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NEW YORK, DECEMBER 9, 1876.

[$3.20 per Annum. [POSTAGE PREPAID.]

IMPROVED KNIFE-GRINDING MACHINE.

This machine is entirely different in construction and mode of operation from any other automatic apparatus heretofore made for similar purposes. On knife-sharpening machines where the grinding is done on the periphery of the wheel or stone, the beveled edge of the knife must necessarily be concave, and in shape exactly the reverse of a section of the periphery of the wheel of like width, and as the wheel becomes smaller by use, the knife edge is ground more and more concave until the wheel becomes too small, and a new one is necessary. After the substitution and at the first grinding, each knife is changed back to the shape it had when the former wheel was new, so that more is taken from the edge of the blade than is needed to sharpen it. This machine is claimed to overcome all the disadvantages described, and the wheel is in the form of a hollow cylinder or shell, and, the grinding being done on its edge, it simply grows shorter as it wears away without decreasing in diameter. Another decided advantage possessed by this machine is that the wheel used is only nine inches in diameter, while the wheels grinding by the periphery are usually from twenty to thirty inches, and hence are more expensive. The following is a description of the machine and its mode of operation:

A is a cup-shaped emery wheel, across the projecting edges of which the knife passes during the process of grinding. B is a truck or way block on which the bed, C, carrying the knife holder, is reciprocated by means of a rack and reversing gear, similar to that of an iron planer. D is the knife holder, adjustable on bearing so as to give any degree of bevel required for the edge of the knife. E and F are respectively a slotted handle and stand connected by a bolt and hand nut, which admit of the knife holder being held in any required position and also serve as a gage for retiring it to the same position after it has been loosened for any purpose. At G are two hinged gages, one on each side, for setting the knife by its edge, bringing the edge exactly to the same position on the wheel. H is simply a shaft and hand wheel, connecting the feed screw so that both ends of the knife holder are fed up simultaneously.

When it is desired to grind a perfectly flat bevel, the track is set so that the knife will strike both sides of the wheel. If it is desired to grind the edge concave, the track is placed so that the knife will strike but one side of the wheel. The more the track is set out of line, the more concave the knife will be ground. When once set, the machine will grind all knives to exactly the same shape until it is changed. Means are provided for setting the angle of the track so as to give a flat or concave bevel as may be desired.

For further particulars, address the Northampton Emery Wheel Company, Leeds, Mass.

Bronze Statue of Daniel Webster.

On Saturday, November 25, the colossal statue of Daniel Webster was unveiled in Central Park, in this city. It is the gift of Gordon W. Burnham to the city, was modeled in Florence by Thomas Ball, and cast in bronze at Munich by Muller. Its hight is fourteen feet, and its weight six tuns. The pedestal is of Quincy granite, twenty feet in hight and a hundred and nineteen tuns in weight, and is of itself a symmetrical and handsome monument. The artist has produced a wonderful likeness of the deceased statesman, and has delineated very powerfully all that grace, dignity, and force which characterized the living Webster. Mr. Burnham has always maintained the greatest admiration for the genius of the great Webster, to whose memory this statue is dedicated. This last contribution is the second expensive bronze statue which, through the liberality of our wealthy citizen, G. W. Burnham, ornaments our beautiful park.

New Alloys.

Mr. P. M. Parsons, of Blackheath, England, a well known inventor of alloys, has lately patented in that country a new series of compositions obtained by mingling spiegeleisen, or some other form of carburet of iron mixed with manganese, with bronze, brass, and yellow and Muntz metals. The advantages claimed are greater homogeneity, hardness, strength, and closeness of texture.

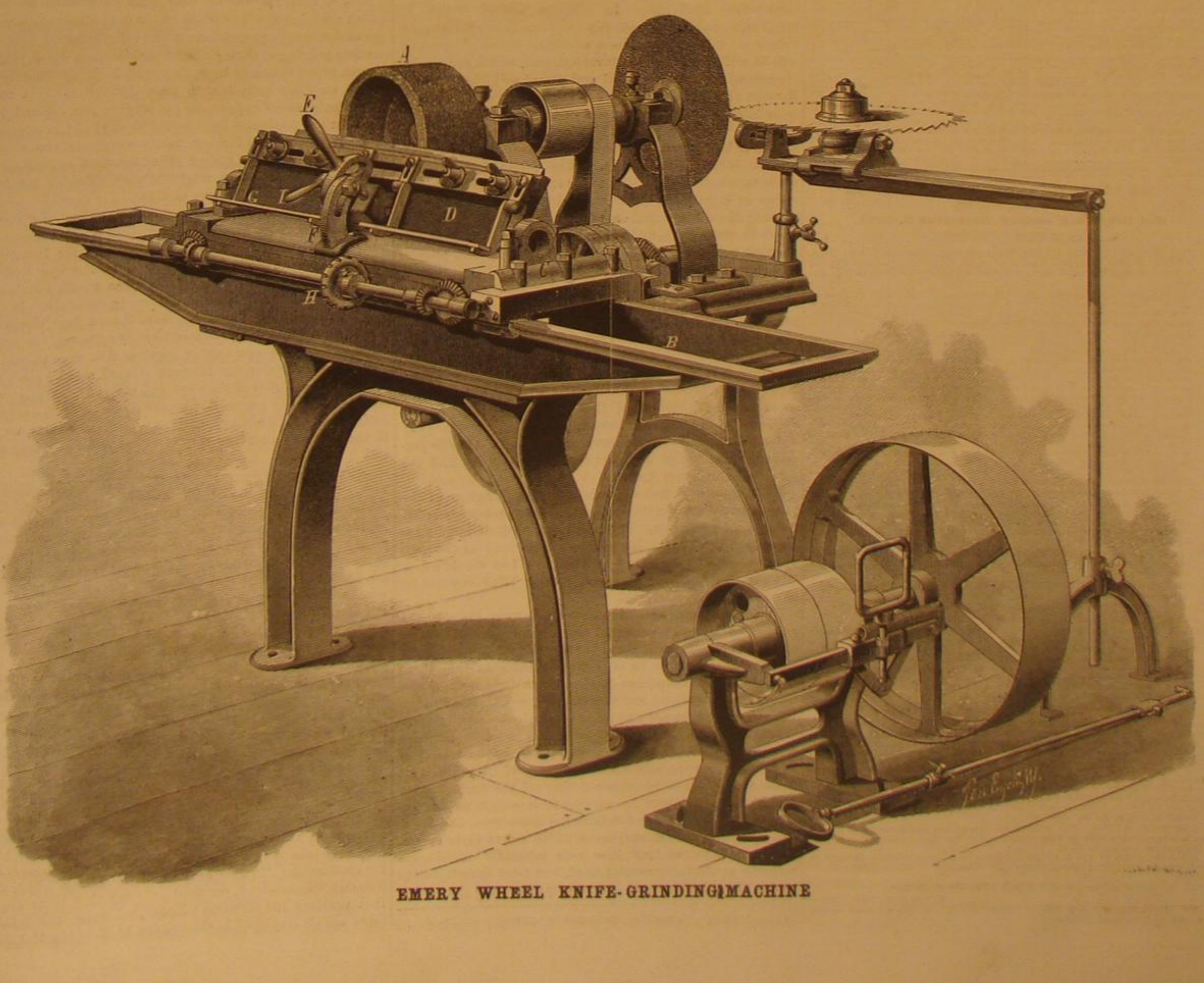
The ferromanganese, used to mix with gun metal, contains from 10 to 40 per cent of metallic manganese; with brass alloys, 5 to 20 per cent of same; and with bronze alloys, the proportion lies between the above according to the proportions of tin and zinc employed. To prepare ferromanganese containing a given amount of metallic manganese, the inventor melts rich ferromanganese, containing up to 70 per cent, in a crucible under powdered charcoal, and with a quantity of the purest wrought iron scrap. Thus, supposing it is desired to employ a ferromanganese to mix with any of the alloys containing 20 per cent of manganese, a ferromanganese containing 60 per cent of metallic manganese and, say, 1 per cent of silicon, is melted with wrought iron scrap, in the proportion of 100 of ferromanganese to 200 scrap. Then a ferromanganese containing 20 per cent of metallic manganese will be obtained, in which there is only one third of 1 per cent of silicon.

Dry sand or loam molds are recommended for casting. Metal molds render the alloy somewhat harder and closer in texture.

To Detect Gas Pipe Leaks.

It is usual to detect gas escapes by applying a lighted taper or candle to the suspected place of leakage. This is dangerous, and many explosions have thus been occasioned. A safer mode is as follows: Mix dark soap and water in the proportion of 2 lbs. of the former to 5 or 7 pints of the latter. The sticky paste or liquid so obtained is ready to be applied by the brush to the gas pipe, when, if an escape is taking place, bubbles will readily be seen on the liquid; thus the positions of the gas escapes are indicated without any danger.

