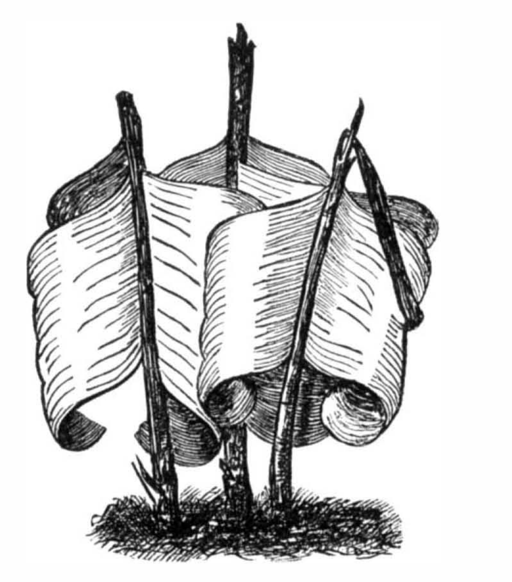
To the Editor of the Scientific American:

Under the heading "The Frost Plant of Russia," your correspondent, Mr. J. Stauffer, of Lancaster, Pa., calls attention, in the SCIENTIFIC AMERICAN for February 24, 1877, p. 116, to the remarkable accumulation of ice around the stems of the *cunila Mariana* (Maryland dittany).

As long ago as 1850, it was my privilege to call the attention of the scientific world to an identical class of phenomena in a paper entitled "Observations on a Remarkable Exudation of Ice from the Stems of Vegetables, and on a Singular Protrusion of Icy Columns from certain kinds of Earth during Frosty Weather." This paper was published in the "Proceedings of the American Association for the Advancement of Science," third meeting, Charleston, S. C., March, 1850 (pp. 20–34), and likewise in the *London, Edinburgh and Dublin Philosophical Magazine* for May, 1850 (third series, vol. 36, pp. 329–342).

As far as I am aware, this paper contains the first attempt at an explanation of the phenomena as manifested in vegetables, as well as their co-ordination with the protrusion of icy columns from the earth. So far as the notice of the fact of such accumulations of ice around the stems of plants is concerned, I was anticipated by several observers. Stephen Elliott, in his "Sketch of the Botany of South Carolina and Georgia," published in 1824, notices a remarkable protrusion of crystalline fibers of ice from the stems of the *conyza bifrons* (vol. 2, p. 322). Sir John F. W. Herschel published a short notice of a similar exudation of icy fringes, occurring around thistle stalks and stumps of heliotropes, in the *London and Edinburgh Philosophical Magazine* for February, 1833 (third series, vol. 2, p. 110). Professor S. P. Rigaud, of Oxford, notices the occurrence of an analogous phenomenon on a recently built stone wall, in the succeeding number of the same journal (third series, vol. 2, p. 190, March, 1833). Professor J. D. Dana appears to have noticed similar phenomena on the twigs of plants (*vide* "Manual of Mineralogy," second edition, p. 46, New Haven and Philadelphia, 1849).

The plants in which I observed the phenomenon were two species of the genus *pluchea* of De Candolle, or *conyza* of the older botanists, namely: *pluchea bifrons* and *p. camphorata*. It is more common and conspicuous in the former. Both of these plants grow abundantly in wet soils, around ponds, and along the roadside ditches, in the low country of Carolina and Georgia. The accompanying sketch, reproduced from my paper in the "Proceedings of the American Association" above indicated (pp. 22 and 23), conveys a tolerably good idea of the appearance presented by the friable sheets, or ribands, of semi-pellucid ice around the foot stalks of the *pluchea*.



This is hardly the proper place to reproduce my explanation of the ice phenomenon in plants, or to show its co-ordination with the more general phenomenon of the protrusion of columns of ice from certain kinds of earth during frosty weather. In the paper referred to will be found a full discussion of the possible sources whence the large supply of water is derived, which, by freezing, forms the accumulations of icy fringes in the one case, and the icy columns in the other. Suffice it to state that I have there shown that, in both cases, the phenomena are purely physical, having, in the case of plants, no connection with the vitality of the stem; and that the appearances "are quite at variance with any idea of the deposition of these icy fringes from the store of aqueous vapor in the general atmosphere, in the manner of hoar-frost."

If your correspondent will consider all of the facts which are established in relation to the phenomenon in question, he will, I am sure, be convinced of the untenability of his explanation. The explanation given by Dr. Darlington, in his *Flora Cestrica*, in 1853 (as quoted by your correspondent), is more in accordance with known facts.

JOHN LE CONTE.
University of California, Oakland, Cal.

State Legislation on Patents.

To the Editor of the Scientific American:

I notice in your issue of March 3 an article from Mr. J. Pusey, of Philadelphia, in reference to legislation by the States upon patents granted by the United States.

The bill introduced in New York appears to be similar to that passed by the Legislature of this State in 1871 ("Compiled Laws of Michigan," p. 519), and one of the same character was held in Indiana (43 Ind., 167, 13 Am. Rep., 395) to be unconstitutional, as interfering with the exclusive power of Congress to regulate patents. See also opinion of Davis, J., *ex parte* Robinson, 3 Ind., Stat. 365: "If the patentee complies with the law of Congress on the subject, he has a right to go into the open market anywhere within the United States, and sell his property." "The law in question attempts to punish, by fine and imprisonment, a patentee for doing with his property what the National Legislature has authorized him to do, and is, therefore, void."

See further upon this subject, Pendar *v.* Kelley, Supreme Ct. of Vermont, Am. Law Register, Sept., 1876, 511.

JAMES B. ROMEYN, Counsellor at Law.
Detroit, Mich.

Boiler Explosions.

To the Editor of the Scientific American:

The cause of boiler explosions is nothing more nor less than carelessness and incompetency of owners and engineers in charge. There are men in charge of machinery and boilers who know nothing about either. I do not blame the men; the owners and operators are to blame for the explosions and loss of life. Many men put in charge of boilers have no idea of the amount of pressure in a boiler; and they will put up a new boiler and let it run until it blows up or burns out. It is seldom that we hear of any person here cleaning out a boiler—not one out of one hundred. When the boiler gets too full of water, they open the blow-off cock and blow some of it away.

I would recommend that surface cocks be placed in line with the middle gauge to blow off the sediment that accumulates on top of the water. The sooner there is a boiler inspector appointed, and engineers put through a thorough examination, the better it will be for owners, operators, engineers, and the community at large.

Turkey City, Pa. J. T. C.

Lightning Rods.

To the Editor of the Scientific American:

In last June, an elm tree standing 10 feet behind my house was struck by lightning. On the comparatively smooth upper limb, which was thoroughly drenched by the falling rain, no marks are visible. As the descending fluid encountered the rough bark—which was more or less dry underneath—of the larger branches, its effects became manifest. The rough bark was scaled off a place three or four inches in width. On the body of the tree, which was very shaggy, the bark was split through to the wood in three places. At the base of the tree, for about two feet above the ground, no effects are visible, which may be accounted for in this way: The upward spattering of the raindrops upon the surrounding stones had thoroughly saturated the bark at the base of the tree, and so afforded a good conductor for the electric fluid. To all appearance, the lightning left the tree as soon as it reached the ground, and ran off upon the surface. Had it followed a root, it would most likely have thrown up the dirt, as it usually does in such cases.

I maintain that it is just as well for a lightning rod to terminate at or just beneath the surface as it is to extend down several feet. For, in the first case, inasmuch as it almost always rains during a thunderstorm, if the rod were struck, the fluid would find no difficulty in passing off upon the wet surface; but in the second case it would often—and especially near a cellar wall—be very apt to find a dry terminus.

Franklin, N. Y. P.

Feeding Poultry.

To the Editor of the Scientific American:

In raising poultry, it is not sufficient merely to provide proper food; but the food must be properly given. Some persons have an idea that, if they throw down a heap of corn once or twice a day, that is all that is required; but no plan is so extravagant nor so injurious as this. The corn or other food should be scattered as far and wide as possible, that the birds may be longer employed in finding it, to the benefit of their health; and that they may not accomplish in a few minutes that which should occupy them for hours. It is the nature of fowls to take a grain at a time, and to pick grass and dirt with it, which assists digestion; but if, contrary to this, they are enabled to eat corn by mouthfuls, their crops are soon overfilled, and they seek relief in excessive draughts of water. Nothing is more injurious than this; and the inactivity that attends the discomfort caused by it lays the foundation for many disorders.

Yarmouth, Me. B. D. ALLEN.

New Fac-simile Printing Process.

We have lately examined, says the *Paper and Printing Trades Journal*, a novel fac-simile printing process (Byford's patent) introduced by Messrs. S. Straker & Sons, of Fenchurch street, London, E. C., by which useful invention a number of fac-simile copies of circulars, drawings, or any matter that can be written on ordinary paper, may, with the aid of an office copying press, be printed in a few minutes, and with little or no preparation, and on any description of dry paper, the original document or drawing remaining unimpaired. The fac-simile printing process is based on the well known and remarkable qualities of aniline. The document from which a number of copies are required is written with a patent aniline ink of immense strength, which is allowed to dry without being blotted up. A sheet of transfer paper is damped, the document is laid on its face downward, they are then placed in the "printing pad" (which is a leather portfolio of peculiar construction), and subjected for a few moments to pressure in the copying press. On removing the original document, a copy in reverse will be found on the transfer paper, and the operator can at once proceed to print the required copies, which is done by laying a sheet of ordinary paper on the transfer paper, the impression plate over it, and pressing for a few moments in the copying press, when it will be found that a duplicate or fac-simile of the original document has been produced; and so the process goes on until the impression becomes faint, when it is at once revived by damping the under side of the transfer. If a large number of copies are required, a second, and even a third, transfer may be taken from the original document, and printed from in the same manner as the first. The fac-simile printing process is somewhat analogous in its results to, but far simpler than, lithographic printing, and is being extensively used in government and public offices. It is so simple that the smallest or dullest office boy can work it without any fear of coming to grief; and as a useful adjunct to the counting house it will be thoroughly appreciated by all classes engaged in commercial pursuits.

Blue Glass Photography.

The blue-violet glass mania abroad seems to be confined to the photographers, and the conflict over the deceptive theory is being waged, not on the question of the curative powers of the light transmitted, but regarding the assertion that increased chemical action can be obtained by glazing photographic studios with the cerulean panes. M. Scottelari, the blue glass defender abroad, has fallen into the same errors as his co-believers on this side of the Atlantic: that is, he confounds the blue-violet rays of the spectrum with blue-violet transmitted sunlight; while he also reaches the obvious absurdity that the violet ray, when isolated from the spectrum, possesses greater capabilities than it had when mingled with the other rays. It is perfectly true that the violet ray is more active, chemically, than the other rays; but the latter do not detract from it when combined with it, and the chemical action of white light containing violet rays is precisely as great as that of the violet rays separated and tested alone. Hence it follows, as a matter of course, that a window glazed with white glass transmits the whole of the solar rays which reach it, violet among the rest. A window of the same size glazed with violet glass would transmit one seventh part of the rays reaching it, and these would be violet-colored rays; but it would not transmit one single violet ray more than the other window.

The *Photographic News* adds that, according to Draper and others, all the rays of the spectrum probably possess photogenic power on some substances; and therefore it is but just to M. Scottelari to conceive that he has found that the rays other than violet have an antagonistic influence on that ray, and obstruct its action on bromo-iodide of silver. But Mr. Thomas Gaffield of Boston, has recently made some new investigations on this very point, wherein the inferiority of the violet glass to clear glass is most clearly shown. Mr. Gaffield's conclusion relative to the photographic aspect of blue glass accords with our own relative to its employment for curative purposes. He says: "It is undoubtedly true that violet or other colored screens may be used with advantage in cutting off too much, or in making an even diffusion of, light upon the face of the sitter; but it can never be true, while two from six leave a less number than six, that the cutting off of a third, or any fraction, of the chemical rays of sunlight by a violet glass can enable the photographer to obtain more rapid or effective results."

THE "London" cement for joining broken glass, china, wood, etc., is made by taking a piece of Gloucester cheese, boiling it three times in water (each time allowing the water to evaporate), and mixing the paste thus left with dry quicklime.

STONE-WORKING IMPLEMENTS.

In stone working, as our readers are aware, the carbon or black diamond is now greatly used. The difficulty prominently encountered, however, in this particular, is that of fixing the diamond in the saw or cutter head so that it shall not work loose. In Fig. 1 (selected from Knight's "Mechanical Dictionary"*) we illustrate several modes of inserting the boot in

Fig. 1.

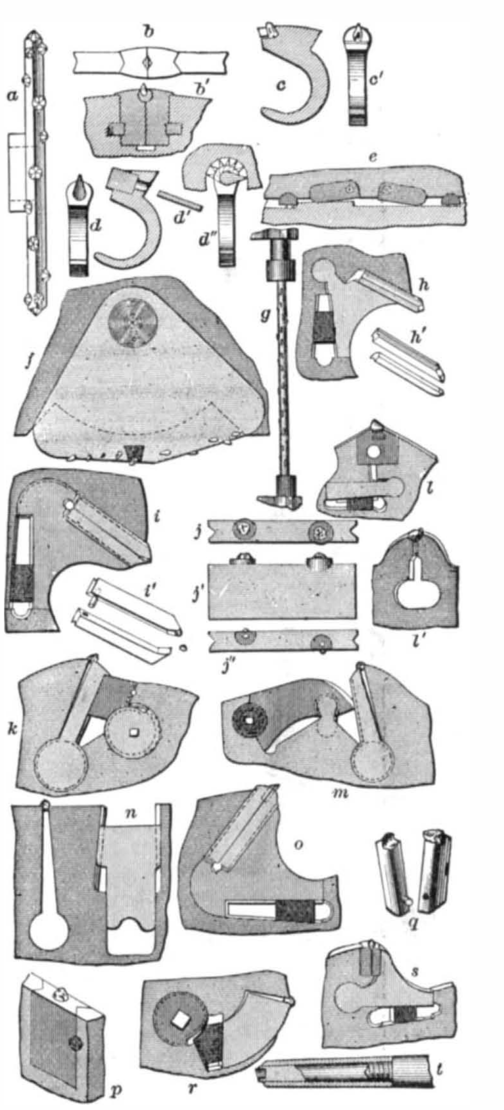


Fig. 2.

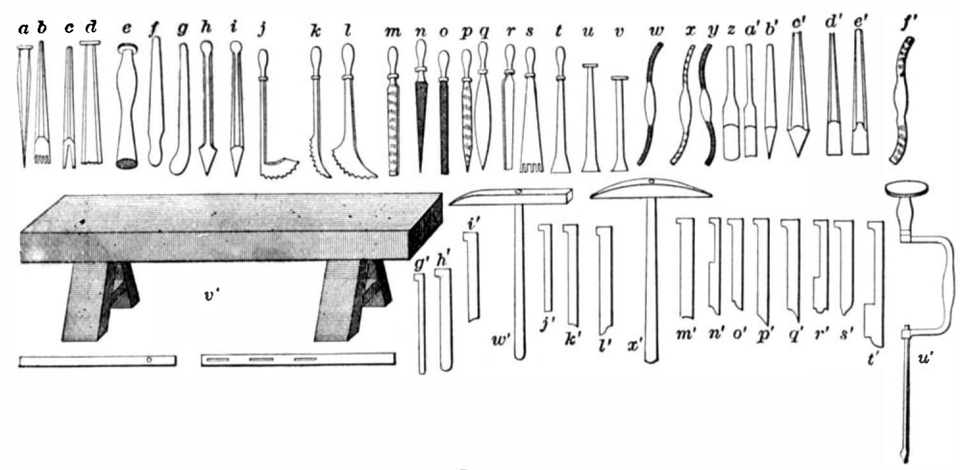
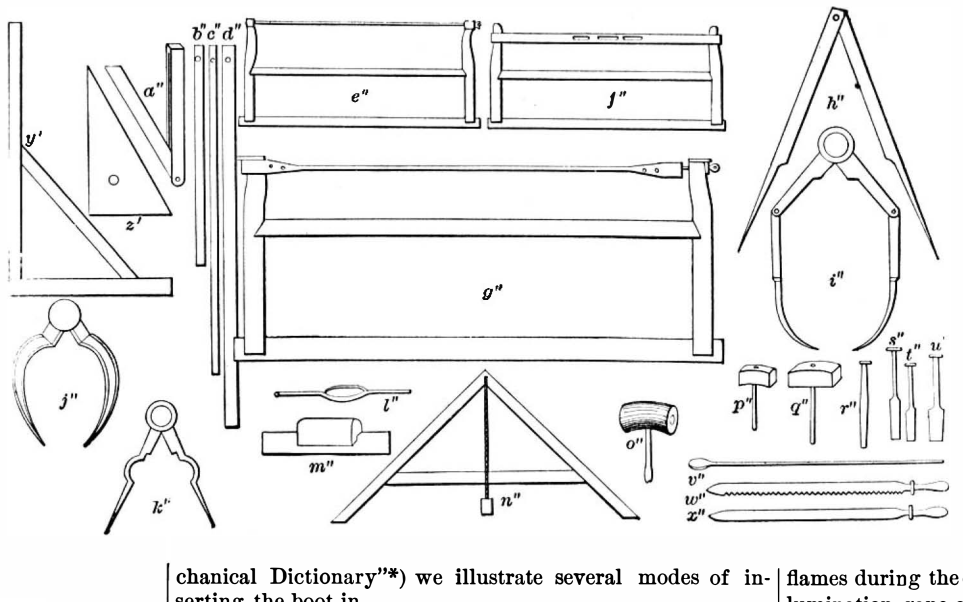


Fig. 3.



STONE SAWS.

It will be perceived that some of these imbed the diamond in the saw by sockets, rings, or solder; others grasp it by fingers which are clamped in sockets; others grasp it by wedges in the slot, or by clamps which are themselves jammed by wedges, etc.

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

In Figs. 2 and 3 are represented all the various kinds of

STONE WORKERS' TOOLS,

the names of which are as follows: *a*, square etching needle; *b*, marteline chisel; *c*, toothed chisel; *d*, marteline chisel; *e*, puncheon; *f*, *g*, scrapers for sinking flutings; *h*, *i*, etching needles, called *houguettes*, partly flattened and sharp; *j*, hook for leveling cavities; *k*, round-nose chisel, for leveling cavities; *l*, sharp edged notched scraper, for sinking flutings; *m*, half-round rasp; *n*, round file; *o*, flat file; *p*, German half-round rasp; *q*, *r*, safe-side rasps; *s*, *t*, marteline chisels; *u*, *v*, puncheons; *w*, *x*, *y*, parting tools, with curved ends in rasp or file; *z*, *a'*, gravers and burins; *b'*, *c'*, houguettes or etching needles; *d'*, *e'*, gravers and burins; *f'*, parting tool, with curved rasps; *g'* to *t'*, moulding chisels and scrapers, having edges of varying patterns; *u'*, wimble, for drilling; *v'*, stone-worker's bench; *w'*, *x'*, marteline hammers; *y'*, square; *z'*, triangle; *a''*, bevel; *b''*, *c''*, *d''*, rules and straight edges; *e''*, *f''*, *g''*, saws of various sizes and construction; *h''*, *i''*, *j''*, *k''*, compasses of various sizes and forms; *i''*, sebilla, or wooden bowl for holding sand and water; *m''*, handsaw; *n''*, level; *o''*, mallet; *p''*, *q''*, sledges; *r''*, *s''*, *t''*, *u''*, chisels of various sizes; *v''*, ladle for feeding sand and water to the saw; *w''*, *x''*, hand saws.

Contamination of the Air by Artificial Illumination.

In judging of artificial light from a sanitary point of view, we must consider its effect on the visual organs as well as on the other organs, and we have to notice both the effects produced by the products of combustion on the air we have to breathe and the increase of temperature due to the flame. Frederick Erismann has made some comparative measurements in both directions with different means of illumination. The results were published in the *Zeitschrift für Biologie*, xii., 315.

The experiments were made in a portion of the laboratory inclosed with wood and glass walls, and having a space of 353 cubic feet, or 10 cubic meters. The air was drawn out of this space at different heights by means of aspirators. By the use of a forked tube, a portion of the air was conducted directly into baryta water, and another portion through a tube filled with oxide of copper and kept at a red heat, and then into baryta water. The first portion gave the percentage of carbonic acid in the air, and the second the amount of other carbon compounds. The lights used for comparison were obtained by burning stearine candles, rape seed oil, petroleum, and coal gas. They burned for eight hours in this space with as equal flames as possible, and in the experiments with the candles six were burned at a time. The results of the measurements lay no claim to absolute exactness, because a whole series of inaccuracies, difficult, if not impossible, to remove, come in here; nevertheless they are of interest for relative comparison. The figures obtained show that, under all circumstances and with all kinds of luminants, the air of an inclosed space contains more carbonic acid and carbonaceous organic substances than in the absence of artificial illumination; yet in Erismann's experiments the quantity of carbonic acid was never greater than 0·6 or 0·7 per 1,000, while the percentage of other carbon compounds was extremely variable, so that the amount of carbonic acid is not a correct criterion for the pollution of the air. The quantity of carbonic acid actually found in the air of this experimental chamber was only a small fraction of that produced by combustion, so that by far the greatest part escaped by natural ventilation.

To compare the relative contamination of the air by the four luminants mentioned, the amount of carbonic acid and hydrocarbons was reduced to the standard of six normal candles. It was shown that with lamps of good construction petroleum contributed less carbonic acid to the air than any other source of light tested; and, what is more important, less of the products of incomplete combustion. Also that by equal illumination stearine candles contaminated the air most of all.

In regard to rise of temperature, Erismann made his experiments at four different places. They show that during the eight hours of the experiment, the lower strata of air, up a height of 5 ft., increased but slightly, on an average 3·5° to 5°, while the temperature of the uppermost strata near the roof increased considerably; for gas, oil, and petroleum this increase was 19° to 19·5° Fah., and for candles only 7·12°. If we regard the photometric effect of the flames during the experiments, it showed that with equal illumination rape oil and gas increase the temperature much more than petroleum, so that the action of the latter is about equal to that of the candles.

ROPES made from sheep's entrails are now made at Oakland, Cal., to be used for hoisting in mines.

NEW LUBRICANT-TESTING MACHINE.

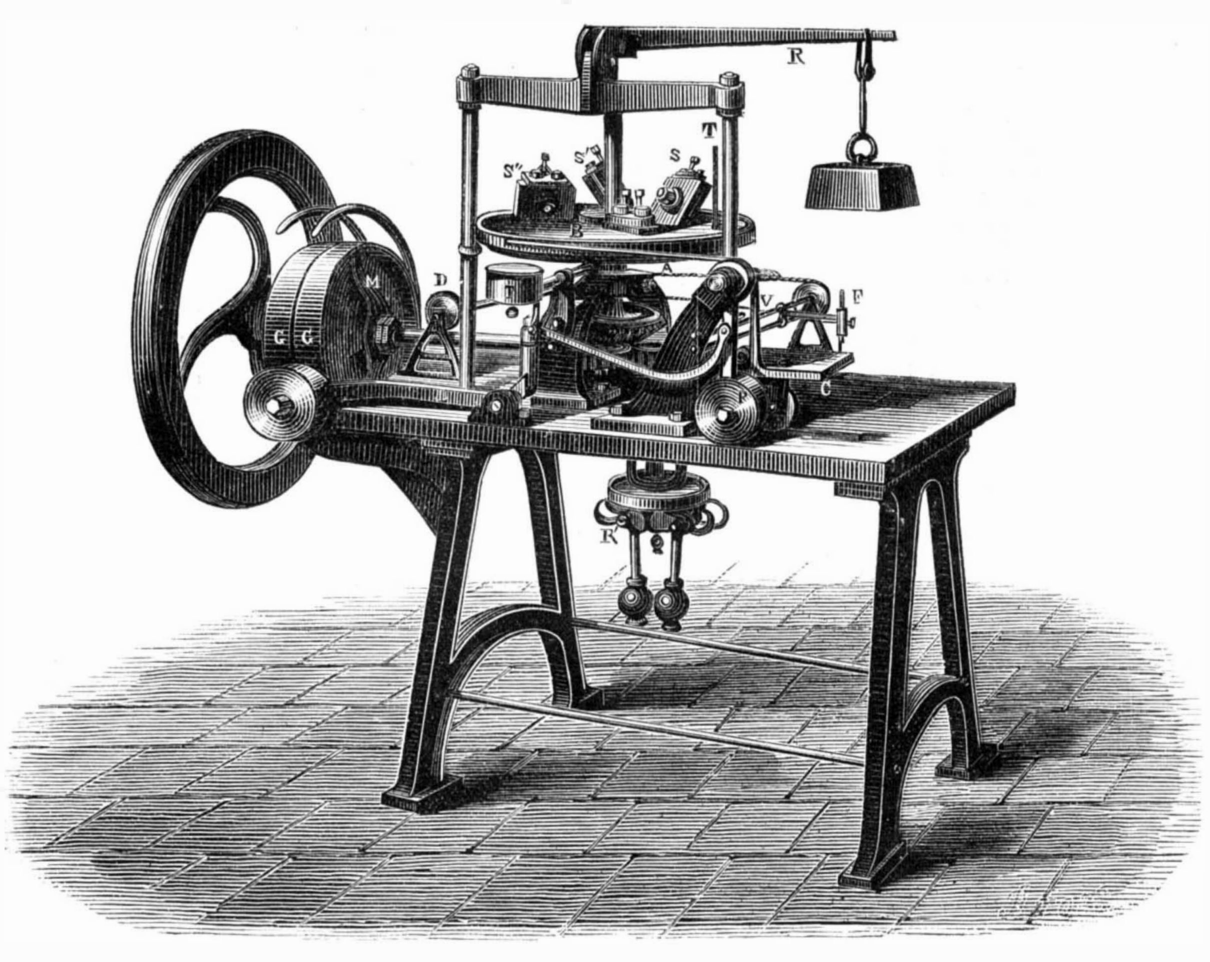
We illustrated quite recently Professor Thurston's apparatus for testing lubricants. We now present another machine for the same purpose, the invention of MM. Deprez and Napoli, which also serves for purposes of comparison of various oils, etc., by giving for each a distinctive trace on suitably ruled paper.

A, in our engraving, is a plate, adjusted perfectly level and polished. It is rotated by gearing from the pulley, G. This plate supports a second plate, B, by the intermediation of three pieces of bronze, S, S', S'', which make an angle of 30° with the vertical, and of each of which the surface in contact with plate, A, is of precisely similar dimensions, namely, one square inch. From this it results that the pressure exercised on the plate, B, by the lever, R, is equally distributed over the three pieces.

In order to measure the co-efficient of friction of any oil, a certain quantity is placed between the two plates; the friction developed by their relative movement tends to draw the plate, B, and this tractile force is as much greater as the lubricating quality of the oil is the less. In order to measure the extent of the drawing, to the plate, B, is attached a very thin steel ribbon, connected at its other extremity to a very easily moved pulley, which is mounted on points, and to the axis of which is secured the pendulum, P. Representing by L the distance from the center of gravity of this pendulum to the axis of suspension, by t the angle which the right line joining these points makes with the vertical, by R the radius of the pulley over which the steel ribbon passes, and by P the weight of the pendulum, the relation between these five quantities is expressed by the equation: (1) $f\text{R} = \text{PL} \sin. t$, whence (2) $f = \dfrac{\text{PL} \sin. t}{\text{R}}$

But the rod, R, of the pendulum carries, at any point of its length, a roller which engages upon a vertical piece, V, attached to a carriage, C, the latter mounted on wheels which traverse rails. If we represent by y the displacement of the carriage, corresponding to a deviation, t, of the pendulum, by l the distance of the roller fixed to the pendulum from the axis of suspension of the latter, we evidently have $y = l \sin. t$. This, compared with (2), gives $y = \dfrac{fl\text{R}}{\text{PL}}$; or, in other words, the displacement of the carriage is proportional to f, that is to say, to the rubbing friction.

The carriage carries a sheet of paper, against which is pressed at will a pencil, F, which has a very slow motion of translation proportional to the number of turns of the platform, A, and the direction of which is perpendicular to that of the movement of the carriage. The curve traced on the paper by the composition of these two movements is then the curve representing the value of the friction in terms of the number of turns made by the platform, A. Simple inspection of the curve, therefore, is all that is needed to determine at once the intensity of the friction at each instant, and its quadrature will give the total work absorbed by the machine. The chart on which the curves are described is suitably divided and marked, horizontally to show number of turns, and vertically to indicate effort in lbs. or kilograms. Each variety of oil gives a clearly distinct curve from other varieties, so that its relative lubricating power may be readily estimated.



DEPREZ AND NAPOLI'S LUBRICANT TESTER.

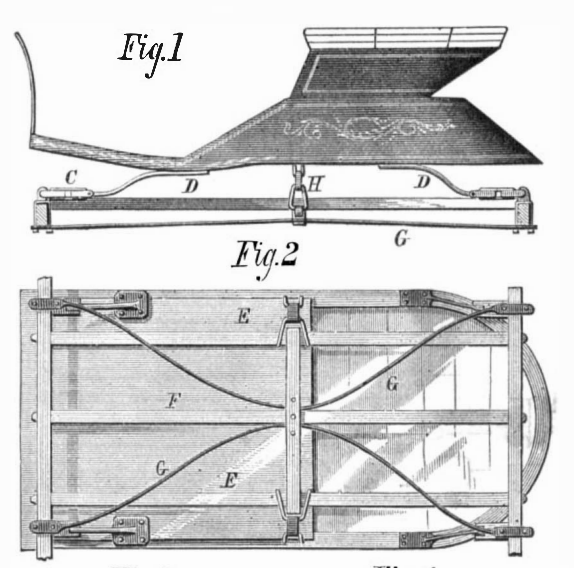
Discontent.