MONEY.—In order to guard against the possibility of loss through the mails, we advise our subscribers to send their money either in postal money orders, bank checks, or drafts.



EMERY WHEEL KNIFE-GRINDING MACHINE

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(Illustrated articles are marked with an asterisk.)

THE SCIENTIFIC AMERICAN SUPPLEMENT.
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For the Week ending December 9, 1876.
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COLOR BLINDNESS AND ITS REMEDY.

The name of color blindness has been given to an affection of the eye which renders it insensible to certain colors, whether they arise from the decomposition of the solar rays, or from artificial pigments, or from the action of natural bodies upon light. In 1855 Dr. George Wilson, of Edinburgh, published a short volume on this subject; and before considering the latest scientific views thereon, it will be well to sum up his investigations, which are probably among the most extended and complete hitherto made. He tells us that in England one person out of every 18 is color blind, basing his statement upon personal examination of over a thousand persons. Color blindness, he says, is moreover hereditary, and affects males more than females, and people of all habits alike. Three forms of the malady are recognized. 1. Inability to see any color but black and white or light and shadow, a highly colored picture appearing like a mezzotint engraving. 2. Inability to distinguish browns, grays, and neutral colors. 3. Inability to distinguish between red, blue, and yellow, and green, purple, orange, and brown. The first of these varieties is very rare. In the second variety, the mere shades of the more compound colors, such as browns, grays, and neutral tints, are alone mistaken. The third is the most common; and on an average 1 person in 55 confounds red with green, 1 in 60 brown with green, and 1 in 46 blue with green. Red and green are the two colors which the color blind are least able to appreciate; and it is one of the most ordinary occurrences in connection with the defect that a person seeing a scarlet verbena in full blossom, cannot detect, at a little distance, any difference in color between leaves and flowers, nor can he perceive any contrast of color between ripe cherries and the foliage of the cherry tree.

Dr. Wilson says that no satisfactory explanation of the phenomena of color blindness has ever been propounded; but he wrote 21 years ago. The labors of Helmholtz, and more recently of Von Bezold, have since solved many of the most difficult optical problems. In Professor Von Bezold's new work on the "Theory of Color,"* color blindness and its causes are fully considered.

Physicists, even before the time of Newton, assumed the existence of three fundamental colors and attributed to them a physical significance: that is to say, the white light of the sun was supposed to be objectively resolvable into three such colors, an assumption which is now disproved. Later Young and Helmholtz renewed the idea, but ascribed to the fundamental colors not a physical but a physiological significance. They assume that the eye is accessible to three fundamental sensations, which we may perhaps conceive of as being made perceptible to us by means of three different kinds of nerves. It is supposed that all the various color sensations experienced by us owe their origin to the cooperation of these three fundamental sensations, and it becomes important to determine to which colors these correspond. Red, yellow, and blue were generally looked upon formerly as the fundamental triad, but later investigations lead to the substitution of green for yellow, and the selecting of a blue closely bordering upon violet; and this conclusion, that red, green, and deep blue are sensations of a simpler nature than those of any other color, is especially supported by the pathological phenomena of defective color vision, and thus we are led to an explanation of that ailment.

It is curious that not only are persons born color blind, but that they may be rendered artificially so. Violent injury to the head or overstraining of the eyes can induce a loss of the color sense; santonin derived from worm seed produces vertigo and headache, and causes the person afflicted to see all objects in two hues, yellow and violet.

When a person who confounds red and green regards the spectrum, he sees the red end shortened. The place in which the red is visible to the normal eye is to him black, hence red light does not affect his eye. He is red-blind. When intoxicated by santonin the violet end of the spectrum is wanting, on the contrary; and this condition may therefore be designated as violet blindness. The violet shadows seen under the influence of santonin are therefore simply the consequence of contrast, that is to say, a deception of the judgment.

In order therefore to explain these phenomena, Professor Von Bezold holds that it is only necessary to assume that color blind persons are devoid of one or the other of the three fundamental sensations. If we suppose that these sensations are brought to our perception by nerve fibers especially assigned to each, it is presumable that, in the case of a red-blind person, the fibers corresponding to the sensation of red are either paralyzed or that they are perhaps even wanting entirely; while in the case of a violet-blind person, the same would have to be true of the nerves set apart for the violet sensation.

We can arrive at an idea of the condition of a color-blind person approximatively by looking through colored glass, or by noting our natural conditions when viewing objects by lamplight, when our vision is closely analogous to that of a violet-blind person. Hence the reason why dealers in paintings prefer to exhibit them for sale by gas light, when, the violet rays being absent, the eye sees other colors under a rich glow of red and yellow, which adds greatly to the brilliancy of the pigments and softens and mellows tones which by daylight are crude and cold. Conversely, if a painting were executed by lamplight, it would look strange and faulty by daylight, and its incorrectness would increase with the number of cold colors intended to be employed in the picture. The same absence of blue and violet rays in lamplight explains why red and yellow dresses show nearly the same color under it, while blue stuffs can hardly be told from green, and violet becomes grayish or reddish. This is taken into consideration by ladies in buying dresses for evening wear, and by artists in decorating apartments especially intended to be used at night.

Now it follows that we have only to weaken the rays which are in excess, to cure the defects of either the normal eye under peculiar conditions or the color-blind eye. By regarding paintings through light yellow glass by daylight, we can perceive nearly how they will look by lamplight; and if we allow lamplight to pass through the blue solution of sulphate of copper, we can weaken the red and yellow rays and produce a light equal to daylight in composition. If we proceed further, and concentrate the altered light, we obtain a still nearer approximation to daylight in brilliancy, and one which might be very valuable for those who have to deal with colors at night.

To come back to people naturally color-blind, the consequence of the above is that colored glass offers a means of materially lessening the ocular defect. If for instance a solution of sulphate of copper renders the eye looking through it red-blind, then a colored glass which eliminates the blue green rays, interposed, restores equilibrium. In this way Professor Von Bezold suggests that a few pieces of glass of suitable color, mounted like eye glasses, for color-blind people whose profession requires that they should be able to tell the difference between colored signals (and the red and green lights of railways and ships are of the very colors most easily confounded), patterns, etc., or to study or design technical drawings, such as plans and charts, might be the means of affording very essential relief at a very low cost.

* Translated by S. R. Koehler. Published by L. Prang & Co., Boston.

OTTO OF ROSES.

The most delicious of all perfumed essences is obtained by the simple distillation of rose leaves. In our climate, roses are not sufficiently highly scented to produce the properly odoriferous essence or oil; and all that the druggists can produce from rose leaves is rose water, which in fact is water slightly impregnated with the essence or oil, which is, to a small degree, soluble in it. The most favorable country for the production of the most highly scented roses is the middle portion of European Turkey, at the base of the southern slope of the Balkan Mountains, where the roses are grown in localities where they are protected against all winds except those from the south; and the flowers thus attain a luxuriance in perfume and in growth, as well as in size, of which those who have not visited these regions can hardly form any idea.

The town of Késanlik, situated in the province of that that name, is the center of the field of cultivation and distillation of the rose leaves. The leaves are gathered all over the province, which is 40 miles long, and is watered by the river Thungha and the many mountain streams which discharge into the same, furnishing the water necessary for the distillation. To give an idea of the extent which this industry has attained, we need only say that there are in that province 128 different villages, of which the inhabitants are all employed in the culture of the beautiful flowers. These all live in peace together, Turks and Christians; and they prosper, having become wise by experience, finding that it is better to work than to waste time in religious or political quarrels.

Almost all the country is occupied by rose plantations, and only a comparatively small portion is devoted to raising rye and barley, for the subsistence of the inhabitants and their cattle. The rose grows best on those parts of the slopes where the sun shines most, and which is the least northern in exposure. A light soil is best; and the planting is done during spring and autumn, in parallel ditches three inches deep and five feet apart. In these ditches shoots from old rose trees are laid; they must however, not be cut from the tree, but torn off, so that each shoot has some portion of the root or bark of the root adherent. They are then covered with earth mixed with a little manure. If the land is horizontal, and a mountain stream can be diverted so as to inundate it, this is done, to hasten the growth; at the end of six months, shoots are seen coming up all along the furrows, and at the end of one year these shoots are 3 or 4 feet high, forming regular hedges. At the end of the second year, roses appear, but not in sufficient abundance for them to be gathered. The gathering is commenced in the third year, after which they produce largely, the hedges being, at the end of 5 years, 6 feet high. The bushes produce flowers until 15 years old, when the field is worn out, and must be plowed up. They do not prune the rose bushes at all, as we do; but they cut off, every year in the late fall or winter, the dead branches.

The great harvest commences about May 15, and lasts until June 5 or 10: the gathering is done daily in the morning before sunrise, and the distillation is finished before 12 noon, so as to have the benefit of all the freshness of the flowers, which is at once driven off by the heat of the day. In hot seasons, the roses open more rapidly, and the crop may last but for 10 days; but in wet, cooler seasons, the progress is slower, and the crop may last for 25 days: but then the daily harvest is smaller in proportion, so that the final result is about the same. However, cool, slow weather is preferred, as it eases the daily labor.

The stills used are of the roughest kind, and small; they hold from 200 to 240 pints of water, and are carried to the rose bushes to be filled. To 20 lbs. rose leaves, 160 pints of water are added; and the whole is distilled at a gentle heat until 20 pints of water are distilled off. This quantity contains nearly all the perfume of the leaves, which are then thrown away with the remaining water; and the still is again filled with 20 lbs. leaves and 160 pints water. This operation is repeated until all the leaves have been used. The water thus distilled off is a strong rose water; and the result of 8 or 10 distillations is put in a still and submitted to a second distillation, when a stronger rose water is obtained: so strong, indeed, that it is unable to contain the essence in solution, and the latter floats on the top of the water. Experience has shown that, for every ounce of otto of roses, 3,000 lbs. of rose leaves are required.

The total yearly production of eight districts, into which the 160 villages of the province of Kézanlik are divided, is on an average 3,500 lbs. of otto of roses, of which the district in which the capital is situated produces half. Some years ago, however, the bushes were exceptionally prolific. Thus, in 1866, 6,000 lbs. were produced; but in 1872 only 1,700 lbs. could be obtained. We ought to add that every rose farmer has his own stills for producing otto of roses immediately after picking the flowers; and thousands of industrious workers are thus occupied, earning in a single short period of 20 days the products of a year's labor in preparing the soil, planting, and taking care of the growing plants. When the distillation is over, the farmers come from all parts of the provinces to the capital to sell their products, those who have large quantities selling directly in the great commercial centers, such as Constantinople and Adrianople. At present, however, an enterprising firm in Kézanlik, considering the delay to which the trade with the last-named cities is subject, and the chances of adulteration, have established a depot in Paris, France, from which this delicate and expensive perfume is now distributed over Europe and all the world

A VALUABLE DISCOVERY IN ELECTRIC ILLUMINATION.

M. Jablouskoff, a Russian physicist, has recently communicated to the French Academy of Sciences a new and apparently important device on which a single electric current can be divided among several burners of electric lamps, disposed apart at distances more or less great. At the same time the light is augmented, and the regulators, which are the most costly and most easily disarranged portion of electric lamps, are entirely done away with.

The ordinary electric lamp consists of the carbon pencils disposed perpendicularly one above the other. Between their extremities the current forms the luminous electric arc, provided, however, that these extremities are, as the material burns away, constantly maintained in the same relative position. To this end, delicate clockwork mechanism is used, which is both expensive and difficult to adjust. M. Jablouskoff's substitute for the latter apparatus leaves nothing to be desired on the score of simplicity. He places two pencils of carbon in a solid cylinder (of clay, powdered stone, or any other refractory material), so that the pencils form as it were a double wick to the novel candle. The pencils are adjusted to the proper distance apart, so that, when the candle is inverted, the current passes from the end of one to that of its neighbor. As the combustion progresses, the intense heat volatilizes the refractory material of the candle, and thus new portions of the pencils are constantly exposed, while the material itself, burning in the electric light, adds to its power. The pencils of course always remain parallel, and hence at the distance apart to which they are primarily adjusted. One of these candles placed in a case, with reflector, etc., constitutes all that is necessary to connect with the battery to produce the light; and it is easy to see how a large number of them might be joined in circuit, and thus one current utilized to produce an extensive illumination.

THE VALUE OF FINE WORKMANSHIP.

"Whatever is worth doing is worth doing well" is, it is true, a platitude; but it has a peculiar value when applied to the machinist's art, for the difference in durability between an ordinary and a fine fit is so great that the latter is in the end the true economy. There is of course a large class of work in which the fit of the parts is of no practical moment, and in such cases the work may be put together as it leaves the machine tools; but for all general work, such as the connecting rods, link motions, guide rods, crossheads, and valve motions of engines, either stationary or locomotive, it pays to finish the work everywhere to a fine fit. And it may safely be said that, while every piece of turned work should be finely turned, and each piece of boring carefully bored, every brass or journal box should be fitted with the smooth file and half round scraper to its place, red marking being used to show the fit; and if this is properly done while erecting the work, there will be no danger of hot journals, or of stiff working, which too often occurs when new engines or machines are first run. It is often advanced by machine builders that "the working parts will in a few days wear down to a bearing," and it is no doubt true; but in the process of that wearing down, infinite mischief is done. Suppose, for example, that a journal box is left to wear itself to a bearing instead of being fitted to one; then the whole strain placed on the bearing will be sustained by the reduced amount of journal area at first in contact, and as a consequence the wearing will not be smooth, the degree of roughness being proportionate to the area of metal in contact and the pressure upon the same. It is often found that the oil escaping from a newly run crosshead and slide, or from a new journal box, appears like liquid bronze, evincing that cutting is going on; and as that cutting will cease when the working parts have come down to a bearing, it is evident that, were the brasses fitted to a bearing, the cutting would not take place. Axle boxes are often left slack at first, and gradually tightened up as the engine or machine is run; and there would be no necessity for this if the parts are properly fitted, not only separately, but also when put together. If a journal box is properly fitted, the nuts may be screwed tightly home at once; and it will work smoothly and noiselessly without requiring any special attention. In lathe work, we find that, no matter how carefully it is turned, it is not true; and though outside work may be made sufficiently true for practical purposes, inside work, such as boring, will be greatly improved if fitted by hand, especially if it is put together in pieces. Eccentric straps and pillow block or connecting rod brasses are examples of this fact; for if we bore them to the correct size, we shall find that they close in across the joint during the process of boring, and we must, to make a good job of them, fit them to their places by hand work. But if once properly fitted, they will work a long time without causing any lost motion.

If we turn to flat surfaces, experience has demonstrated that, no matter how carefully they may be planed or milled, they are not finished true; and though for small work, such as sewing machine work, they may be true enough, they are not so for large work. Three cast iron surfaces, 11x8 inches, were recently carefully planed in a very superior planing machine; and yet it took two good hours' work with a 14 inch smooth file to file them sufficiently true to show a good bearing surface when tried together. Work may appear to be true and of a good fit when such is far from being the case, especially in the matter of flat surfaces. In fitting up connecting rods, for instance, it is no proof that, because the keys seem to have a very close fit to the keyways and the straps to the stub ends, the fitting is well done, because the vise hand or fitter knows that those are the points to which the examiner will look to judge of the fit; and hence he is very liable to keep those edges in contact, even though the interior surfaces are hollow, and therefore not in contact at all. But it must be remembered that the wearing surface is that which is in positive working contact; and the smaller its amount, the sooner will play, looseness, or lost motion occur; and after that has once begun, the wear is much more rapid and destructive.

In the matter of all flat surfaces, it is actually cheaper to make a good job than an indifferent one Suppose, for example, we are filing out a keyway: we may use a keyway surface plate, and file it out level and out of twist; and then we know, when fitting the key, that, the keyway being right, our attention need only be directed to the key. When the latter is planed, we may apply it to the surface plate and true it up and fit it to the keyway without having to drive it in and out to try the fit. If it binds in the middle or at the edges, we may, by applying the key to the surface plate, ascertain at once whether the key or the keyway requires to be eased, and thus ensure not only a close fit, but one fitting over the whole area.

It may in fact be said, without fear of contradiction, that no flat work can be either well or quickly done without the aid of a surface plate; nor can any work be really well done unless the parts are fitted together and the fit tried with marking. That work is often put together as it leaves the machine tool is too true, but its durability is comparatively short-lived; and it may safely be said that, whatever extra cost is entailed, making work true and of a very fine fit is true economy. It is, *per contra*, frequently urged by engine builders that purchasers will not pay the increased cost; but the reply to this is that the cost is but little increased, because, in a majority of cases, the work may be performed actually more quickly by applying tests to ascertain its accuracy; and furthermore, the application of the tests shows where the defects are, and the machinist directs his attention to remedying them; and in fitting up the work, he knows just where to find them.