How universal it is! We never knew one who would say "I am contented." Go where you will, among the rich and the poor, the man of competence, or the man who earns his bread by the daily sweat of his brow, and you hear the sound of murmuring and the voice of complaint. "The other day," said Freeman Hunt a good while ago, "I stood by a cooper, who was playing a merry tune with his adze around a cask. 'Ah!' said he, 'mine is a hard lot—for ever trotting round like a dog, driving away at a hoop.' 'Heigho!' sighed our neighbor, the blacksmith, in one of the hot days, as he wiped the drops of perspiration from his brow, while his red hot iron glowed on the anvil; 'this is life with a vengeance, melting and frying one's self over the fire.' 'Oh, that I were a carpenter!' ejaculated a shoemaker, as he bent over his lapstone; 'here I am, day after day, working my soul away in making soles for others, cooped up in this little seven by nine room.' 'I am sick of this out-door work,' exclaims the carpenter, 'broiling and sweating under the sun, or exposed to the inclemency of the weather—if I only was a tailor!' 'This is too bad,' perpetually cries the tailor, 'to be compelled to sit perched up here, plying my needle—would that mine was a more active life!' 'Last day of grace—the banks won't discount—customers won't pay—what shall I do?' grumbles the merchant; 'I had rather be a dray horse—a dog—anything!' 'Happy fellows!' groans the lawyer, as he scratches his head over some perplexing case, or pores over some dry record—'happy fellows! I had rather hammer stone than cudgel my brain on this tedious, vexatious question.' And through all the ramifications of society, all are complaining of their condition—finding fault with their particular calling. 'If I were only this or that, or the other, I should be content,' is the universal cry—'anything but what I am.' So wags the world, so it has wagged, and so it will wag."

IMPROVED VEHICLE SPRINGS.

We illustrate herewith a new construction of springs for vehicles, which is light, easily applied to any style of carriage, and not costly. The springs, we are informed, weigh but one lb. each, and they are connected to the wagon body and frame by a simple arrangement of brackets. The manner in which the springs are made will be understood from Figs. 3 and 4 of the engraving. Fig. 3 consists of two interlocked metal pieces, A, between which rubber is inserted. This is termed a single spring. In Fig. 4, which is a double spring, two half boxes are interlocked with a third piece, B, thus making two spaces, both filled with rubber. The latter may completely fill the space, or may be notched or cut away to regulate the elasticity of the spring.

It will be seen from Fig. 1 that double springs are attached at one end to the upper parts of the hind axle tree and rocker, C, by means of bolts. Their opposite ends are fastened to brackets, D, which are secured to the body so as to support the same; thus holding the rubber in the springs in a state of compression. On the lower frame of the buggy are represented two parallel longitudinal bars, E, strengthened by a cross girt, F. There are also two metal braces, G, extending diagonally from the corners to the center, these being secured to the lower sides of the hind axle tree and rocker, and also to the cross girt, F, in the center. These prevent either axle tree or rocker from being turned over by the action of the springs and load. On each side of the lower frame, secured thereto and to the body, is a link, H, which prevents the body being tipped sideways on the occupant's getting in or out. This link is made of metal, and consists of two brackets and an intermediate connection. The brackets are attached respectively to frame and body; and the bolt holes on the link are elongated so as to allow of some freedom of action. The remainder of the body is constructed in the usual way. The device is well calculated to add to the lightness of vehicles, both in appearance and in actual weight; while it is also neat and compact.



Patented through the Scientific American Patent Agency, February 13, 1877. For further information, address the inventor, Mr. Lucius A. Fogg, Parker City, Armstrong county, Pa.

More Mysterious Clocks.

M. Cadot, of Paris, has recently invented a curious clock which deserves a prominent place among the number of similar ingenious devices which we lately described. It has two apparently free hands placed in the center of a double pane, the two sheets of glass composing which are held in an ornamental frame. The clock is operated by concealed mechanism in the frame, which once a minute causes a slight and nearly invisible motion of one of the glasses. This causes the movement of the minute hand, and a minute train of gearing concealed in the pivot of the latter actuates the hour hand.

Mr. Robert Heller, the conjurer, has lately been exhibiting a clock of his own invention, the mystery of which no one, we believe, has yet fathomed. It is a clear disk of glass, marked with the usual numbers. The hands have no bulb or other enlargement at the center, where it might be imagined mechanism could be concealed, and appear to be simply pivoted to the face. A ring like that of a watch suffices for the support of the clock from two cords suspended from the ceiling. At the command of its owner, the clock marks any hour, moves backward or forward, and otherwise behaves in an astonishing manner. The use of the cord naturally suggests concealed wires and electricity, which is probably the secret of the movement. But this theory is somewhat damaged when the magician removes the clock from its cords, and, holding it with two fingers at arm's length, carries it in the midst of his audience and causes it to continue its performances under the very eyes of the people, allowing the closest inspection. One clock like that would serve as an invaluable aid to an exhibiting spiritualistic medium, and would cause widespread rejoicings among the elect.

A Dog Show in New York.

We are informed that a dog show of considerable magnitude is to be held at the Hippodrome in this city in May next. A number of sporting and non-sporting dogs are expected from England and Canada to compete for the prizes, which will be numerous and valuable. The foreign contributions will add interest to the exhibition. It is expected that this will be the largest show of the kind ever held in this country. Messrs. Tiffany & Co. head the list of those offering special prizes, which is a guarantee that they will not be of a cheap or inferior quality.

Mr. C. Lincoln, who may be addressed at P. O. Box 2832, N. Y., is Superintendent of the exhibition, and of him all information may be had. Entries are not to be received after April 25, except from abroad. Foreigners are allowed till May 1.

TO SOFTEN metal castings, bury them in sawdust in an iron box. Make it airtight with clay, and subject to a red heat for several hours. Let the whole cool before taking out the castings.

CUTLER'S cement, for fastening blades of dinner knives in ivory handles, consists of rosin 4 parts, beeswax 1 part, plaster of Paris or brickdust 1 part. Fill the hole in the handle with the cement, heat the tang of the blade, then press it in.

SOME MEMBERS OF THE LIZARD FAMILY.

We published, on page 295 of our volume XXXIII. and page 311 of volume XXXV., some engravings of typical members of the family of iguanas, a very numerous species of the genus of lizards. The name iguana (says the Rev. J. G. Wood, from the pages of whose admirable "Illustrated Natural History" we select the annexed engravings) is employed loosely to many species of lizards, such as the monitors and varans, which in reality have little in common with the true iguanas. These reptiles can mostly be distinguished from the rest of their tribe by the formation of their teeth, which are round at the roots, swollen, and rather compressed at the tip, and notched on the edge. There are generally some teeth on the palate. All the true iguanas, moreover, are natives of the New World.

Our first illustration shows the marine oreocephale, an animal first discovered by Mr. Darwin on the turtle-haunted coasts of the Galapagos Islands. It is amphibious, and passes a considerable portion of its time in the water. Mr. Darwin says: "It is a hideous-looking creature, of a dirty black color, stupid and sluggish in its movements. The usual length of a full grown one is about a yard, but there are some even four feet long. I have seen a large one which weighed 20 lbs. These lizards are occasionally seen some hundreds of yards from the shore, swimming about, and Captain Collnett says that they go out to sea in shoals, to catch fish. With respect to the object, I believe he is mistaken, but the facts stated on such good authority cannot be doubted.

"When in the water, the animal swims with perfect ease and quickness by a serpentine movement of its body and flattened tail, the legs during this time being perfectly motionless and closely collapsed on its sides. A seaman on board sunk one with a heavy weight attached to it, thinking thus to kill it directly; but when, an hour afterward, he drew up the line, the lizard was quite active. The limbs and strong claws of the lizard are admirably adapted for crawling over the rugged and fissured masses of lava which everywhere form the coast. In such situations, a group of six or seven of these hideous reptiles may oftentimes be seen on the black rocks, a few feet above the surf, basking in the sun with outstretched legs."

The throat of the marine oreocephale is not formed into a pouch, but the skin is loose, and the animal can dilate it at will. The body is covered with sharp, tubercular scales; a crest of longer scales runs along the back. The teeth are sharp and three-lobed, and although, when the mouth is opened, they present a very formidable array of weapons, the creature is quite harmless, and feeds on vegetable diet, seaweeds forming the chief part of its substence. The middle toes are united by a strong web, and the claws are large. There is some difference in the aspect of the young and the adult, which is most obvious in the head, where the scales are rather convex in the young, but in the adult are enlarged into unequal and rather high tubercular shields.

Our second engraving is one of a basilisk, an animal mentioned in Scripture and known to heraldry, but whose existence was long regarded as apocryphal. Its name (from the Greek *basileus*, a king) was bestowed on it on account of its supposed authority over other reptiles, which perished, according to ancient writers, in the glance of the basilisk's eye. "This poyson," says Topsel, "infecteth the air, and the air so infected killeth all living things, and likewise all green things, fruits and plants of the earth, it burneth up the grasse whereupon it goeth or creepeth, and the fowls of the air fall down dead when they come near his den or lodging." Other writers state that the crowing of a cock would so alarm the reptile that, on hearing the sound, it would fly into the depths of the desert and there conceal itself. Travelers in the deserts of Libya were recommended to carry with them a supply of roosters, to drive away the basilisks from the routes. In all probability, a basilisk, as shown in our engraving, was once found in the East; and its ugliness being exaggerated by successive writers, these fables became generally believed. The basilisk is a good climber of trees and can swim well; and its food consists apparently of insects and various little creatures which frequent the water and its banks. Its greatest length is three feet; and along the back, in place of the row of pointed spines usually found on an iguana, runs one crest-like membrane, another occupying the upper surface of the tail. There is a slight pouch on the throat, and the palate is toothed.

Our third engraving is a fringed tree gecko (*ptychozoön homalocephala*), one of the sub-order of lizards termed *pachyglosæ*, or thick-tongued. It is a native of Java, and is worthy of notice on account of the broad membranous expansions which fringe the sides of the head, back, limbs, and tail. On the body this membrane is covered with scales, and waved on its edges; but on the tail, the waves become suddenly deepened, so as to form bold scollops. The toes are webbed to the tips, and, with the exception of the thumb joint, are furnished with claws at the swollen extremity. The scales of the back are smooth and flat, and even the membranous fringes are covered with scales. Formerly this animal was thought to be aquatic in its habits; but it is now known to live on trees, and to employ the membranous expansions to aid its passage from branch to branch, after the fashion of the flying squirrel. Its color is brown above, with a yellowish tinge on the spine, crossed with dark brown lines. Below it is of a whitish gray color.

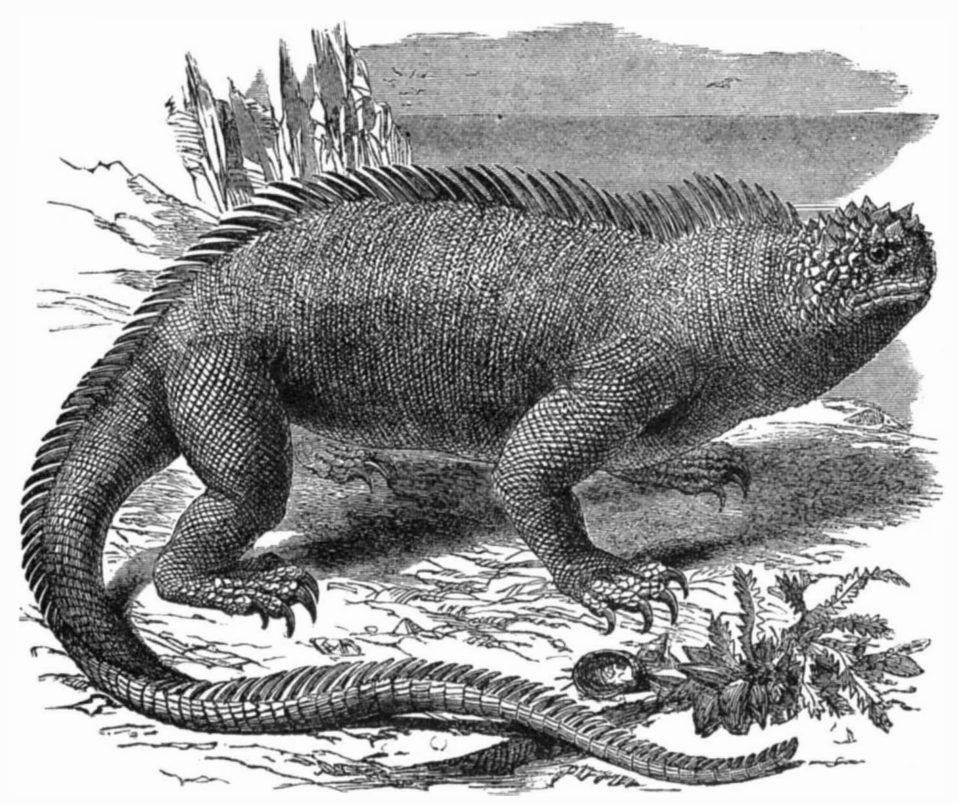


Fig. 1.—THE MARINE OREOCEPHALE.

Fig. 2.—THE BASILISK.

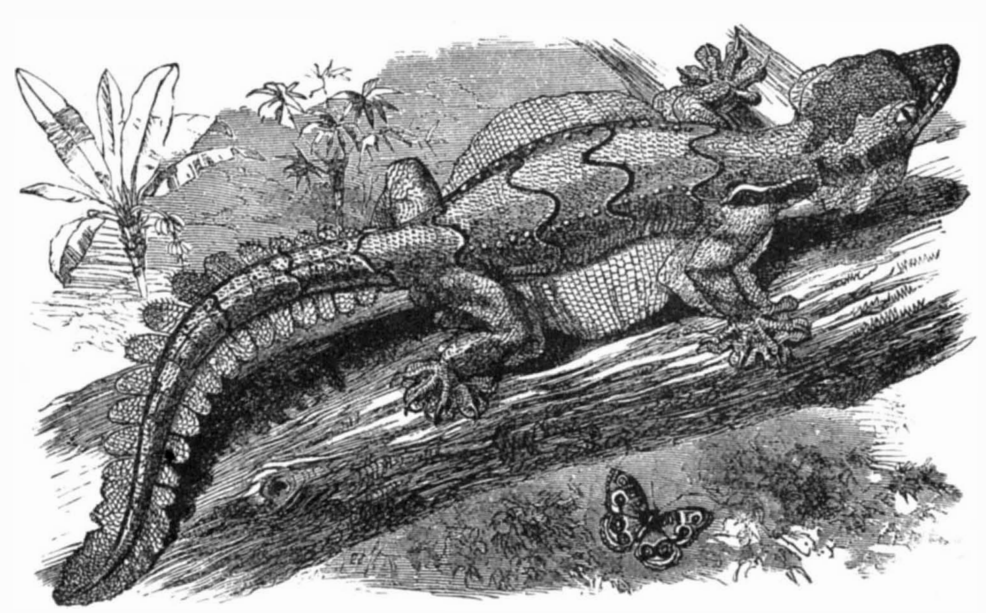


Fig. 3.—THE FRINGED TREE GECKO.

Cleopatra's Needle.