The standard of excellence to which work should be finished depends upon what, if any, means are to be taken to test the quality of the finished work, or whether it is to be subjected merely to a casual observation. We believe it costs much more to do good work without hand work than with it, and we are sure that good work cannot be done without actual testing, by trying the work together, and a careful application of marking, calipers, gages, etc.; and if any of our readers are not cognizant of this fact, let them test the flatness of the most carefully manipulated piece of work, and they will be speedily convinced. Even the extra finish upon work is labor well bestowed; for in using it, the operative is constantly reminded of its degree of superiority, and is just so much the more careful in using or working it. Another consideration is that the users of machinery are not slow to appreciate excellence of workmanship, and will be ready and willing enough to pay for that which time will inevitably prove to be commercially valuable. It very often occurs that a fine adjustment of fit is neglected because the parts are provided with a means of taking up any wear or lost motion. In many instances, however, the provision of such parts is more costly and not more desirable than omitting them and making the parts a good fit. The crossheads of stationary engines may be taken as a fair example of this. Solid crossheads have been known to work for years without any appreciable wear, while on the other hand it is not uncommon to find that the brass adjustable gibs and the surfaces of the guide bars are considerably worn after a few weeks' travel only. Locomotive guides and bars are much more subject to excessive duty than are those upon stationary engines; and yet it is not found desirable to provide them with any means for taking up lost motion. The link motion, etc., of a locomotive engine in England, that had run express trains for fifteen months, were taken apart, and it was found that the parts were so little worn as to be practically unimpaired; while another engine had oil on the guide bars, which was like a liquid bronze from the wear due to an improper adjustment of the gibs to the guide bars. It may also be noted that, while in many cases provision for taking up the wear is decidedly advantageous, in all such cases the wear is very likely to be excessive in consequence of an improper adjustment of the parts. In conclusion, it may justly be said that, in view of the similarity and excellence of design to which many of the more prominent builds of stationary engines have attained, the quality of the workmanship promises to receive more minute attention than has in former years been paid to it; while the employment of steel and the hardening or casehardening of the working parts promises to be much more general as their great advantages become universally known.

NEW YORK ACADEMY OF SCIENCES.

The chemical section of this society met at their rooms, 64 Madison avenue, on Monday evening, November 13, 1876. Some beautiful specimens of tourmaline from Brazil were shown, which exhibited the peculiarity of having a red center and green exterior, or were red at one end and green at the other. A very large black garnet also attracted a good deal of attention, as did a specimen of crystallized dolomite from Westchester county, N. Y.

Professor Winchell, Chancellor of the Syracuse University, made some remarks on cephalopods, more especially the endoceros, which he has been recently studying. His remarks were illustrated by blackboard drawings.

Dr. H. Carrington Bolton showed some experiments with Böttger's ozone mixture, namely, permanganate of potassium and sulphuric acid. Sulphuretted hydrogen gas is immediately inflamed by contact with this mixture, without the application of heat. When a jet of ammonia gas is directed against this mixture, it causes an appearance of flame, but the gas does not itself continue to burn. Dr. Bolton also referred to the fact that sulphuretted hydrogen gas may be ignited by means of concentrated nitric acid. Professor Falke spoke of the danger attending the use of this ozone mixture, and Professor Seeley described the use of chromic acid for producing heat and igniting substances.

Professor Charles A. Seeley read a paper on the friction of fluids. Including air and other gases under the name of fluid, he explained the ball puzzle at the Centennial, the formation of smoke rings, etc.

The next chemical meeting will be held on December 11, 1876.

THE shipment of American beef to England is becoming a large and growing business. Two Liverpool steamers took over four hundred dressed cattle a few days ago.

IN accordance with a long-established rule, all subscriptions terminating with this volume will be discontinued at that time. We trust that all our subscribers will not only renew, but that they may find it convenient to induce some of their neighbors to become subscribers. We shall in the future, as in the past, give our readers full measure and running over, in return for their money.

THE NILES ENGINE.

When it is considered that the majority of steam users employ the cheaper classes of steam engines, it is hardly necessary to seek for further reasons why the engine with the single slide valve still finds abundant usage, despite the existence of the improved automatic cut-off machines, with all the advantages which they offer. To meet the demand for an efficient motor of the first mentioned type at low cost, the machine herewith illustrated in Fig. 1, modeled after the English Tangye engine, is offered. The design is quite novel and simple, the working parts are neatly proportioned and adjusted to compensate for wear, and access to them is rendered easy. The bed casting is cored out, and the metal disposed as nearly as possible in the line of strain; when bolted down on the foundation, the entire length is in contact with the masonry, thus insuring stability. The steam chest is on the side of the cylinder, and low enough to drain it of condensation. The connecting rod is a solid forging, without straps or stub ends. The mortises through each end are accurately broached for reception of the brasses, and a single cotter takes up the wear. The valve is driven directly by the eccentric rod.

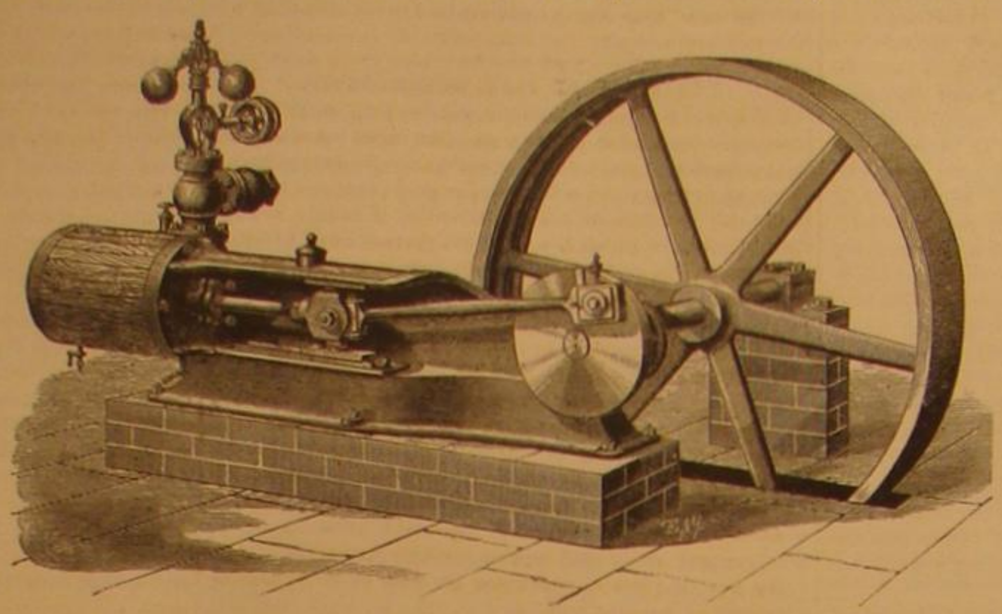


Fig. 1.–THE NILES ENGINE.

The diagram, (Fig. 2) is taken from a 13x20 engine, and exemplifies the valve motion given to the engine. In this case the machine was carrying its maximum load, at rated speed, with exhaust connected to a feed water heater. The average back pressure, independent of cushion, is less than one half pound, the total counter pressure referred to the whole stroke being less than five per cent of the average direct pressure.

The engines are designed for use where the ordinary slide valve engine has hitherto been employed, and are built in sizes varying from 6 to 16 inches diameter of cylinders with 10 to 24 inches stroke.

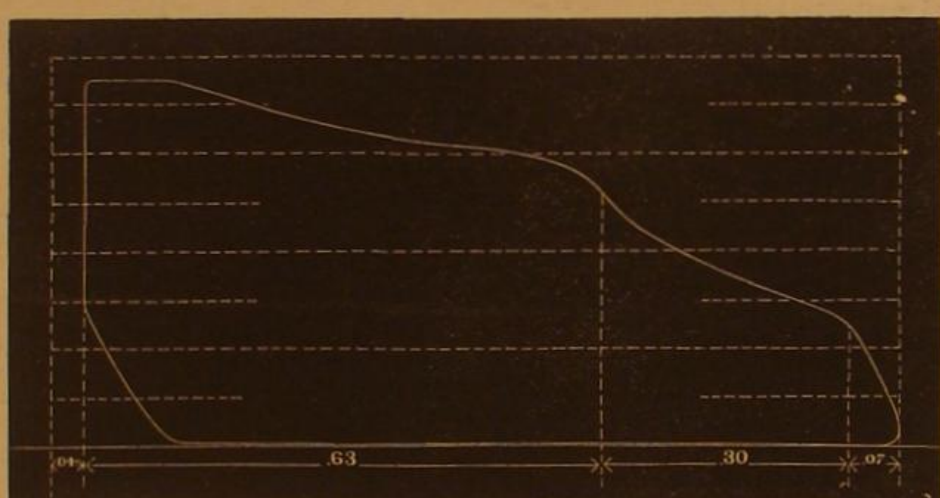


Fig.2.–INDICATOR DIAGRAM OF A 13x20 NILES ENGNIE.

Fig. 3 exhibits a complete stationary engine with vertical tubular boiler, conveniently arranged on a substantial cast iron base. This engine is also modeled after the Tangye, but possesses some novel features of its own. The bed, cylinder, inboard pillow block, slides, and seat of steam chest are all combined in a single casting. Around the cylinder is cast a thin shell forming an air space, into which the condensation from the cylinder is drawn. Ample provision is made to compensate for wear, and steel is freely used in the construction. The pump (not shown in the engraving) is driven by a small crank at the outboard end of the main shaft. The boiler is of the vertical tubular type. The smoke bonnet is made in two sections, the upper one of which is pivoted, allowing it to be swung entirely clear of the boiler, for cleaning the tubes.

The boiler is provided with compression gage cocks, spring pop safety valve, with hand lever to blow-off steam gage, check valve, blow-off, and drip tubes. The engine, boiler, governor, feed pump, and appurtenances are furnished in sizes from two to twelve horse power, complete, as shown in the engraving, all ready for the boiler to be charged with water, fired up, and run. The engine is warranted by the builders to develope the rated power at 60 lbs. boiler pressure.

For further information regarding either of the above engines, address the Niles Tool Works, Hamilton, Ohio.

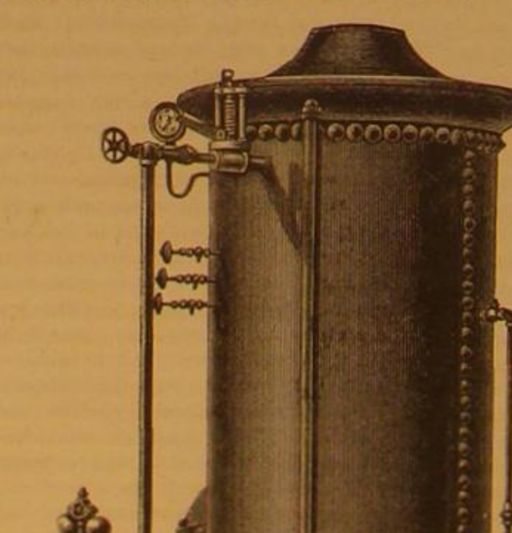


Fig. 3.–NILES SEMI-PORTABLE ENGINE.

New South Wales International Exposition of 1877.

We would remind manufacturers, inventors, and all who have exhibited at the Centennial that an excellent disposition of their show articles would be to pack them and ship them to Sydney, New South Wales, for display at the International Exposition, there to be held in the months of April and May, 1877. Messrs. R. W. Cameron & Co., of 23 South William street, New York city, are representative commissioners here, and will despatch a ship direct from New York to Sydney on the 1st of December. Freight is fixed at $10 per tun.

The exhibitions in Sydney, which are annual, are not so much attractive spectacles as places of business where people from all the Australasian colonies meet to buy and sell. The Australian public is wealthy but utilitarian: that is, it cares little for fine arts, but a great deal for useful and improved inventions which will aid in developing the resources of the country. What is especially wanted is labor saving machinery and in a recent letter the Executive Commissioner of New South Wales at the Centennial, Hon. Augustus Morris, offers some valuable suggestions as to the kinds of machines required. He says: "The greater portion of the best pastoral lands of Australia are wholly without surface water, and generally when wells are sunk they only reach salt water. Therefore, the great requirements are apparatus for sinking through the saline stratum to the fresh water, which probably lies below; and especially appliances for excavating tanks or reservoirs, into which the rainfall may be led from the plains. The most effective pumps for use on land or in ships are desirable objects of exhibition. So, also, are the best agricultural machinery and implements, being strong and simple in construction. Timber-sawing machinery always finds a sale, and, if adapted to fell standing trees, and to cut them into lengths when on the ground, so much the better. This opportunity of bringing American railway appliances to the notice of the Australian Governments, which own nearly all the railroads, should not be neglected. Such a display would undoubtedly attract the principal civil engineers from all the colonies, and many prejudices would be removed. Although the Australian Commissioners have been very much impressed with the suitableness of the American railway system to our colonies, and we have so reported, unfortunately none of us are civil engineers, and our opinions will certainly be taken with much allowance for error. I will, failing a more suitable person, gladly take charge of any railway exhibits, and do my best to forward the interests of the exhibitors, if, on consultation, I can advise them to be sent. There are very many articles in the Centennial buildings, which would, when known, be introduced into Australia advantageously to the makers. I will mention a few only: Brickmaking machines, if cheap and strong; small cheap planers and matchers; scroll saws; the latest improved woodworking machinery; any small, ingenious household goods of the latest patents; spring wagons of best construction; lightning cross-cut saws; samples of furnishing goods, etc. I could extend the list, but I shall be happy to advise any one who may wish to exhibit as to the probability of his obtaining orders. There are very few articles subject to duty in New South Wales, but any reasonable quantity of dutiable goods for exhibition will be admitted free of the custom house which will have no control over anything which enters our exhibition buildings. Everything for the exhibition should be addressed to Jules Joubert, Esq., secretary of the New South Wales Agricultural Society, Sydney, so that it may be taken free of expense to the exhibition building, and otherwise cared for."

American Progress Viewed from Abroad.

M. Louis Simonin, one of the ablest of French writers on political economy contributes to the *Revue des Deux Mondes*, a very valuable and, to Americans especially, interesting summing up of what the Old World thinks of our Centennial. The chief fault which he finds is due to a misapprehension which which we are surprised to discover in an observer in other respects so acute. He objects to the award system on the ground that "the great builder and the great manufacturer who went to large expense in order to take part in the Exhibition are not distinguished from the smallest exhibitor, since they all alike receive bronze medals." Now, as the medals included in awards amount to nothing more than to attract attention to the report of merit, and as the reports offer a means of differentiating honors with a minuteness only limited by the adjectives and modes of expression comprised in the English language, it certainly follows that no one who reads the reports is liable to misunderstand why, and for what, awards were conferred. We cannot agree with M. Simonin in thinking the Corliss engine "the most remarkable thing in Machinery Hall and one of the greatest curiosities, perhaps the principal, in the Exhibition;" nor can we applaud the comparison of the spinning and weaving machines with similar collections in other Expositions "in number and noise." In his review of our industrial progress and possibilities we should expect to note the master hand of the writer, and the following significant paragraph certainly more than compensates for the minor errors into which he has strayed:

America can feed Europe with corn, wheat, preserved meats, and live stock, as it has supplied it with cotton; it has clothed Europe, and it can nourish Europe. It can get along without Europe as far as regards iron, steel, copper, machinery, and most of the manufactured products. It will not cease, however, to give Europe the gold and silver which is needed for all transactions, for the mines of the United States yield more than the mines of the whole world. As for coal, America will soon produce as much as England, that is, as much as all the rest of the world, and its carboniferous deposits are twenty times greater than those of England.

"America will learn more and more how to get along without Europe, but Europe will not be able to get along without her. It is truly a new England which is rising across the seas, and which already threatens the old England in all her markets. The commercial interests of France are also threatened; even American wines are competing with ours. The connoisseur alone demands the wines of France.

"But what is still graver is the fact that the Americans are getting hold of the processes, the sleight of hand of our workmen. Already in the manufacturing of jewelry, watches, bronzes, furniture, and artificial flowers, they produce an article which bears the real stamp of solidity and good taste. In these departments the American is more to be feared than the Englishman, because of his situation, which climate, a mixture of races, and an incessant contribution of European and Asiatic immigration render peculiarly favorable. Switzerland is already in a state of agitation over the success of American watches. In carriage making, cabinet work, glass work, and pottery, the United States is almost the peer of France and the other great nations. In other things they have got ahead of us; and all this in spite of the high price of labor. It may be said that we are their instructors and masters, as Italy was for us at the Rénaissance, and that they are destined to surpass us some day, as we did the Italians. Venice, Milan, and Florence taught us formerly how to melt glass, to weave silk and velvet, and soon we got ahead of them. Will the same thing happen to us in respect to the United States?"

To determine whether beeswax is adulterated with paraffin, heat the suspected material to 329° Fah., with sulphuric acid. On cooling, the paraffin, if any be present, will rise to the surface

A CURIOUS CLOCK.

We take from *La Nature* the annexed engraving of a new clock lately devised by M. Guilmet. The odd feature about the timepiece is that the clock oscillates while the pendulum is stationary, thus reversing the usual order of things. The mechanism is contained in a circular case which is pivoted to the branches of the bracket, A B. The rear of the clock, with the escapement and small pendulum, P, is shown in Fig. 3. The ring, B, Fig. 2, is connected to the crosspiece, C C, Fig. 1, by means of three springs. Below the cross-

Fig. 1.

Fig. 2.

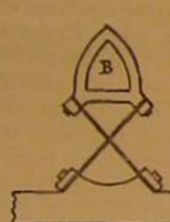
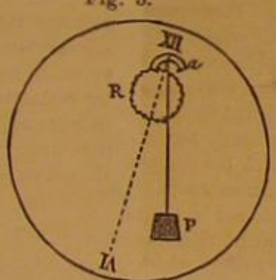


Fig. 3.



piece is attached a balance rod, which also acts as a pendulum. The ring is slipped over a hook, *a*, in the hand of the statue, and the clock is thus sustained, a slight swing being sufficient to start its oscillations. The effect obviously is the same as if the piece, *a*, Fig. 3, vibrated in the usual manner. The outline on the right of Fig. 1 indicates the swing of the main pendulum, the position of the bob of which governs the oscillation, and consequently regulates the movement of the clockwork. The weight of the small pendulum and the elasticity of the supporting springs unite to render the vibrations continuous.