Through the liberality of an eminent physician and scientist, Dr. Erasmus Wilson, of London, the plan for moving the obelisk—presented to the British Government some years since by Mehemet Ali—to England is about to be carried out. In our issue of March 25, 1876, we published an engraving of this celebrated relic, and stated that plans had been suggested for conveying it to London. The London *Times* gives the history of the obelisk, from which we extract the following:

It is to the period of Egypt's splendor, the summit of its power, and the reign of Thothmes III., the powerful monarch and conqueror, that the fallen obelisk of Alexandria belongs, and it was one of the triumphal columns raised by that monarch to record his victories over Asia and Ethiopia. The central line of hieroglyphs on each side the original dedication contains the name and titles of the monarch and records that it was erected to the god Ra, or the Rising Sun, and to Tum, or the Setting Sun, on the occasion of the festival of thirty years at On or Heliopolis The inscription states that it was capped with gold, but of course it has been stripped of that ornamental portion. How or when it fell is unknown; probably the effects of an earthquake or the undermining of the soil by the sea, to which it lies near, may have caused it to fall. The pedestal is still *in situ*, and at the base was found a dial showing that it had either stood in the Hippodrome or else served as a gnomon to the Cæsareum. In the days of Pliny both were erect, and he attributes them to Miphres or Moeris, the classical name of Thothmes III. It was, perhaps, not erected in his reign, for two lateral lines of hieroglyphs, one on each side of the central one, have been added by Rameses II., more familiarly known as Sesostris.

When the Emperors of Rome began to embellish the Eternal City with these spoils of vanquished Egypt, it is difficult to know why the two obelisks of Alexandria were left behind, except that, as they stood in the Cæsareum and were convenient landmarks, they might have been left as a monument to Cæsar and a guide to mariners. The last obelisk transported to Europe and set up in the Place de la Concorde, at Paris, was selected for its superior beauty and finer condition, the standing obelisk of Alexandria being rejected on account of its worn state, especially on that side which faces the sea. The idea of removing the fallen obelisk to England, as a memorial of the departure of the French from Egypt, was entertained at the beginning of the present century, but it was abandoned in consequence of orders from Lord Keith and General Fox, who held command of the naval and military forces in the Mediterranean; and a bronze plate, commemorating the principal events of the campaign, was inserted in the pedal of the obelisk. Mehemet Ali presented it to the Prince Regent, and the gift was accepted by the British Government. The question of its removal was seriously entertained, but the estimate of the expense deterred the government from the attempt. But the question was again brought forward in 1876 by General Sir J. E. Alexander, and there is now every prospect of its being removed and being placed on an appropriate site on the Thames Embankment. The removal is to be undertaken by Mr. John Dixon, civil engineer, who proposes the following means of transporting this shaft of granite: The sand is to be cleared away, and the obelisk set square, parallel with the existing sea wall. An iron cylinder, finished off to a chisel edge, with sufficient diaphragms to give it strength, is to be constructed round the obelisk, which is to lie in the long axis of the cylinder and to be wedged and caulked where it passes through the diaphragms so as to divide the cylinder into water-tight compartments. The cylinder is to be ninety-five feet long by fifteen feet diameter, and will have a draught of nine feet of water when afloat. All being riveted water-tight, it will be rolled into the sea and across the sandy bed of the water until it floats. It will then be turned over and the manholes at the top opened, and about thirty tons of ballast will be put in to keep the ends vertical, so as to act like stem and stern. It will then have two keels, a rudder, spar deck, mast and lug sails attached, and be provided with an anchor and good chain cables, and, if necessary, a pump in case of leakage. The cylinder ship will then be fit to go to any port of the world with its freight, and in any weather.

The cost of this operation will amount to about $15,000. The obelisk in its case will be towed over during the summer months and laid aside the Thames Embankment on a platform properly prepared for the purpose and lifted high enough to clear the parapet, and the bilge keels and other additions being stripped off, the cylinder will be rolled to the proposed site and then stripped off the obelisk, which will lie ready to be elevated to its pedestal, an operation which will be simply effected by means of a few balks of timber and two small hydraulic rams. The whole cost is not to exceed $50,000, and that of the obelisk at Paris is said to have been $400,000.

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 April, 1877.

Mercury.

Mercury cannot be seen early in the month. On April 1, it rises at 5h. 42m. A. M., and sets at 5h. 52m. P. M. On the 5th, it is at its superior conjunction, that is, it ranges with the sun and on the side remote from the earth. On the 30th, Mercury rises at 5h. 49m. A. M., and sets at 8h. 47m. P. M. At this time it should be looked for in the twilight, some degrees north of the point of sunset.

Venus.

Venus cannot be seen. It is approaching superior conjunction, is apparently small, and ranges nearly with the sun.

On the 1st, Venus rises at 5h. 32m. A. M., and sets at 5h. 32m. P. M. On the 30th, Venus rises at 5h. 1m. A. M., and sets at 6h. 40m. P. M.

Mars.

Mars can be seen only in the morning. On April 1, it rises at 2h. 14m. A. M., and sets at 11h. 20m. A. M. On the 30th, Mars rises at 1h. 24m. A. M., and sets at 10h. 56m. A. M.

Mars can be recognized on April 30 by its position relatively to the double star a^2 *Capricorni*. It is south and east of this well known star.

Jupiter.

Jupiter is coming into better position. On April 1, Jupiter rises at 1h. 2m. A. M., and sets at 10h. 4m. A. M. On the 30th, Jupiter rises at 11h. 6m. P. M., and sets at 8h. 8m. the next morning. Jupiter is very low in the south, but can easily be known by its size. It is among the stars of *Sagittarius*, moving very little through the month, stationary on the 19th, and after that date is retrograde in its motion.

Saturn.

Saturn is visible for very few hours. It rises on April 1 at 4h. 53m. A. M., and sets at 3h. 57m. P. M. On the 30th, Saturn rises at 3h. 6m. A. M., and sets at 2h. 18m. P. M.

Uranus.

Uranus is the only planet in a good position for observations. On the 1st, Uranus rises at 1h. 56m. P. M., and sets at 3h. 48m. the next morning. On the 30th, Uranus rises at noon and sets at 1h. 53m. A. M. of the next day.

Uranus is occulted by the moon on the 21st a little after midnight. The moon passes directly between the earth and the planet, and hides the latter from our view. According to the *Nautical Almanac*, the planet disappears behind the moon at 12h. 31m. A. M. (Washington time), and reappears at 1h. 24m. A. M. of the 22d.

Uranus will be low in the northwest at this time, but it will not set until some twenty-five minutes after two; and as the moon will be just past its first quarter, the observation of the phenomena can be easily made, and cannot fail to be interesting. An ordinary opera glass will render Uranus visible as the moon approaches it, and the difference of color between moon and planet will be very noticeable.

Sun Spots.

The report is from February 19 to March 16 inclusive. The pictures of February 19 and February 21 show the sun's disk free from spots. From February 21 to March 1, photographing was prevented by clouds. The pictures of March 1 and March 3 show, near the center of the disk, a large group, consisting of a large spot surrounded by a chain of small ones, and above this a very small spot. On March 5 the small spot could not be found, and a change was observed in the number and arrangement of the spots in the group. On March 6 the small spots in the group were no longer seen, and only the large one remained, while near the center a pair of large spots was observed which had not been visible on March 5. The observation of March 8 showed the group still visible, but the single spot had passed off. On March 9 the disk was free from spots. On March 10 a very small spot in the midst of faculæ was seen on the western limb. From March 10 to March 16, whenever observations have been made, the disk has been uniformly free from these phenomena.

[For the Scientific American.]

THE SEPARATION OF COBALT FROM NICKEL BY COLORIMETRIC TEST.

BY LEONIDAS SCHUCH, PH.D., NEW YORK.

The handbooks of chemistry give methods for the separation of cobalt from nickel which could only be practically used when operated on a large scale, and with a considerable expenditure of time and money. Induced some time ago to seek a practicable method, I herewith give the results of my experiments to the public. The ore used was iron pyrites carrying cobalt and nickel free from arsenic, dispersed in green or black hornblende. This ore is found at Stony Point, Rockland county, N. Y., where a vein of it appears almost on the surface. The mat produced by cupola furnaces consists especially of sulphuret of iron, about 1 per cent of cobalt and nickel, and 3 per cent of copper. The mat is nearly all dissolved by diluted sulphuric acid, copiously evolving sulphureted hydrogen. Iron vitriol stays in solution, and this is crystallized and brought to market, and the remainder is a muddy, black deposit in the form of carbureted iron, bisulphureted iron, and the sulphurets of cobalt, nickel, and copper, slowly and only partially soluble in concentrated acids. The black residuum is separated from the mother liquor by strong pressure, and mixed to a pulp with English sulphuric acid in ample stone jars, and soda saltpeter added (with occasional stirring) as long as red vapors rise. Very remarkable heating of the mixture takes place, and nitrous acid is evolved. The end of the operation is at hand when the pulp begins to solidify, and the whole mass appears of a rather brown color. The mass is then emptied into vats, and cold water under agitation added. The undissolved part, consisting mostly of sandy particles, is deposited there.

The clear supernatant liquid which holds in solution (besides the salts of iron) the salts of cobalt, nickel, and copper, is mixed with a thin pulp of hypochloride of lime, until ferrocyanide of potassa fails to produce a blue color. Finally the iron salts are thrown down with chalk. The liquid separated from the iron salt contains now cobalt, nickel, and copper. After passing sulphureted hydrogen gas through the solution (by which operation the copper is taken out), the liquid, holding considerable quantities of lime salts, is treated with sulphuret of soda (which latter is prepared by boiling together soda, slaked lime, and sulphur). The deposit of the sulphureted metals is washed as much as possible, pressed, and, by additions of concentrated sulphuric acid and soda saltpeter, dissolved. The liquid, brought to the boiling point, is neutralized with soda until metallic carbonates begin to separate, and then treated with a solution of hypochloride of soda (made of hypochloride of lime and soda); and after each addition, a small portion of the precipitated hyperoxyd of cobalt is separated by filtration to observe the change of color.

By the first precipitation, there is a pink-colored solution produced, which gradually, by continued additions of the precipitating medium, turns to a grayish green. When the filtrated liquid stays at a pure green, the point is at hand where all the cobalt is separated. A solution of a pure nickel salt, kept in a test tube of the same diameter as that used for filtration, can serve as a guide.

To ascertain when the separation of the two salts is perfect, it is necessary to make a quick test. A small portion, neutralized with an excess of ammonia until a light blue nickel salt solution is obtained, is filtered through a small paper filter. Change of the color (by the formation of oxycobalt salt) of the filtrate is a proof that the separation is not entirely effected; in which case an additional quantity of the hypochloride of soda is carefully added till no change of color takes place after filtration; the separation is then completed. The liquid now is left undisturbed until the clear supernatant part can be drawn off, the hyperoxyd of cobalt filtered, and the adherent liquid finally separated from the deposit by pressure. The solution of the nickel is now brought to the boiling point and the metal precipitated by a solution of hypochloride of soda, as hyperoxyd of nickel.

Finally, I have to state that, by the presence of cobalt in nickel salts, or *vice versa*, the color of either one of the salts is rendered grayish green or reddish green, the phenomenon of which explains itself by the complementary action of red and green.

How to Use a Galvanic Battery in Medicine.

Dr. Herbert Tibbits recently delivered an important lecture on the above subject before the Hunterian Society of Edinburgh, Scotland. After discussing the various modes of applying electricity, he explained that, the dry skin being a non-conductor of electricity, dry metallic conductors from an electrical instrument in moderate action when applied to it produced only sparks and crackling, but no physiological phenomena, the electricity not penetrating the skin; but that, if these metallic conductors were replaced with well moistened sponges, very variable phenomena of contractility or sensibility were produced, according as the electricity acted upon a nerve, a muscle, or an osseous surface. That the voltaic current was applied as an interrupted and as a constant current; in the former case, the current being interrupted by gliding over the skin one or both of the conductors, or keeping one stationary and lifting and re-applying the second at intervals; in the latter, by maintaining both conductors immovable, or by the feet or hands of the patient being immersed in tepid water with which the conducting wires of the battery were in contact. Radcliffe's "positive charge" was then explained, and it was shown that by connecting the negative pole of the battery with the earth, and carefully insulating the patient, the negative electricity passed away, and that the patient remained charged with positive electricity only. Direct muscular electrization, by placing the conductors upon points of the skin corresponding to the muscle, was then contrasted with indirect muscular electrization, consisting in causing muscular contraction by acting upon the special nerve-trunk and branches, instead of placing the conductors upon the muscle itself, and the methods of electrizing the brain, spinal cord, internal organs, and organs of the senses were shown.

The general principles of electro-therapeutics were then considered: that the influence of faradaism in those cases in which it does not produce muscular contraction is chiefly stimulant; that where it does produce contraction it acts in addition as an artificial gymnast, imitating natural muscular action in a way quite impossible to any agency but electricity; that the interrupted voltaic current is similar in its action upon muscle to faradaism; but that this is complicated by chemical effects upon the animal tissues, and by special influences upon the central nervous system. That the constant voltaic current differs altogether from either of the above; that it consists not only of a current which is continuous, and which does not vary in power during the application, but of this current so applied to the patient by the operator that its flow through that part of the patient's body to which it is directed shall be as continuous as the stream of the current from the battery to the conductors; and it was strongly insisted upon that unless thus applied it is not a constant current at all, and that its therapeutic application will be unsatisfactory; that the effects of the current thus applied are chiefly sedative, restorative, or refreshing and absorbent; that it possesses great power, power sometimes unapproached by any other remedy, in relieving pain; that in its application for the relief of neuralgia the sponges should be so applied as to include the affected nerve in the circuit; that the strength of current should not be sufficiently great to produce pain; and that not only should the conductors be maintained quite immovable, but that care should be taken that the strength of the current should be so gradually increased that no shock is felt, and at the end of the application it must be as gradually decreased. Length of application from five to ten minutes, and frequently, usually, once or twice daily.

Dr. Tibbits believes that in severe and obstinate cases the full sedative effect of the current is only to be obtained by applying it as frequently as the paroxysms of pain recur. The use of electricity in muscular rheumatism and rheumatic gout was next considered, and cases quoted. In cerebral paralysis no support was given to cerebral galvanization, and it was advised that peripheral faradization should not be used until three or four months after the attack, and then only of a strength just sufficient to bring the muscles into full contraction, but that in cases in which the paralyzed muscles were cold, blue, flaccid, and ill-nourished, they should be well sponged with the voltaic current alternately with faradization. Applications to be made daily, or every other day, for from five minutes to fifteen minutes. In spinal paralysis the evidence in favor of direct electrization of the cord was said to be much greater than could be adduced in support of similar treatment of the brain, and when powerless to cure, it not unfrequently relieved some of the most distressing symptoms. Peripheral faradization should not be employed during the early periods of active mischief in the cord, but in the persisting localized paralysis following upon myelitis it is often of the greatest service, especially in relieving symptoms of paralysis of the bladder and rectum: the dribbling of urine, which is so troublesome in some paraplegic cases, being frequently relieved. In locomotor ataxy the constant current was recommended as often relieving many of the symptoms. Reference was made to Dr. Poore's successful treatment of writer's cramp by localizing the voltaic current in the nerves of the affected muscles, and exercising these muscles during the passage of the current by various gymnastic movements; and two successful cases were quoted in which faradization of the antagonists of the suffering muscles, united with the localization in the muscles themselves of Radcliffe's "positive charge" for fifteen minutes daily, had resulted in a cure. The subject of essential infantile paralysis was then discussed, the lecturer saying that the more his experience of this disease extended the more strongly did he feel how lamentable it is that the physiological treatment of the affected muscles in this affection has not yet become the routine treatment invariably directed by the practitioner in attendance, and that within a short time of the onset of the disease. Were it so, he added, an incalculable amount of helplessness and subsequent unhappiness would be spared to children; and if proper treatment is adopted in time, the greater number of cases admit of cure, and where perfect recovery cannot be obtained we have the great authority of Mr. William Adams for the statement that deformity ought never to result.