IMPROVED APPARATUS FOR CURING TOBACCO.

It is well known that a large portion of the tobacco grown never enters into that state of fermentation necessary to fully develope its burning quality, flavor, and dark color, so that it retains its wild rank elements and its green and yellow leaves, and is therefore unfit for cigar purposes.

The inventor claims that, by the process and apparatus shown in the accompanying engravings, such tobacco can be forced to sweat and color, and its quality can be improved, thus reclaiming a large quantity of goods hitherto considered worthless. The case of tobacco to be operated upon is unpacked, and the tobacco, one or more hands at a time, is laid loosely in layers upon the rack bottom of the truck, D. As each layer rises a little above the horizontal bars of the side racks, one of the loose racks, E, is placed upon it, and so on until the whole case has been transferred to the truck, D. Each layer is then moistened with water. As the tobacco becomes soft it settles down, and the racks, E, rest upon the horizontal slats of the side racks of the truck, which prevents the tobacco from packing so closely as to prevent all its parts from being moistened evenly. The loaded truck is now run into the steam chest, A, the door, C, is closed steam-tight, and steam is admitted until it has attained a pressure of from 3 or 5 lbs., which pressure is maintained for 5 or 10 minutes. During this time any excess of moisture that may be contained in the leaves will be vaporized and distributed evenly through the entire mass, and the tobacco will have settled so that the hands press upon each other, and will be in suitable condition to sweat and color. The steam valve is now nearly closed, only enough steam being admitted to maintain a temperature of from 150° to 200° Fah., long enough to thoroughly sweat the tobacco and bring it to the depth of color desired. It is then ready for stripping.

This invention was patented through the Scientific American Patent Agency, September 26, 1876, by Mr. Charles S. Philips, of Brooklyn, N. Y.

A Two-Story Street Car.

The Sixth Avenue Railroad Company of this city have introduced a novel car on their road, which attracts considerable attention and will be found specially desirable for summer use. It is only the pioneer of others if the new design prove desirable. Its interior is of hard wood, handsomely finished, polished, and varnished. The braces, bolt heads, door handles, and even the match scraper, are nickel plated. The seats are of fine polished wood, perforated, the nail heads mounted and burnished. The body of the car is shortened to give space for the stairway on each platform. The two benches on the center of the roof are placed so that passengers will sit back to back. A canopy is spread on braces that are screwed to two strong uprights, and is high enough to allow a person six feet in stature to stand upright.

This car has one commendable improvement in the shape of a guard before the front wheels. It is a broad iron strap attached to the under edge of the car, extending to within an inch of the track, thus sheathing the wheel, and acting as a sweeper of the rail.

The Cornell Owl.

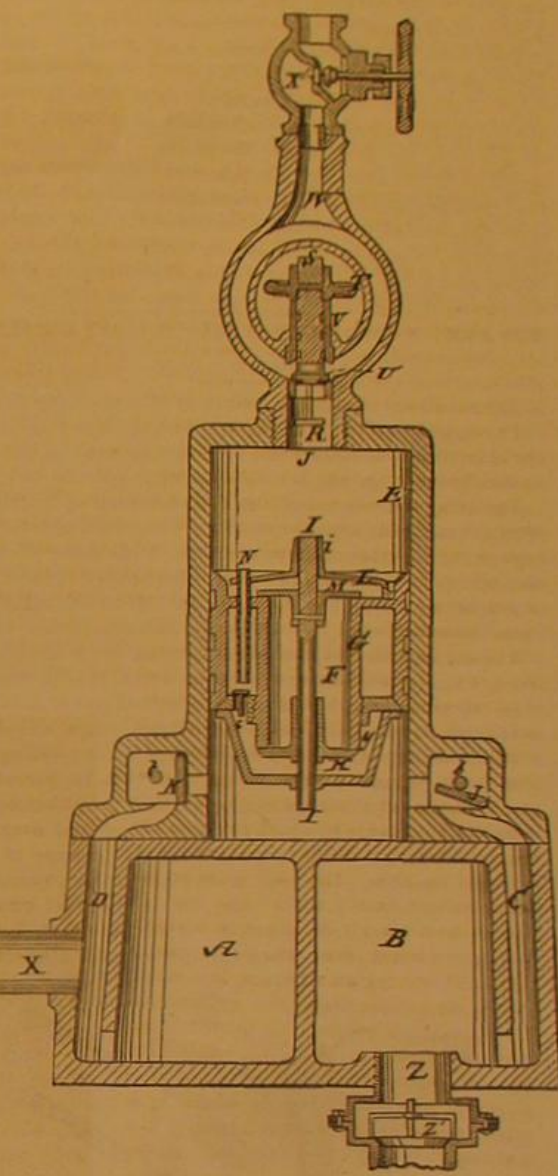
During the past week, a bittern, a duck, and four owls have been received at the laboratory. One of the owls is kept alive. He has disposed of parts of several fish, a chipmunk, and a live snake two feet long. The encounter with the snake was quite amusing. The owl, on spying him in a glass case, evinced a desire to form a closer acquaintance, and so the snake was placed on the floor of the laboratory. The owl with one fell swoop came down upon his snakeship, and, striking its claws into his back, raised his head to its mouth and instantly smashed it. Then commenced the process of deglutition. The owl proceeded to swallow the snake's head first, and proceeded badly enough, until, after a minute's struggle, all was swallowed but two inches of the tail. At this point the owl stopped to take breath, and stood with its eyes slowly blinking, while the two inches of tail, still visible, was wiggling vigorously. At last, summoning up courage, the owl gave a last struggle and the end of the tail disappeared, still wiggling, down his throat.—*Cornell Era.*

Wall Papers and Typhoid Fever.

An Englishman, several members of whose family had been sick with typhoid fever, had a room repapered, and found that there were no less than twenty-five wall papers already on the wall. The presence of this mass of decomposing paste and paper sufficiently accounted for the disagreeable smell that was always noticeable, although drains and water closets were well trapped.

A NEW STEAM PUMP.

We illustrate herewith a novel steam pump, operated by the condensation of steam, something after the pulsometer principle. To start the pump when first set up, it is only necessary to pour a small quantity of water into the cylinder, then open the globe valve, X', and raise the steam valve, U, by means of the milled nut, T, which allows the steam to flow into the cylinder, E, forcing the air therefrom through the port, K. The head, G, being at the bottom of the cylinder, the valve stem, I, projecting below, holds the valve, M, open, and allows the steam to come in contact with the water. Then, by closing the steam valve, U, a partial vacuum



is formed. The steam is then again admitted, and the same operation continued until the air is exhausted from the pump and pipes. This being accomplished, the pressure of the atmosphere forces the water up the suction pipe, Z, nearly filling the vacuum chamber, B, then up the passage, C, forcing the head, G, upward until the hub on the disk, L, comes in contact with the counterbalance, R, and, lifting the steam valve, U, admits steam into the cylinder, E. As the valve, M (the only means of escape for the steam), is closed, the head, G, is forced downward, forcing the water with it until the valve stem, I, is brought to bear on the bottom of the cylinder, when the head, G, leaves the valve, M, which is thereby opened and allows the steam to pass through the piston, past valve, H, and exhaust into the water below the piston, which condenses it instantly, thus forming nearly a perfect vacuum in the cylinder, E, the valve, U, being at that instant closed by the pressure of the atmosphere. When the vacuum is formed in cylinder, E, beneath the piston, the air instantly expands and forces the water out of the