A case was then detailed which was first seen by Dr. Tibbits in 1869. The child was then suffering from a typical attack of infantile paralysis affecting the muscles of the left thigh and leg. Electrical treatment was recommended, but circumstances only allowed of its administration upon three or four occasions, and the child went to India, returning in June, 1875, with a useless leg measuring some inches less in circumference than the healthy limb. There being complete abolition of reaction to both currents in all the affected muscles, no hope of benefit was entertained; but at the earnest request of the mother, she was taught how to apply electricity, and recommended to do so daily, in addition to shampooing. The treatment has been carried out almost daily for sixteen months with a result that is surprising. There is now little difference in the appearance of the two limbs; there is reaction in all the muscles but the anterior tibial muscles, and a large amount of voluntary power has returned.

NEW YORK ACADEMY OF SCIENCES.

The regular monthly meeting of the Academy wa. held at 64 Madison Avenue on March 5, 1877. After some routine business and the election of several new members, Mr. T. O'Conor Sloane, E.M., read an interesting paper on a new and accurate method of

DETERMINING SULPHUR IN ILLUMINATING GAS.

After describing and illustrating the methods usually employed, Mr. Sloane proceeded to exhibit his apparatus, which, he claimed, possessed the following advantages: First, the air which supports the flame is purified to remove any sulphur contained in it, an important precaution when performing an analysis in or near the place where the gas is made; second, no aspirator is required. The burner employed is made by unscrewing and removing the base of the ordinary Bunsen burner, closing all the openings but one, and inserting it in a brass tube 1 inch in diameter. A tapering or funnel-like tube is screwed to the lower end of the latter, thus reducing its diameter to half an inch, so that it can be inserted into the perforated cork of a large bottle. Another tube about 2 inches in diameter and 2 inches long is screwed on the upper end of the latter, and filled with water to form a water joint about the chimney of the burner. A large bent tube of glass leads all the products of combustion into a large tubulated bottle, placed horizontally and containing a solution of permanganate of potash and hydrochloric acid. From the tubulus of this bottle another tube leads into a second bottle containing the same mixture. About 5 cubic feet of gas are burned in a small thin flame. The air which supplies the burner passes through a bottle filled with broken glass and marbles, which are moistened with a solution of permanganate of potash. The sulphur compounds in the gas are burned, forming sulphurous and sulphuric oxides; by contact with the chlorine and permanganate of potash they form sulphate of potash. At the close of the operation the liquid should still have a violet color. The excess of permanganic acid is destroyed by boiling, or by adding alcohol. The sulphuric acid is then precipitated by means of a barium salt, and weighed as sulphate of barium.

The chemical section met at the same place on Monday evening, March 12, 1877, Professor Martin in the chair.

Mr. Amend exhibited a fine specimen of scapolite.

Dr. Bolton then read a paper by Professor Lupton,

ON THE FISHLIKE ODOR OF POTABLE WATERS.

Professor Lupton ascribes the fishlike odor of some of the waters of Nashville, Tenn., to the presence of *algæ* and other low plant forms in the water, since he found that the residue left on filtering the water, and consisting for the most part of *algæ*, developed a strong odor of fish when treated with warm water. During the discussion, which arose after the reading of this paper, Mr. Cox was of the opinion that no proof had been adduced to show that the odor arose from *algæ*. Professor Leeds rei arked that the researches of a French chemist had shown tnat, as the amount of oxygen dissolved in the water decreased, the amount of lower vegetable life increased. Professor Seely thought it would have been well to have ascertained if the odor did not really arise from the presence of putrefying fish in the water.

Dr. P. Townsend Austen then read a paper by Drs. Cech and Schwebel, of Berlin, on

A NEW FORMATION OF ISOBENZONITRILE.

In the course of some introductory remarks, Dr. Austen said that the organic cyanides are particularly useful, since they form the stepping stone from the organic halides to the acids. Thus we are able to pass from marsh gas into acetic acid by a series of typical reactions:

$$CH_4 + Cl_2 = \underbrace{CH_3.\ Cl}_{\text{methyl-chloride.}} + HCl$$

$$CH_3.\ Cl + KCN = \underbrace{CH_3.\ CN}_{\text{methyl-cyanide.}} + KCl$$

$$CH_3.\ CN + 2H_2O = \underbrace{CH_3.\ COOH}_{\text{acetic acid.}} + NH_3$$

These same cyanides or nitriles, as they are also termed, may be derived by dehydration of the ammonium salt of the acid:

$$\begin{array}{rl} CH_3.\ COONH_4 & \text{ammonium acetate.} \\ O\ \ H_2 & \\ \hline CH_3.\ \ CONH_2 & \text{acetanide.} \\ O\ \ H_2 & \\ \hline CH_3.\ CN\quad & \text{aceto-nitrile.} \end{array}$$

If we examine the constitution of the lowest member of the nitrile series, the nitrile of formic acid, hydrocyanic acid—

$$\underbrace{H.\ COONH_4}_{\text{ammonium formiate.}} - {}_2H_2O = HCN,$$

we shall see that it contains a tetravalent carbon united with a trivalent nitrogen and a monovalent hydrogen, $H - C = N$. Knowing, however, that nitrogen often appears in the *rôle* of a pentivalent element, we can suppose the possible existence of a compound isomeric with hydrocyanic acid, and having the formula $H - N = C$. Although this acid is not known, several of its derivatives are. The first member of this series was discovered by Hofmann, who obtained it by treating aniline with chlorotorm and an alkali. The reaction is $C_6H_5.\ NH_2 + CHCl_3 = C_6H_5.\ NC + 3\ HCl$. This compound is called isobenzonitrile and is isomeric with the benzonitrile derived from benzoic acid:

Benzonitrile........................C_6H_5. CN.
Isobenzonitrile......................C_6H_5. NC.

Lately the class of isonitriles has received the generic name of "carbylamines." The isonitriles of the fat series have in many cases been obtained by treating an organic halide with silver cyanide. The silver cyanide seems to consist of a mixture of Ag CN and Ag NC. Finally, small amounts of isoacetonitrile are obtained in the preparation of the real nitrile by treating potassium ethylsulphate with potassium cyanide. The reactions of the nitriles and isonitriles are different and characteristic. On boiling the acetonitrile, for instance, with an alkali, ammonia is evolved and acetic acid is obtained. On subjecting aceto-isonitrile to the same treatment, methylamine and formic acid are formed.

The paper of Drs. Cech and Schwebel was then read. The authors described the production of dichloracetic ethyl ether by the treatment of potassium cyanide with chloral hydrate. The dichloracetic acid was obtained from this ether by treatment with hot concentrated hydrochloric acid under pressure. On boiling aniline dichloracetate with a dilute solution of caustic soda, the odor of isobenzonitrile was detected. The authors found the products of this decomposition of aniline dichloracetate were isobenzonitrile, hydrochloric acid, and formic acid.

Cast Steel Without Flaws.

We find in the report of a recent session of the Society of Mineral Industry, of St. Etienne, France, a very interesting communication from M. Pourcel on the fabrication of cast steel without flaws. M. Pourcel stated that, from the day when the different phases of the Bessemer process were explained *à priori*, the means of casting steel without flaws were discovered. It being known that silicon hinders the formation of carbonic oxide, it remained to determine the extent of the applications of the principle; and these are the analytic methods which, at Terre Noire, have led to the production of flawless cast steel. The following are the facts observed:

In the Martin furnace, on softening a gray silicious pig iron by means of successive additions of malleable iron or steel, it is found, by examining samples of the metal after each addition, that at a certain moment the metal is full of flaws. And further, if there be submitted to analysis a sample abstracted immediately before ebullition, silicon is found in combination with the metal exempt from flaws, while the metal may contain interposed scoriæ, but not free silicon. Such is the analytic result, the effects of which may be reproduced synthetically, thus: If silicon in the form of silicate of iron be added to a bath of steel entirely formed, the flaws are caused completely to disappear. It is true that this steel is generally red short, a condition attributed to the presence of silicon, not only by steel makers but by many eminent chemists. M. Pourcel, however, doubts the conclusion, and believes that silicon, in the proportions in which it is usually found, does not abstract from the steel any valuable qualities, and does not render it brittle, either when hot or when cold. The flaws which exist in cast steel—as Bessemer pointed out and demonstrated several years ago—are due to the carbonic oxide which is generated in the liquid metal by an intermolecular reaction between the carbon of the metal and the oxide of iron formed during the melting. When the metal remains liquid for a long period of time, the gases escape; but generally, the temperature of steel when run off being but little superior to that of its solidification, the carbonic oxide remains imprisoned, and causes flaws or silvery alveolæ disposed symmetrically and perpendicularly to the major axis of the ingot.

Silicon hinders the formation of these flaws, because it is more oxidizable than carbon through intermolecular combustion, the oxidizing body being either peroxide of iron or carbonic acid; but then, in place of the product of oxidation being a gas, it is a solid body which is produced in the mass of the metal, and is found uniformly disseminated among its molecules. It is a silicate of iron, a scoria interposed between the molecules, which renders the metal fragile when hot. The means of removing this scoria is to add a base, which causes it to liquefy; and for this purpose M. Pourcel uses manganese.

Manganese serves in the Bessemer process to remove from the molten metal the peroxide of iron which it holds in solution. It reduces it to its minimum of oxidation by taking one equivalent of its oxygen; and the combination of the oxide of manganese with the silicate of iron which is produced yields a very fluid scoria which liquates.

In lieu of silicide of iron, M. Pourcel has used a double silicide of iron and manganese. The two reducing agents, silicon and manganese, act simultaneously in the mass in fusion to reduce the peroxide of iron, and to prevent the formation of carbonic oxide; and the result of their oxidation is a silicate of protoxide of iron and of protoxide of manganese, very fluid at the temperature of solidification of steel, and which liquates easily. With regard to the silicide in excess, M. Pourcel thinks its effects are not deleterious.

While the process we have described is apparently quite simple in practice, its application is found to be both delicate and complex. Still the difficulties attendant upon it have been in great part resolved, and there is now produced at the Terre Noire founderies cast steel having nearly all the gradations of forged steel, from the hardest to the softest. The perfect homogeneity of these cast steels, a result of their chemical composition and the equilibrium of their molecules (which is produced by a reheating or hardening or varied nature), may, in M. Pourcel's opinion, lead to other results, such as have never been obtained with forged steels.

Transplanting Evergreens.

A correspondent says:

"I am aware that the general opinion and advice are that the time to transplant evergreens, whether trees, shrubs, or vines, is in the spring. I fell in at one time with this idea, and stated that in spring, just as the new growth was forming—just as soon as the buds began to swell—was the time to make a sure thing in the transplanting of an evergreen, no matter what the variety. In a long life of practice in the laying out of gentlemen's places, public grounds, etc., in my way as a landscape gardener, it has come to me that error existed in the aforesaid advice to plant only in the spring. I reason in this way: 1. It is not possible for a large number of those who plant evergreens to have them in the spring just when they should. 2. There is always more hurry of work in the spring than in autumn, and consequently the work of planting is not as thoroughly done as it should be. 3. In the month of September and early October the nurserymen are comparatively at leisure, and can give more and better attention to the digging and shielding the roots from the sun and cold dry winds, before they pack. 4. In the autumn, say from the 1st of September for three months, the evergreen is as near in its dormant state as ever; the ground is warm, and from fall rains is usually moist, without being really wet, as in the spring, and, being warmer than the atmosphere, Nature does what our best gardeners do when they propagate by bottom heat: she furnishes a bottom heat and moisture in sufficiency to cause new roots or rootlets (fibers, if you will) to grow from the wounds made in the work of digging, by which many of the supports of life, to the tree or plant, are lost. This renewal of new roots made in autumn not only aids the tree or plant to support itself during winter, but it goes to work in spring, and supplies food for growth; when the roots of trees planted in spring are struggling to make new fibers in a cold soil with the atmosphere twenty degrees above, and calling through the leaves for food.

"I write not from theory, but based on practical theoretical knowledge, and from practice in removal of thousands of evergreen trees and shrubs in the autumn months. Here let me say, that I prefer from the 10th of September to the 20th of October to do the work; but with due care never to leave the roots half an hour exposed to the sun or dry coid winds. There is no fear of want of success—provided the planter has the ground prepared for planting as it should be, and at the same time knows how to do the work."

A Colossal Organ.

We recently explained M. Montenat's new pyrophone, which consists of tubes of copper in which incandescent pieces of charcoal inclosed in wire gauze are introduced, to create an upward current of air and so to cause the pipes to sound. It is now proposed to construct an instrument on this principle on an enormous scale for the French Exposition of 1878, the tubes being large enough to receive small charcoal furnaces. The inventor points out that his device may be used as a fog signal, as it produces a loud noise and requires scarcely any machinery to operate it.

A New Use for Asbestos.

Some experiments have recently been successfully made in Italy on a new way of burning petroleum under steam boilers. The method consists simply in pouring the oil over a thin layer of asbestos. The petroleum burns with an intense heat; while the asbestos, being incombustible, is not affected, and thus not only serves as a means of retaining the oil, but, being so good a non-conducting substance, the prevention of fire from the volatile oil is obvious. In the experiments, sheets of paper placed beneath the furnace were not injured, despite the fierce incandescence of the oil above.

NEW BOOKS AND PUBLICATIONS.

ELECTRICITY AND THE ELECTRIC TELEGRAPH. By George B. Prescott. Illustrated. New York city: D. Appleton & Co.

We have already published in the columns of both SCIENTIFIC AMERICAN and SUPPLEMENT copious extracts from the advance sheets of the above work, from which our readers have doubtless ere this arrived at an idea of the thorough and complete manner with which it deals with some of the branches of the great science to which it relates. Familiar as we are with the progress which has been made in electrical knowledge of late years, we cannot but feel genuine astonishment at the immense advancement evidenced by the volume before us over what was known hardly ten years ago. Here is a book of nearly one thousand pages replete with engravings of devices of marvellous ingenuity, and yet this large volume does not exhaust a subject of which three times ten years ago the world understood scarcely more than a few empirical facts; and even regarding those, few who had studied them agreed. If the 19th century becomes memorable for nothing else, it certainly will be known as the age during which the science of electricity was developed. We have nothing but praise for Mr. Prescott's book. It is the best on its subject not merely in virtue of its being the latest modern work there on, but because it is written by a thorough electrical expert. Mr. Prescott writes whereof he knows, and knows well. He gauges inventions by the rigid rule of practicability and susceptibility to useful ends, and is chary of commendation when he fails clearly to see utility. He is therefore a safe and cautious guide, and the student who follows him will never be landed in doubtful theory or left in perplexity over questionable matters of practice.

A BEAUTIFUL CATALOGUE.—We have received from Messrs. B. K. Bliss & Sons their "Illustrated Gardener's Almanac, and Abridged Catalogue of Garden, Field, and Flower Seeds," for 1877. This is one of the most complete catalogues issued in this country, and valuable both to the practical farmer and florist, as well as to the gentlemen farmers and florists who seek merely to beautify their homes and raise vegetables and flowers for their households. Any one desiring a dollar's worth for 35 cents should remit the last named sum to 34 Barclay street, New York, and obtain a copy free by mail.

Recent American and Foreign Patents.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED HORSE POWER.

William H. House, Bennett's Cross Roads, N. C.—This invention has for its object to provide an improved horse power for operating cotton gins and other mills.

IMPROVED METHODS OF CASTING CAR WHEELS.

William Wilmington, Toledo, O.—The first of these two patents is for an improvement in the manufacture of cast iron wheels for railway cars, the purpose being to lessen the cost and increase the durability of the wheel. The method consists in casting car wheels from two different qualities of metal by pouring in first the superior metal to form the tread and flange of the wheel, and afterwards the inferior metal to form the central parts of the wheel, and regulating the inflow of both by radial passages, whereby circulating currents and the homogeneous mixture of the .wo metals is avoided, and the proper disposition of the two metals in the car wheel is secured. The second method here consists of casting car wheels from two kinds of metals, or composition of metals, by first introducing the inferior metal until it shall have attained the level of the barrier formed by the outer raised or swelled portion of the plates next to the rim, then introducing the superior metal to the rim portion through separate channels, and finally continuing the inflow of the inferior metal through its channels to force the superior metal contained in the outer plate portion of the wheel outwardly and upward to cause the latter to fill the upper rim and tread portion of the mould.

IMPROVED METHOD OF CHARGING BLAST FURNACES, ETC.

Charles Himrod, Youngstown, O.—This invention relates to a method of charging and managing blast furnaces having longitudinal compartments, which consist in feeding ore and flux into one compartment and fuel :nto the next, and at intervals reversing this mode of charging to distribute the furnace burden, the generated gases being compelled to traverse the compartment in which the ore is uppermost on their way to the exit to their entire exclusion from the ore in which the fuel is uppermost. The means for carrying out the method consists in a longitudinally divided stack having an exhaust pipe that communicates with each compartment of the divided stack through separate pipes with dampers arranged to be alternately reversed and separately controlled.

IMPROVED PNEUMATIC PUMP FOR REFRIGERATING APPARATUS, ETC.

Daniel L. Holden, Covington, Ky.—This invention belongs to that class of pneumatic pumps in which a valve of greater diameter than the bore of the cylinder is used to form the cylinder head. The improvement consists in combining an imperforate piston with a valve of the above construction, and a cylinder having but a single inlet valve, in such a manner that the piston in forcing out the charge of air or gas produces a partial vacuum beneath the same and passes the inlet orifice, whereby the compressed gaseous charge held in said inlet valve chamber is allowed to pass beneath the piston and to expand into and be absorbed by the partial vacuum, so that, upon the downward exhaust stroke of the piston, there will be no charge of compressed air or gas in the inlet valve chamber to expand above the piston and prevent by its elasticity the perfect exhausting stroke of said piston. An outlet check valve is employed in the opposite end of the cylinder from the inlet for the discharge of the compressed charges of the air or gas taken from the said inlet valve chamber.

IMPROVED TOBACCO AND COTTON PRESS.

Allan Talbott, Richmond, Va.—This invention has for its object to enable the operation of compressing tobacco in hogsheads, etc., to be effected with greater convenience and celerity than heretofore. The special feature of the invention is a plunger pivoted to and beneath the immovable head of a hydrostatic, or other form of press, in such manner that, while it is fixed in position as relates to the reciprocating plunger, it may be turned or swung out from under the head of the press in order to facilitate filling the hogshead, preliminary to the compressing operation. A new supply may then be placed in the hogshead, and the compressing operation quickly repeated.

IMPROVED RAILWAY CHAIR AND TIE.

Norman S. White, Millerstown, Pa.—Metal ties are employed, and these are joined at the ends to continuous chairs or rail-beds. The ties are preferably + or H-shaped in transverse section, and detachable clamp pieces secure the rails to the beds. The beds or sleepers are grooved to receive wooden strips on which the rails are laid.

IMPROVED SEWING MACHINE.

William G. Cummins, Cokeville, Tenn.—After passing through the fabric or goods to be sewed, the needle is raised a little, to spring the thread loop sufficiently for the point of the shuttle to enter, and is then carried down again, to allow the loop to pass easily on the body of the shuttle, after which it is held stationary, to give the shutt'e time to pass through the loop before it is drawn up. The needle is then raised while the shuttle thread is tight, or before the shuttle starts back. The machine is adapted to sew from or toward the operator at will. This function is especially useful when it is desired to double or duplicate a row of stitches, and thereby strengthen or fasten a seam.

IMPROVED SAW-SHARPENING MACHINE.

Parker D. Robbins, Harrellsville, N. C.—This consists of a circular or rotary file having a diagonal groove on its face for carrying the saw forward placed on a suitable mandrel. The said mandrel is journaled to a table which can be adjusted to give the proper bevel to the teeth being filed. The object of this invention is to rapidly file the teeth of a saw at any desired bevel, by rotating the file by means of a crank and suitable gearing, the saw being drawn forward by the diagonal slot in the edge of the file.

IMPROVED MOTIVE POWER.

Jarratt Gross, Catlettsburg, Ky.—Around a large wheel passes a band, which passes around a shaft pivoted to posts, and from which motion is communicated to the machinery to be driven. To the journals of the wheel are pivoted two levers, the outer ends of which are heavily weighted, so that when the levers are raised and allowed to rest upon the shoulders of the projections, attached to the sides of the rim of the wheel, their weight may revolve the said wheel, and thus give motion to the machinery to be driven.

IMPROVED BELT SHIFTER.

William W. Hubbard, Manchester, N. H.—This consists in the combination of a stationary drum, for receiving the belt from the driving pulley, and a follower moved over the said dr:m by levers or suitable gearing, for forcing the belt from the drum on to the pulley, and also for removing it from the pulley. The object of the invention is to provide a means for shifting belts which shall obviate the difficulties hitherto experienced in using loose pulleys or idlers with the ordinary means for shifting.

IMPROVED ROTARY ENGINE.

Philo A. Knapp and Ira S. Knapp, Danbury, Conn.—This consists of a cylinder having an annular space, in which a rotating piston is placed, and a shaft running through the central portion or core of the cylinder, and connected with the said piston by a thin arm, which passes between annular spring plates, secured in the center of the core of the cylinder. The said plates form a packing, which permits the piston arm to rotate, but closes together after the arm passes, preventing the steam from coming into contact with the shaft.

IMPROVED WIND WHEEL.

George W. Penn, Onawa, and William S. Sharpneck, Missouri Valley, assignors to P. D. Mickel, Missouri Valley, Iowa.—As the velocity of the wheel increases weights are thrown outward by centrifugal force, and mechanism is actuated to turn the fans away from the wind. New means are provided whereby the wheel may be easily adjusted to run at any desired velocity.

IMPROVED DISCHARGE NOZZLE FOR GRAIN ELEVATORS.

Frederick J. Kimball, Philadelphia, Pa.—This is an improved nozzle for the spout of grain elevators, by which the grain may be discharged into a vessel or car in any direction and angle under pressure of air, so as to dispense with the shoveling off and leveling of the heap of grain forming under the spout of the elevator. The device consists of a discharge spout with a valved air blast pipe, and a check plate or telescoping nozzle turning on the spout, and being directed by a forked handle applied thereto.

IMPROVED CAR COUPLING.

James C. Pugh, Ambia, Ind.—This invention consists of a drawhead with recessed and weighted drop gate that bears on the link, which is coupled by a spring hook at the bottom of the car coupling. The spring hook enters through a recess at the bottom of the draw-head. For coupling, the lever is released from the spring hook, the link passing then over the same by raising the gate and coupling automatically by dropping back of the hook.

IMPROVED MACHINE FOR MOUNTING HAIR SWITCHES.

Charles Bourgard, New York city, assignor to himself and Jones Waters, Brooklyn, N. Y.—This is an improved machine for mounting human hair switches, by which one hand may work the machine, while the other hand feeds simultaneously the weft of hair in convenient manner, winding it regularly and without danger of taking in or catching any part of the hair. The device consists of a loose cord spool, revolving with a vertical shaft by the tension of the cord, that passes through an end hook of the shaft, and is clamped at the lower end to a tension weight.

IMPROVED EARTH AUGER.

Orson H. Polley and Dwight W. Toles, Plymouth, Mich.—In this device there is an adjustable feed gage, which is slotted vertically, to receive the two bolts by which it is secured to the body, so that it may be adjusted to project less or more, to cause the auger to enter the ground slower or faster, according to the hardness of the earth upon which the auger is operating.

NEW AGRICULTURAL INVENTIONS.

IMPROVED COMBINED HARROW AND CLOD CRUSHER.

William H. Kuhn and Samuel Miller, Albany, Oregon.—This implement is constructed in sections, which are provided with teeth and hinged in such manner that one or all of the sections may be detached as required, or the whole weight of the frame and the driver may be imposed upon any one section when passing over a clod or other obstacle.

IMPROVED PLOW.

Errin D. French, Byhalia, Miss.—This invention consists in an improved point for plows, so arranged that all the various plows ordinarily used in farm labor may be run with the same point.

IMPROVED GRAIN SEPARATOR.

William Edr s, Eugene City, Oregon.—This machine consists of an inner and outer reel located concentrically upon the same shaft, in combination with a trough and spiral conveyer adapted to carry away the impurities passing through the outer reel and a subjacent case connected with the annular space between the two reels by means of a chute, and containing a fan and a set of shaker sieves, which devices effect the new result of eliminating both the large and the small impurities from the commingled wheat and chaff before the latter is admitted to the shaker sieves, which latter, in connection with the fan, separate the chaff.

IMPROVED GANG PLOW.

John R. Cummins, McKinney, Tex.—This gang plow is so constructed that it may be readily adjusted to cause the plows to take or leave land. The wheels may be adjusted closer to or further from the plows.

IMPROVED STRAW STACKER.

William Deetz, Saltillo, O.—The carrier is made of two sections, which are adjustable to different lengths, so that the same may be lengthened or shortened, according to the distance and height to which the straw has to be conducted for storage or stacking. An endless belt takes up the straw and conveys it up along the carrier to the upper end for dropping. Rigid supports at the lower front part secure, in connectio: with the uprights and brace rods, the rigid position of the carrier in whatever direction the same may be run from the thrasher, the supporting and stiffening rods being merely transposed from one side to the other, and adapted to the position of the carrier when the same is placed in position to run to either side or in straight direction from the machine.

IMPROVED CHURN.

James A. Duryee, Nunda, N. Y.—This churn dasher is so constructed that it may be readily adjusted according to the amount of milk in the churn. It is claimed to bring the butter very quickly, gather the butter thoroughly, to be easily operated, and to work equally well when turned in either direction.

IMPROVED SULKY PLOW.

William N. Riddle, Caddo Grove, Tex.—This sulky plow is so constructed that it may be readily adjusted to take or leave land, and to work at any desired depth in the ground. It may also be readily raised from the ground.

IMPROVED GRASSHOPPER KILLER.

Charles Hoos, Arago, Neb.—This consists of a frame mounted on wheels and having a platform with fingers, which are curved upward, and are designed to enable the machine to pass over obstructions, and to cause the grasshoppers to rise from the ground and fall upon the platform. The platform is grooved and is made highest in the center, and declines toward the front and rear, so that the grasshoppers may be crushed against the shoulders of said rabbets by cross bars attached to endless belts. Rollers are placed at the rear edge of the platform so that any grasshoppers that may not be killed by the cross bars may be crushed.

IMPROVED HAY LOADER.

David F. Roach, Atlanta, Ill.—The construction is such that as the machine is drawn forward one of each pair of toothed bars will rise, carry the hay a little distance toward the wagon, and then descend and move back, while the other bars rise and carry the hay forward a little farther, and so on, until it has been delivered upon the wagon, the alternate bars always moving in opposite directions.

NEW HOUSEHOLD INVENTIONS.

IMPROVED FURNACE.

Edwin Varney, Leavenworth, Kan.—This invention consists in constructing the combustion chamber in a double conical form, and combining it by means of down draft fire flues with the base having side compartments provided with partitions, whereby the smoke and flame is made to emerge from the swelled or enlarged portion of the combustion chamber and pass down the fire flues to the side compartments of the base, and by means of the partition in the same is first directed forward, and then backward, as in a return flue, and thence passes to the exit smokepipe, which arrangement serves to produce a stronger and more compact form of furnace, a better distribution of heat, and a larger radiating surface.

IMPROVED AIR-HEATING ATTACHMENT.

David McAlliston, Walton, N. Y.—The object of this invention is to furnish an improved attachment for hot air or other furnaces, for the purpose of utilizing and economizing the heat which ordinarily escapes into the flue and is thereby wasted. The device is simple and inexpensive in construction, being formed by combining two drums of different size, one being placed within the other, and also provided with partitions or diaphragms of peculiar form for directing the course of the products of combustion in such manner as to most completely eliminate the heat, and thus attain the most economical result. For details of construction and arrangement of parts, see patent.

IMPROVED AIR-HEATING STOVE.

John B. Oldershaw, Baltimore, Md.—This invention covers certain implements in air-heating stoves of that class in which a drum is arranged in the upper part of the combustion chamber, to which drum air is admitted to be heated and thence escapes into the room. The improvements consist in making the drum detachable, arranging its inlets and outlets to register with corresponding openings in the outer case, and combining with the said drum and outer case detachable sleeves containing dampers or registers, to regulate the admission and escape of the air, which sleeves form break joints to the registering openings of the drum and outer case that prevent the gases from the combustion chamber from commingling with the fresh heated air and escaping into the room.

IMPROVED DRAWER DESK.

Ernest N. Doring, New York city.—This is a desk with a double set of pigeon holes, the whole being so arranged as to shut up and slide into a chiffonier, the back of the pigeon holes being finished the same as the chiffonier front.

IMPROVED TEAPOT.

Ebenezer Oliver, New York city.—This is an improvement in the class of teapots which are provided with a removable perforated or wire-gauze holder or receptacle for tea leaves. The improvement relates to the construction of parts, whereby the tea holder is attached to the bottom of the pot; and also to the combination, with said holder or receptacle, of a device employed for removing the tea leaves subsequent to the steeping operation.

IMPROVED EGG HOLDER.

Pantalion M. Leprohon, Brooklyn, E. D., N. Y.—This consists of clamping leaves or plates, curved to the shape of an egg and supported on spring arms or posts attached to a base plate.

IMPROVED KEROSENE LAMP.

Samuel Dodsworth, Leavenworth, Kan.—This embodies a new arrangement of the oil reservoir and a novel wick tube made with flanges upon the inner surface of its edges, to adapt it to receive a permanent wick, and also the burning wick. The permanent wicks serve to keep the burning wick constantly supplied with oil.