Fig. 1

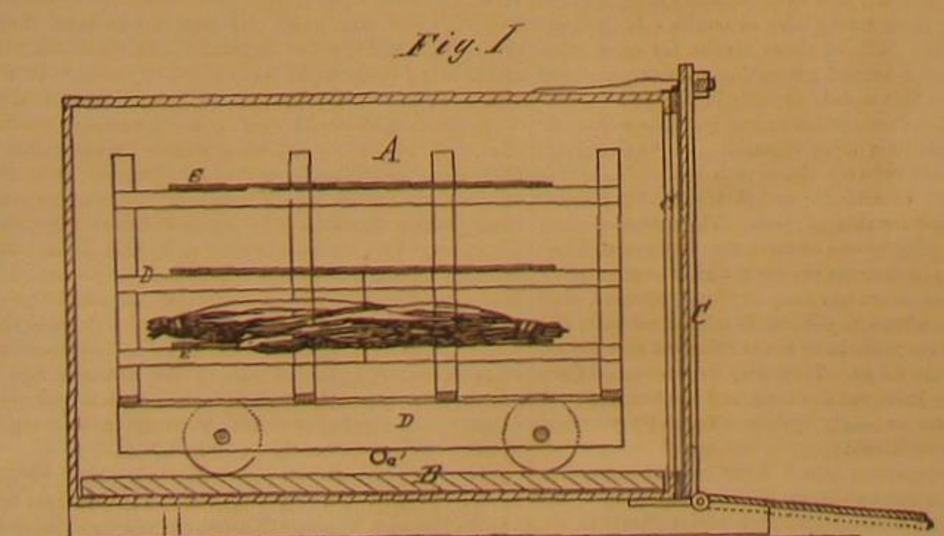
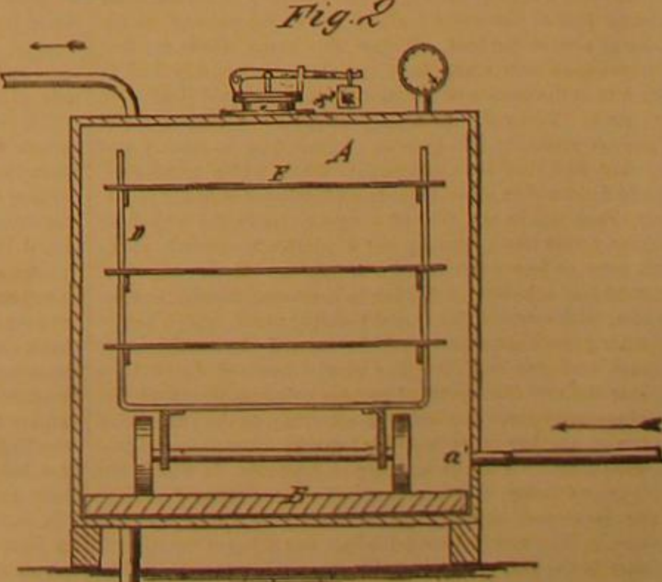


Fig. 2



PHILIPS' APPARATUS FOR CURING TOBACCO

chamber, B, into the cylinder. At such time the foot valve, B', is held closed by reason of the pressure in the chamber, B, being superior to the atmospheric pressure without. But the instant the piston begins to descend again, so that the valve, J, closes, the water at once rushes past the foot valve and into the chamber, B, with great force, thus compressing the air as before. In this respect the action is similar to what takes place in a hydraulic ram. When water enters the cylinder, E, a jet is forced through tube, N, above the piston. The steam valve, U, is held open while steam is to be admitted by the pressure of steam under it, but is closed by atmospheric pressure as soon as it is allowed to descend by the forming of the vacuum under it, the action being gentle, so as to prevent hammering the seat by the valve. The arrangement of the cylinder, E, and head, G, with its valves or equivalent, effects separation of the steam and water until the time of exhaust, and secures at all times a hot steam cylinder, in which the water to be pumped has no access either to space or surface.

This machine may be used as a condensing steam engine, it being only necessary to connect a piston rod with the head, allowing it to take in only sufficient water for condensation purposes. The invention was patented through the Scientific American Patent Agency, September 19, 1876, by Mr. E. G. Shortt, of Carthage, N. Y.

THE ARMY WORM: ITS NATURAL HISTORY COMPLETE

BY PROFESSOR C. V. RILEY.

The substance of some experiments of mine made during the year, on the biology of the army worm, was laid before the American Association for the Advancement of Science at its late meeting, and is here repeated in popular form.

The army worm is one of the most destructive insects to North American agriculture. At irregular intervals it sweeps through the meadows and grain fields about the time that wheat is beginning to ripen, often rendering them un fit for the mower or harvest machine. It proves injurious from Maine to Texas, and from the Atlantic to the 100th meridian; and though the same species, or geographical races of it, occur in other parts of the world, it is not known to be anywhere else so injurious. It is the larva of *leucania unipuncta*, Haw, a moth with buff-colored wings, and characterized chiefly by having a conspicuous white speck on the disk of the primaries. Up to the year 1861 its parentage was unknown; and it is a singular fact that, notwithstanding the great abundance in which the insect occurs all over the country indicated during certain years, the nature of the eggs, and the time, place, and mode of disposition, remained unknown up to the present year. Two trains of circumstances serve to explain this fact. The one is that, during great army worm years, when the species most attracts at-

Army worm moth.—*a*, male moth; *b*, abdomen of the male—natural size; *c*, eye; *d*, base of male antenna; *e*, base of female antenna—enlarged.

tention, the worms are so followed by parasitic and predaceous insects, and so persecuted and destroyed by other animals, man included, that comparatively few of them survive long enough to produce the moth. The other is that, in seasons when the insect does not abound, no one thinks of looking for the eggs.

The time and place of oviposition in this species is quite important from the economic standpoint. Structure is a reliable index to habit; and anatomical study of the structure of the ovipositor, made last winter, convinced me that there was a third and more important reason why the eggs remained undiscovered, namely, that they are secreted. With this clue, I have in the present year been able to solve the mystery, and to prove the correctness of the conclusions arrived at from structural study. The eggs are, indeed, thrust in between the sheath and stalk of well grown grasses, whether cut or standing, or occasionally in between the natural fold of the green leaf, or the unnatural curl at the sides of a withered leaf. On low blue grass, where my first observations were made, they are almost invariably laid in the fold at the base and junction of the terminal leaf with the stalk. The moth invariably endeavors to secrete them. They are generally laid in rows of from five to twenty and upward, and they are accompanied with a white, glistening, viscid fluid which glues them to each other and to the plant; and, when laid in the fold of a spear, draws the two sides securely over them, leaving but a glistening streak along the more or less perfectly closed edges. Each egg, when first laid, is spherical, 0·02 inch in diameter, smooth, opaque white, with a very delicate and yielding shell, which before hatching becomes faintly iridescent, and shows the more sordid embryon within. The newly hatched larva is a looper, the two front pairs of prolegs being so atrophied that it necessarily loops the body in crawling, as the full grown larvæ of another large family of moths—the *geometridæ*—normally do. A large number of noctuids, in which the full grown larvæ have the normal complement of prolegs fully developed, exhibit this peculiarity in the early larval stages. The newly hatched army worm bears no resemblance to the full grown individual and is so small, and so much of a color with the pale base of a grass blade, that it would scarcely be noticed even where occurring in hundreds to the square foot. It developes very rapidly, going through five molts, and attaining full growth in from two to three weeks.

There is one other mooted question in the natural history of the army worm which I have been able this summer to settle, namely, whether the species is single or double brooded. In a review of the matter in my eighth report, I came to the conclusion that, in the more Northern States at least, or over the larger portion of the country in which it proves injurious, it is but single-brooded, and I am still of the opinion that such is the case. But I have proved that, like so many other species which are single brooded further north, it is frequently, if not always, double-brooded in the latitude of St. Louis. By carefully feeding the moths reared from my first larvæ with sweetened water, and supplying them with grass in spacious vivaria, I succeeded in obtaining eggs from them. These eggs in due time hatched, and the second brood of worms gave me the moths again early in August. The worms were generally paler than those of the first brood; and being the second generation, reared in confinement, they were less healthy. I obtained, in consequence, but five moths, all of them unfortunately females. One of these escaped, three died without showing any development of the ovaries, while the fifth died with the ovaries so well developed that the eggs, in a state of nature, would probably have been laid within a week. It is very clear, from the above recorded facts, that the eggs of this insect do not as a rule, if at all, pass the winter at the foot of grass stalks, as was heretofore surmised. Nevertheless, the burning over of meadows and grain stubble in winter will act as a preventive of army worm injuries, for the reasons that the moth lays very early in spring, that she prefers the full grown sheath and stalk, even when dry, to the young green spears, and that she cannot well lay her eggs, for want of support, where the grass is yet sparse and thin, as it is when first starting in a burnt meadow.

Chrysalis of army worm.

Full grown army worm

In my own experiments, the females, in secreting their eggs, showed a preference for old hay over fresh and growing grass. Finally, without entering into further details, I give the following as a revised summary of the natural history of the army worm:

The insect is with us every year. In ordinary seasons, when it is not excessively numerous, it is seldom noticed: 1, because the moths are low, swift flyers, and nocturnal in habit; 2, because the worms, when young, have protective coloring, and, when mature, hide during the day at the base of meadows. In years of great abundance the worms are generally unnoticed during early life, and attract attention only when, from crowding too much on each other, or from having exhausted the food supply in the fields in which they hatched, they are forced, from necessity, to migrate to fresh pastures in great bodies. The earliest attain full growth and commence to travel in armies, and to devastate our fields, and to attract attention, about the time that winter wheat is in the milk—this period being two months later in

Army worm moth: *a*, end of abdomen denuded and showing ovipositor at rest; *b*, same with ovipositor fully extended; *e*, *f*, retractile subjoints; *h*, eggs—all enlarged; *g*, eggs, natural size.