IMPROVED SPRING BED BOTTOM.

John F. Coder, Toledo, O.—This consists of a spring bed bottom made in two sections, one of which is made of thicker strips than the other. It also consists in cross bars for supporting the slats that are covered with chamois skin, or other material, to prevent noise, and rest in notches in side piece of the bedstead.

IMPROVED LAMP BURNER.

Wirt L. Carter, Monroe, Mich.—This is an improvement in Argand lamp burners, and consists in means for steadying or equalizing the action of the air current to prevent flickering of the flame.

IMPROVED ASH SIFTER.

Thomas H. Badger, Boston, Mass.—This invention consists in placing below the hopper of an ash sifter fingers that are inclined downwardly from each other, and others that are inclined from the side of vessel downwardly toward each other. The coal is conducted from one series of fingers to the other, while the ashes are screened off and conveyed through the channels to a suitable receptacle.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED VEHIC .E AXLE.

Patrick F. White, Westernport, Md.—The body of the axle is + shaped in transverse section, and blocks are attached to its ends which are bored longitudinally to receive detachable journals. The object is to provide an axle which is strong and light, and which may be easily and cheaply supplied with new journals when required. The axle is particularly applicable for carts, mining cars, etc.

IMPROVED CONVERTIBLE WAGON BED AND HAY RACK.

James M. O'Neall, Fort Worth, Tex.—The body of the wagon is so constructed that it may be readily converted or changed from its ordinary form to adapt it for use as a lumber, wood, cotton, or hay frame, etc. For details, see patent.

IMPROVED SCREW.

James Plenkharp, Columbus, O.—This invention has for its object to provide a cheap wood screw for use in securing the legs of tables to the top or frame thereof; also for securing together other parts where it is particularly desirable or necessary the connecting device shall possess flexibility as well as strength. To this end, the screw is formed of a wrought iron core and cast metal thread or flange, the screw being double ended and provided with a central circumferential flange or rib.

IMPROVED FACING FOR WALLS OF HOUSES.

Thomas Walton, Wheeling, W. Va.—This invention relates to a facing for the outer and inner walls of buildings, also for floors, ceilings, etc. It consists in an ornamental plate of glass, or other suitable material, provided with lugs or projections which enter the spaces between the stones or bricks, and are imbedded in the mortar or cement.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED SCISSORS.

Amos W. Coates, Alliance, O.—This invention covers certain improvements in guarded scissors, or scissors provided with protective end guards, designed for the use of little children, to protect them against accidents which are liable to occur from their careless handling of scissors provided with sharp points. The improvement consists simply in bending the points of the scissors around so as to form a loop, ring, or an eye, which with but little expense secures the desired result in a simple and durable manner.

IMPROVED CALENDER.

Oscar P. Morse, Batavia, N. Y.—This invention consists in a paper cardboard having a top ring by which it may be hung up, and a slit connecting with two others at right angles thereto. There is thus formed a flap that can be pushed aside or lifted with the finger. It is provided with twelve monthly calenders with a line to the right of each day of the month, so that memoranda may be noted. After a month has elapsed, a calendar is turned up, passed through slit, and held on the opposite side of cardboard for future use.

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

J. H. P. will find something on images on the retina on p. 193, vol. 36.—R. S. B. will find something on iceboats sailing faster than the wind on p. 107, vol. 36.—S. E. will find something on burning gas as fuel on p. 390, vol. 33.—J. O. C. will find an article on setting wagon axles on p. 299, vol. 34.—J. J. K. will find an answer to his question as to a cannon on a car on p. 273, vol. 34. The pressure is greater on the bottom of the boiler by the weight of the contents than it is on the top.—S. will find a description of the art of taxidermy on p. 159, vol. 32.—C. C. S. will find that waterproof glue will make a watertight joint between cork and cloth. See p. 43, vol. 32.—A. F. B. can copper iron wire by following the directions on p. 90, vol. 31. To nickel iron wire, see p. 186, vol. 34.—T. E. will find a recipe for a liquid bronze for brass on p. 51, vol. 33.—J. A. R. will find directions for making durable whitewash on p. 133, vol. 34.—F. G. T. will find a recipe for a mucilage that will not mould on p. 196, vol. 34.—J. R. will find a description of the manufacture of earthenware on p. 191, vol. 32.—R. S. will find a description of a battery for plating on p. 26, vol. 32.—J. M. W. will find on p. 341, vol. 27, directions for making hydrogen. For making oxygen, see p. 75, vol. 32. To make carbon plates for batteries, see p. 187, vol. 32.—J. A. L.'s queries about a hole and its plug are merely questions of definition. There is nothing to be decided in them.—R. M. C. will find directions for ebonizing wood on p. 50, vol. 33.—E. H. M. will find instances of spontaneous combustion mentioned on pp. 343, 368, vol. 34.—J. W. S. will find directions for preserving eggs on p. 306, vol. 34.—A. B. C. will find instructions for tempering rock drills on p. 202, vol. 31.—A. L. is informed that we cannot answer legal questions.—R. P. P. will find something on wooden railroads or tramroads on p. 324, vol. 29.—G. A. C. will find a recipe for blackboard composition on p. 299, vol. 28.—H. A. will find directions for enameling metals on p. 203, vol. 29.—W. H. B., J. H. W., Y. I. W., J. H. N., J. L. G., G., J. McB., 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) C. A. W. asks: How can light-colored kid gloves, that have become spotted with sea water, be dyed any other color than black? A. They can be dyed to any of the darker shades in the usual way. See p. 166, vol. 28.

What is the best thing with which to clean silver or silver-plated ware that has become black and will not brighten up with whiting? A. Use tripoli powder, mixed with a little olive oil if necessary.

(2) E. A. F. asks: Is there any process by which the liquid that drops from stovepipes can be removed from carpet? A. Use plenty of soap and water.

(3) J. S. S. asks: Is woolen clothing healthy? Fine soft wool, unless colored, will shrink; and cloth made from coarse hairy wool is too heavy to wear in the summer, and will irritate the skin and give those who wear it a cold in the fall when they put it on, and again in the spring when taken off. Clothes made of cotton can be more thoroughly washed and boiled than those of wool, and are they not more healthy? Is not white clothing healthier and more comfortable both in summer and winter than colored? A. As a general rule, light woolen clothing, if clean, is more healthy and a better protection against colds, from sudden changes of temperature, than cotton or other vegetable fibers. In winter, dark or black clothing is best, as it is warmer than light. In summer, light colors should be worn. Some woolen fabrics, dyed with some of the coal tar colors, when permitted to remain for any length of time in direct contact with the moist cuticle, have produced poisonous effects; but not otherwise. It is for this reason advisable to use only undyed fabrics for underclothing.

(4) H. H., Jr., asks: Are there any chemicals by which glue can be made into a paste, to be used (cold) for closing quarter cracks in horses' feet? A. Heat the glue for some time in strongest acetic acid, and evaporate in the air until of the consistence desired. Such a solution of glue will not gelatinize. It dries rapidly, forming a stronger and more flexible joint than ordinary glue.

(5) J. E. M. asks: Why is it that, in a window fitted with alternate panes of blue and white glass, the former become quite warm in the sunshine, while the temperature of the white glass remains almost, if not altogether, unchanged? A. Clear glass permits the passage of all the rays of the spectrum, while blue glass intercepts all the rays except the blue. The destruction of these luminous rays determines their conversion into sensible heat, which is absorbed and radiated from the surface of the glass. The heating effect of this absorption is intensified, from the fact that the sensible heat rays of sunlight preponderate in the lower or red end of the spectrum, which is, in the present instance, intercepted. The darker the color of the glass, the greater will be the amount of heat developed.

(6) L. H. R. says: I have a flute of 8 lever keys that was laid away for about two years; at the expiration of that time I found it so dry that all the joints were loose. I oiled it several times, so that it is now perfectly tight; but I find that I cannot blow the lower notes at all, and can only blow the upper ones with great difficulty. After wetting the inside with water, it fills perfectly easily until dry again; but I am of opinion that this operation will, in time, have a damaging effect. Can you inform me how the difficulty arose? A. The wood has probably become rough on the interior and the bore distorted by excessive desiccation. Free all the cavities from dust, and rub the instrument inside and out with a little warm glycerin.

(7) W. L. D. asks: I dissolved a bit of German silver in nitric acid in a test tube; it gave a greenish blue solution, and after diluting with water I dropped sulphuric acid into it slowly, which threw down a white precipitate. When this was completed, I immersed a copper plate, which threw down a gray metallic powder. What was the chemical action, and what were the several precipitates? A. It is probable that the alloy, or the water you added to the solution, contained lead in some form, which, combining with the sulphuric acid, produced an insoluble sulphate of lead. The deposit on the copper may be metallic arsenic from the impure nickel used in the alloy.

(8) E. C. M. says: I have a walking cane of whalebone about ½ inch thick; it was set with little ivory points to represent knots, but these are falling out and the bone cracks and splits. I know that this cannot be helped; but how can I prevent it from further breaking and scaling? A. Try impregnating it with a little warm glycerin.

(9) H. B. C. asks: Can I make a crucible, that will stand a white heat, of water lime or quicklime, either alone or by mixing with something, such as sand or plumbago? A. Small crucibles cut out of pure caustic lime are sometimes used; but if not heated gradually and uniformly, they are apt to crack. A crucible moulded from lime, made plastic by the addition of water, will crack and fall to powder in the process of dehydration, by heat or otherwise. Moulded with sand it would fuse into a hard glass at high temperatures. Plumbago cannot be formed with lime into a crucible.

(10) J. S. says: Balsam of fir will render paper translucent. Pitch does the same in a pine plank. Why is this? A. For the same reason that water, filled with bubbles of air, loses its transparency. Neither paper nor wood is a homogeneous substance; but both become nearly so by impregnation of the fibers, and filling the interstices with translucent resin.

(11) J. R. A. says, in reply to E. A. W., who asks how to remove the clinkers from stove linings: When you have a good fire, cover the coal with three inches or more of oyster shells, and let the fire burn out, and burn the shells; you will be able to remove the clinkers, without the aid of mechanical means or injury to the firebricks, on the following morning.

(12) B. H. S. asks: 1. Of what is lightning composed? A. As to the precise nature of electricity, nothing definite is at present known, other than that it is a peculiar motion, analogous to that of heat, of the atoms in their molecular groupings, within the body which is electrically excited. In the case of lightning, the clouds, the air, and the moisture which it contains, and the surface of the earth, constitute the bodies excited. It has been shown that the cause of the electrical excitation in our atmosphere is due to a disturbance of the normal statical equilibrium by the translation of aqueous vapor from the earth's surface, and its subsequent condensation in the form of clouds and rain in the cold upper regions of the atmosphere. 2. Why are metals conductors? A. The metals are generally better conductors of electricity than the non-metals, owing to some, not yet well understood, arrangement of their molecules, which facilitates the transmission of the motion throughout the material. 3. Which is the positive pole, and which the negative, of a battery? A. The positive pole, or electrode, of a galvanic battery is the upper end of or connection with the negative plate of the cell—in the Daniell's, gravity, and similar zinc-copper batteries, this is the copper; in the Bunsen, or bichromate cell, it is the carbon plate. The negative pole, in all present forms of batteries, is the zinc.

(13) L. C. J. says, in answer to J. H. W.'s query as to ice in a sand mould: I wish to inform him that the ice under his loose sand had melted to some extent, and the hot coal and iron came in contact, or his sand was insufficient, or not well packed or rammed. The safest plan is to have the floor beneath the cupola dry or comparatively so; but in the event of water or ice being under the cupola, put under the dry sand just before dropping the bottom.

(14) J. S. M. says: Having accidentally broken a small cast iron gear wheel, I tried to solder it with soft solder, using muriatic acid (diluted with an equal quantity of water, after having taken up all the zinc it would) as a flux, but the solder would not unite with the iron. I then added some sal ammoniac, but with the same result. I also tried to make a mat joint with tinfoil, clamping the parts together, but it all ran out. I heated the wheel in the stove and also with the blowpipe; and after several attempts I gave the job up as a failure. Can you tell me what the trouble is? A. A. You will find it impracticable to solder your wheel together unless you galvanize the surfaces.

(15) W. H. H. says: 1. Your paper of February 10, says: "Dissolve crude rubber and shellac in naphtha." I put them separately in bottles, and set them in warm water. The rubber dissolved, but the naphtha did not. What is the reason? A. We do not understand you. Coal tar naphtha is a volatile liquid. The powdered shellac may be dissolved in it by heat and agitation. 2. How are the rubber bands sold by stationers joined together? A. By pressing the ends of the rubber band together before vulcanizing.

(16) B. F. asks: 1. The iron won from waste tin plates, even when absolutely free from tin and acids—which after chemical analysis contains no tin—gives in the blooming forge a cold short iron of little value, though the material employed for the plates must have been a very good one. Can you give reasons for this singular experience? A. A determination of the percentage of carbon in the iron would very probably reveal the cause. 2. Is there any way of treating this iron differently, so as to obtain a better material? A. It may be improved by re-puddling.

(17) R. E. B. asks: How can I prepare paper so that, when burned, it will leave a perfume similar to that from pastiles or fumigators? A. Take cascarilla bark 8 drachms, gum benzoin 4 drachms, yellow sanders 2 drachms, styrax 2 drachms, olibanum 2 drachms, charcoal dust 6 ozs., niter 1½ drachms, mucilage of gum tragacanth, sufficient quantity. Reduce the substances to a fine powder, form into a paste with the mucilage, coat the paper with this, and dry in an oven.

(18) F. G. H. says: I have 25 gold fish in a bath tub. What steps shall I take to make them breed? A. The gold fish (*cyprinus auratus*) seldom deposit spawn when kept in vases or aquaria. In order to secure a supply, the young healthy fish must be placed in reservoirs of considerable depth, in some places, at least, shaded with water lilies and constantly supplied with fresh water. When the spawn is deposited, it rises to the surface, and should then be collected and exposed to the sunlight until vivified by the heat. Care must be taken to collect the spawn as soon as it rises to the top of the water, as otherwise it will soon be destroyed by the fishes themselves. The spawning season of the fish is usually in or about the month of May. The Chinese, who bring gold fish to great perfection, feed them with small balls of paste, which they scatter into the water occupied by the fish, who greedily devour them. Large quantities of gold fish spawn are annually collected along the banks of the "great river" (Yang-tse-kiang) by throwing mats or hurdles across the current.

(19) J. J. K. asks: What is used to color maps pink, yellow, green, and pale blue? A. Use water colors diluted to the required degree of paleness, with a little ox gall mixed with them.

(20) C. A. H. asks: How can I make a galvanizing surface smooth, and crystallize it after it comes from the kettle? A. The *moiré* appearance of galvanized iron is produced by first tinning the sheet. Half fill a wooden bath with dilute solution of muriate of tin, prepared by dissolving metallic tin in concentrated hydrochloric acid; this will take two or three days. Use 2 quarts of this solution to 300 quarts water for the bath. Put in the bottom of the bath a thin layer of finely granulated zinc, and then on it a cleaned iron plate, then a layer of the zinc and another iron plate, and so on alternately till the bath is full. The zinc, the iron, and the solution constitute a galvanic battery, and a coating of the tin is deposited on the iron plates in about two hours. Have ready a wrought iron bath containing molten zinc, covered with a layer of powdered sal ammoniac mixed with some earthy matter. In the bath, beneath the surface of the zinc, arrange two iron rollers, tightly compressed together, to be turned by a crank attached to one of them. Take the plates out of the tinning bath one at a time, drain them, and pass them while wet between the rollers in the zinc.

(21) A. E. D. asks: Can you give me any information concerning the putting up and mode of application of Turkish baths? A. The theory of the Turkish bath is to relieve the body of foul matter by creating a profuse perspiration, and then washing the skin in the usual way. Tepid water, used in the washing, closes the pores, and a cold shower or plunge bath creates a glow on the skin and stimulates the whole body. The perspiration is produced by the bather sitting in a room heated by hot dry air till moisture exudes from every pore. The matter brought to the surface by this means is frequently large in quantity.

In the SCIENTIFIC AMERICAN SUPPLEMENT, p. 774, you give an illustration of a pneumatic pen. How is the ink or color spread? A. The ink should be spread with a small brush, such as is used for marking linen with a stencil plate.

(22) J. C. asks: What isthmus, if any, connects Nova Scotia peninsula to New Brunswick? A. There is an isthmus 15 miles wide between the two countries. It has no specific name that we know of.

(23) H. M. C. asks: Given the three sides of any triangle, what is its area? A. Construct the triangle; let fall a perpendicular from the apex to the base. Base×half the perpendicular=area.

(24) B. A. F. asks: What would be the pressure in a steam boiler when the heat indicated by a thermometer is 320° Fah.? A. Seventy-five lbs. to the square inch.

(25) C. H. A. S. asks: Does the exact center of an iron shaft turn, if it be placed in a lathe? A. The center of a shaft is an imaginary line, which is stationary. Any part of the shaft that has breadth or thickness rotates.

(26) A. L. W. asks: Please give me directions for brazing small pieces of thin brass together? A. Use a solder composed of copper 1 lb., zinc 1 lb. Or one of copper 32 lbs., zinc 29 lbs., tin 1 lb.

(27) G. T. asks: What is the easiest and quickest way to make small electrotypes? A. Mould the object, previously brushed over with plumbago, in a wax made of wax 3 parts, and stearin 1 part. Brush the mould with plumbago with a soft camel's hair brush. Then deposit a coating of copper by electricity as described on p. 405, vol. 32. Back the copper deposit with type metal.

(28) J. L., of Manchester, England, asks: What are the compositions and mode of use for japanning or black enameling tea trays, coal vases, etc.? A. To make good work, the metal plate should be primed with stiff size mixed with whiting. Clean the plate, and brush the priming on, let dry, polish with fine glass paper, and apply another coat; let dry, and then smooth with a moist sponge. For a black japan ground, use shellac varnish with ivory black, using finally, for a polishing coat, seed lac varnish. Harden the varnish by means of a hot oven.

(29) J. W. B. asks: How do glass sign writers give a mirror-like finish to gold and silver letters? A. Use gold and silver leaf. Take a little fine isinglass, as much as will lie on a five cent piece, and dissolve in a little boiling water. Add as much alcohol as there is water, and strain through silk. Paint the letters on a sheet of paper with Brunswick black; fix the paper, with the writing reversed, on the glass. Use the isinglass solution as a mordant, laying it on with a camel's hair pencil, and then apply the gold leaf. Place the glass in a warm room; and when the gilding is dry, rub over with a piece of cotton wool. Pass a flat camel's hair brush, moistened with the isinglass solution, lightly over the gold letters; let the solution be hot for this operation. A second coating of gold leaf will improve the work.

(30) W. F. P. asks: How can I keep lice, etc., off geraniums? A. If the plants are in a greenhouse, fumigation with tobacco smoke is the best remedy. Tobacco stalk refuse can be used for the purpose.

(31) C. C. H. asks: How can Babbitt metal be united with cast iron in a journal box, so that it will not be loose? Can it be soldered? A. You may solder your box with ordinary solder, and then pour the Babbitt metal. A better plan is to drill small holes at various angles in the box, then pour your Babbitt in, and it will be firm. It is not unusual to rivet the Babbitt by hammering it when cold.

(32) W. H. asks: 1. How are slots in common wood screws cut? A. By special machinery. 2. Are they cut before the screws are threaded, or after? A. After they are threaded. 3. How many can be done in a day? A. It depends upon the size and the kind of machine used: from 2,000 to 20,000 per day.

(33) W. H. M. says: I have a common tinner's fire pot in which I burn common nut coal, as there is no charcoal to be had here. Placed horizontally through the fire pot are two sheet iron tubes about 1¼ inches in diameter, into which I place my soldering irons to be heated. I find, after heating them two or three times, that a scale forms on the copper tips, so that they have to be tinned several times a day. Can you tell me the cause of the scale forming on them, and how I can prevent it? A. Your soldering irons either get too hot, or else your solder is not fine enough.

(34) J. C. K. asks: Which is the most economical motor to drive a small lathe for turning

wood, a steam engine or an electrical machine? One horse power will be sufficient. A. A steam engine is more economical than an electric engine.

Which is the best oilstone, Arkansas or Turkey? A. It is a disputed point as to which is the best. Of Arkansas stones, the most transparent are usually the best.

(35) H. H. P. says: I am manufacturing solid cast steel cultivator shovels, and want the best recipe or preparation to harden them in so as to not warp and crack them, and to harden at as low a heat as possible? A. In tempering, all depends upon the nature of the steel. You will probably find brine at about 100° Fah. answer your purpose. The brine may be made of ½ lb. salt per gallon of water. Dip slowly edgewise and deep, and then hold the shovels still in the water.

(36) A. T. says: I have a small steam pump and have cracked one of the steam ports, which is of cast iron. Can I stop that crack so that it will not leak? A. Fill the crack with fine cast iron filings well wetted with water and sufficient sal ammoniac (powdered) to just cause the mixture to heat. If the crack is large, caulk the mixture in; if not, a thin sheet plate may be screwed on in addition to using the mixture.

(37) C. R. H. says: 1. I have a casting of brittle type metal to which I wish to give a light brown color. Is there any acid or pickle in which I could dip it? A. Try a strong solution of sulphide of soda or potassa in hot water. 2. Can you give me a good recipe for copperplating type metal? A. Clean the type perfectly, attach it by means of a copper wire to the negative or zinc pole of a strong battery, and immerse the type in a strong solution of sulphate of copper in water. Place a small sheet of clean copper in the sulphate of copper bath with the type (they must not touch), and connect this by means of a copper wire with the other pole of the battery. Under the above conditions, the type will speedily become covered with a film of metallic copper. Great care is necessary in cleaning the type to remove every trace of oil and rust, otherwise the deposition will be unequal or will drop off.

(38) P. L. D. asks: 1. Which size of locomotive cylinder is best for passenger traffic, everything else being equal, a cylinder 17 inches in diameter and of 22 inches stroke, or 16 inches in diameter and of 24 inches stroke? A. The 16 x 24 is generally considered preferable. 2. Which is the best for both freight and passenger traffic, everything else being equal, 16 inches diameter of cylinder, 24 inches stroke, and 5 feet diameter of driver, or 17 inches diameter of cylinder, 24 inches stroke, and 5½ feet diameter of driver? A. The 16 x 24 inch cylinders with 5 feet driving wheels.

(39) J. R. McN. says: I have read your article headed "Bell Metal." How are the metals melted and mixed? A. Use a blacklead crucible and a small crucible furnace with a good draught. Fuse the copper first, then add the nickel in small grains, and proceed as directed in the recipe. Stir the fused alloy from time to time with a stick of green wood.

(40) H. A. W. asks: 1. How fast is an iron turning lathe required to run when turning 1 inch wrought iron? A. At about 130 revolutions per minute? 2. How fast should a wood turning lathe run when turning 2 inch hard wood? A. It may run at speeds varying from 200 to 4,000 revolutions per minute, but about 1,000 is usual on an ordinary lathe.

(41) J. G. says: We have been making a few board rules for our own use. What is the best stuff to blacken the figures with? A. Use black japan varnish. It is usually applied with a stencil and brush.

(42) J. B. C. asks: What is the best method of testing the value of precious stones? A. Precious stones are usually recognized by color, shape, hardness, specific gravity, etc.

(43) S. & R. ask: Which would be the simplest and most durable way to raise a column of water, 1 foot in diameter, to the height of about 40 feet, and how much power would it take? A. We think a pump would be the cheapest and simplest device. The power will depend upon the amount of water lifted. The pressure per square inch will be about 17·5 lbs., exclusive of friction.

(44) E. H. says: I am about to build a boat on the following plan: She is to be a double ender propeller, with 40 feet keel, of 13 feet beam and 5 feet hold, with a shaft running through the whole length and a wheel on each end, to be used as a ferryboat. Her draught is not to exceed 4 feet. Do you think a boat on that plan and those dimensions will succeed? Will she steer well, and will the engines work all right, the shaft running the whole length of the boat? A. We do not see any impracticable features in the plan, although we are not sure that it is the best that could be devised.

(45) M. B. says: 1. We have a well 10 feet deep and 106 feet from the house; we want to draw the water from this well by a cast iron cistern pump and a 1¼ inch lead pipe; this lead pipe has to make a bend upward under the house of 10 feet to connect with pump. Can we draw water such a distance by said pump? A. With a good pump the plan is practicable. 2. Would a lead pipe of the above size collapse? A. Make the bends with as large radii as possible, and be careful to straighten the pipe before laying it. It will, of course, be desirable to use heavy pipe.

(46) E. R. says: We are building a steam yacht 40 feet long and of 8 feet beam, for which we have a double engine with cylinders of 5 inches bore and 6 inches stroke. We would like to know the size and form of boiler best adapted for the engine. A. You can use a vertical boiler, 40 inches in diameter, and 6 feet high.

(47) J. S. says: Since the Ashtabula bridge disaster, there is a great deal said about iron becoming crystallized from repeated vibration, caused by jars, strains, etc. In that sense, is the term "crystallized" used correctly? Is not iron in all conditions crystallized? As I understand it, the strength of iron depends on the perfect cohesion of the crystals which compose it. By jar, vibration, strain, and constant use, the cohesion of the crystals becomes impaired, and the strength weakened; and in that condition I think it wrong to call it crystallized. A. The term is correct as describing the appearance of the iron. Good iron when broken looks fibrous, or somewhat as if it were made up of very fine wires.

(48) J. L. N. says: We have an engine with cylinder 28 inches in diameter and of 6 feet stroke, running 28 revolutions per minute, geared (with cog gearing) into a countershaft running 56 revolutions per minute. We increase the speed of our engine to 46 revolutions per minute, allowing the countershaft to remain at the same speed (56 revolutions), shall we consume more or less fuel? A. Without knowing more particulars, we cannot answer this question positively; but the chances are greatly in favor of a less consumption of fuel, if the change is made.

(49) W. D. C. says: I have a waterfall of 75 feet of a constant stream of water that will fill the space of 1½ inches square. Is there any kind of arrangement by which I can get power from said waterfall, and how much? A. Probably a water wheel will be the most convenient machine for utilizing the power of the water. You will find the advertisements of reputable manufacturers in our columns.

(50) D. H. says: On p. 241, vol. 32, you give 6 angles for slats of a windmill, and there are but 5 sails or slats on each arm of the mill. Please explain. A. You cannot have examined the article very carefully, as the figure shows 6 slats or arms, and the proper angle for each is given below.

(51) W. F. W. asks: What is the correct definition of the word compound, as applied to steam engines? Does it include simply that class in which the exhaust steam from one cylinder is utilized in a second, or would two high pressure engines, connected with a common shaft, and whose cranks were keyed at right angles with each other, also come under this head? A. Your first definition is the one commonly applied to compound or two-cylinder engines. The other describes what are usually called double engines.

(52) R. E. McC. says: Some mechanics and I have disputed about a dead center in a revolving shaft. I claim that there is no such a point in existence; but we cannot agree on it, so I appeal to you for an answer. A. If you speak of the ordinary piston and crank connection, it is well known that there are several points called dead centers, for the reason that at these points a pressure applied to the piston produces no effect on the revolution of the shaft.

(53) C. E. H. says: In small yacht engines, running as high as 300 revolutions per minute, can the feed pumps be advantageously worked from the crosshead as in slower moving engines, or is it necessary to work them slower by means of intermediate gearing? A. The pump can be worked at this speed, but it generally requires larger connections.

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

J. E. S.—It is sandstone, containing crystals of millerite, a sulphide of nickel.—T. D. H.—It is a poor variety of fireclay, containing much sand and iron. It is probably worth about $3.00 per ton in New York.—J. R. B.—It is an impure clay, silicate of alumina.—D. A.—It contains mica and sesquioxide of iron.—F. E. S.—The soft argillaceous material contains clay, carbonate of lime, and magnesia, colored with sesquioxide of iron and chromium, and mixed with sand. The other is Niagara limestone, and may be employed for building purposes or as a source of lime.—F. A. S.—It is a piece of red jasper containing a small quantity of gold. It would require a quantitative analysis to determine the percentage of metal in the ore.—W. R. L.—It is graphite of good quality; graphite and plumbago are different names for the same substance.—J.—Your specimen contains manganese and iron.—C. J.—It is sesquioxide of iron with clay.

A. B. asks: How is the cut which runs around the tops and backs of violins made, and how is the wooden thread inserted in the same? How is the deep staining varnish put on, so that the grain of the wood may be seen?—H. A. asks: Please give a recipe for making paste for whitening leather military belts?—C. F. S. asks: How can I keep goats from peeling the trunks of apple trees?—W. S. G. asks: How can I press hay into small blocks, to burn in a stove?

COMMUNICATIONS RECEIVED.

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

On Electrical Experiments. By J. D. W.

On the Steam Engine of the Future. By J. C. S.

On Materialism and Spiritualism. By J. T.

Also inquiries and answers from the following:

I.—C. H., Jr.—M. C.—C. Y. G.—C. C. D.—W. C. F.—R. B.—J. T. S.—C. H. W.—R. 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 plumbago, for stove polish? Who sells a steam engine, small enough to run a single sewing machine? Who rolls weldless steel tyres? Who makes earth-boring tools? Who makes paper barrels? Who sells small water wheels for running sewing machines, and who sells electric motors for a similar purpose? Who exhibited dental suction disks at the Centennial? Who sells small engines, suitable for pleasure boats? Who sells electric batteries, for plating?" 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

February 27, 1877,

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.

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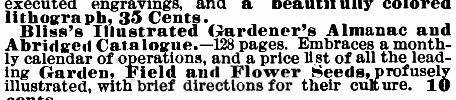

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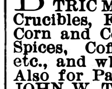

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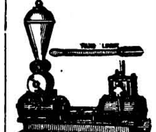

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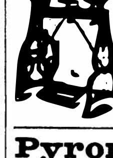

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4	200	7	3½	7
5	275	7	3½	10
6	325	8	4	10
7	400	10	5	12
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