Maine than in Southern Missouri; and they soon afterwards descend into the ground, and thus suddenly disappear, to issue again two or three weeks later as moths. In the latitude of St. Louis the bulk of these moths lay eggs, from which are produced a second generation of worms, which became moths again late in July or early in August. Further north there is but one generation annually. The moths hibernate and oviposit soon after vegetation starts in spring. The eggs are inserted between the sheath and stalk, or secreted in the folds of a blade; and mature and perennial grasses are preferred for this purpose. The worms abound in wet springs preceded by one or more very dry years. They are preyed upon by numerous enemies, which so effectually check their increase, whenever they unusually abound, that the second brood, where it occurs, is seldom noticed; and two great army worm years have never followed each other, and are not likely to do so. They may be prevented from invading a field by judicious ditching; and the burning over of a field, in winter or early spring, effectually prevents their hatching in such field.

It is thus that questions which have caused discussion for years, and given rise to various theories, are settled, and circumstances that seemed wonderful and difficult to account for are explained by a few careful observations and experiments.

St. Louis Mo.

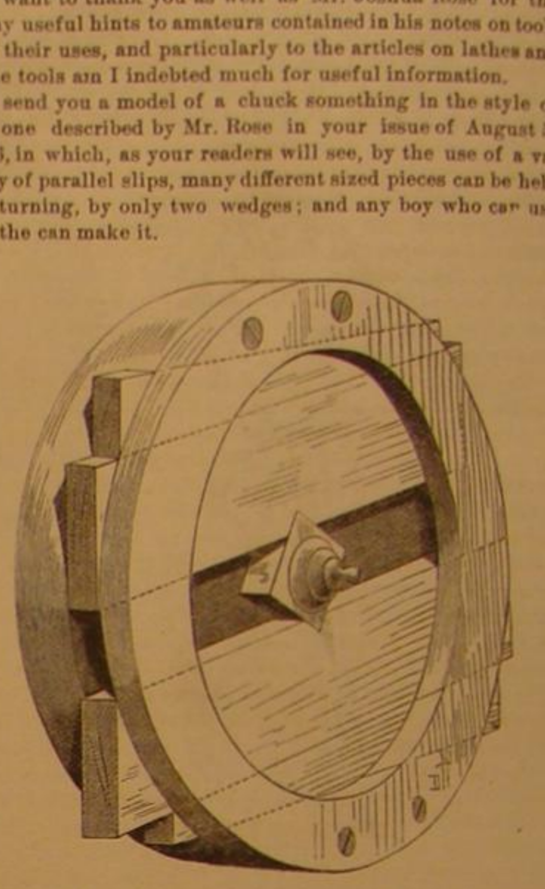
Correspondence.

A Handy Form of Chuck.

To the Editor of the Scientific American:

I want to thank you as well as Mr. Joshua Rose for the many useful hints to amateurs contained in his notes on tools and their uses, and particularly to the articles on lathes and lathe tools am I indebted much for useful information.

I send you a model of a chuck something in the style of the one described by Mr. Rose in your issue of August 5, 1876, in which, as your readers will see, by the use of a variety of parallel slips, many different sized pieces can be held for turning, by only two wedges; and any boy who can use a lathe can make it.



I would advise all amateurs to have a tap to match the screw on the mandrel; and also a small piece of hard, close-grained wood, tapped to fit, the hole being bored with the grain, and then screwed on to the mandrel, and there turned with slight taper from left to right. A small shoulder or flange should be turned on the left hand end, so that, when screwed on, it fits up close. Then turn a piece of good soft dry pine board, as large as will swing, 1½ to 2 inches thick, and turn a hole in the center to exactly fit the piece of hard wood in which you have cut the thread; put these together with good glue; when the glue is dry, turn the face and edge, and you have a chuck or face plate, which (being of soft wood) can be easily turned out so as to hold any block that is less in diameter. When this face plate is used up, it can easily be renewed on the same piece of hard wood in which the screw is cut. Dogwood is perhaps the best of the common woods in which to cut a thread; it is cheap, and to be found in almost any yard where firewood is sold. I have some of these wooden chucks, the threads being cut across the grain, which have been in use in my chuck for years; and they are as good as new. I prefer a wooden face plate, made as above described, to screwing a board on to an iron face plate, because the screws give in the wood, and they do not remain true. AMATEUR.

Philadelphia, Pa.

The Ratio of the Diameter of a Circle to its Circumference.

To the Editor of the Scientific American:

It is not easy to realize the comparative minuteness of the difference between the figures 3·1416 and 3·14159, unless we reduce them to some familiar standard, say to some fraction of an inch. The former of these numbers is too large and the latter too small, the true figure being at some unknown point between them, but about three times as near the latter as the former. The difference between these numbers is 0 00001; and with regard to a 12 inch circle, it would represent 0·00012 of an inch. Every mechanic using a minutely divided steel scale is familiar with the appearance of $\frac{1}{100}$ of an inch; and he may, by an effort, be able to imagine the minuteness of $\frac{1}{100}$ part of one of these one hundredths, $1\frac{1}{5}$ of which latter subdivisions constitutes the 0 00012 part of an inch. But this small fraction is the sum of the two errors contained by the numbers 3·1416 and 3·14159, said errors being respectively only about $\frac{9}{10}$ and $\frac{3}{10}$ of a subdivision for those numbers. Now two lines over three feet long, differing in length only by 0·012 parts of a $\frac{1}{100}$ of an inch, have practically the same length; and slight as is this difference, the circumference of a 12 inch circle, if straightened out, would be longer than one and shorter than the other, that is, it would differ from either one by less than the amount by which they differ from each other. If a microscope having a power of 200 diameters were brought to bear upon these minute portions of an inch, the former (0·3 inch etc.) would appear less than a $\frac{1}{50}$ on the scale, while the latter ($\frac{3}{10}$, etc.) would have an apparent breadth scarcely exceeding that of one of the division marks; and yet these microscopic amounts constitute respectively the extent of the errors developed by using the above ratios to obtain the circumference of a 12 inch circle.

For other sized circles, these errors increase or diminish in exact proportion to the diameters: for instance, in a circle the size of a locomotive turntable they would be respectively about $\frac{1}{2}$ and $\frac{1}{5}$ of a $\frac{1}{100}$ of an inch. The mechanic realizing these facts is enabled to use the numbers 3 1416 and 3·14159 intelligently, as multipliers for the diameters and with full confidence in their almost absolute truthfulness as applied to circles of moderate size.

Rochester, N. Y. E. B. WHITMORE.

The Earth's Motion.

To the Editor of the Scientific American:

In an article on the "Irregularity of the Earth's Motion," on page 321, current volume, it is mentioned that "smaller changes, some in one direction, others in the other, have taken place, generally lasting about four weeks at a time." Whatever may be the cause of the changes of long duration, there must, of necessity, be a change at every revolution of the moon, since it has long been a well established fact that the earth does not move in a regular orbit around the sun, but in epicycloidal curves, the center of gravity between the earth and moon making the real orbit in which both together revolve. And as this center is outside of the earth, the whole body of the earth must cross the orbit twice in every revolution of the moon, and thus must apparently be constantly varying in the velocity of its motion.

To represent the true path of the earth would require a section of over one hundred feet in length, of an arc of one hundred feet radius, in which arc the earth would be but one tenth of an inch in diameter. But the path of the moon, which is affected in a much greater degree, can be given on a much smaller scale. Thus, if we take a plain wheel of six inches diameter and insert a pin in the center and another at one tenth of an inch from the first, and roll this wheel around the edge of another wheel of seventy-six inches diameter, we will find that, while the center pin describes a circle of eighty inches, the other will describe a curved line like that of the moon. It will thus be seen that it is only the common center of gravity that has a regular motion, while the motion of both the earth and moon must be constantly varying. J. A. B.

Canton, Mass

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

SECOND SERIES—Number XVI.

PATTERN MAKING.

Our next example is what is called a T, a drawing for which is shown in Fig. 113. It is shown with flanges on the main body, and a hexagon on the branch. Sometimes a flange is employed instead of the hexagon, but this depends

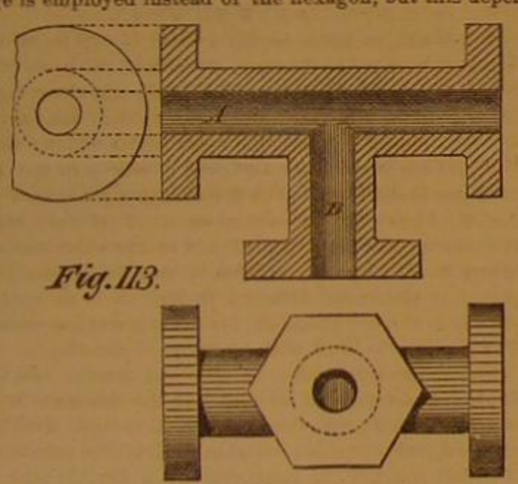


Fig. 113.

upon the connections to which it is to be attached. Patterns of this class are often made so that either round flanges or hexagonal connections may be put on at will; and it is in that style that we propose to make our example. It is apparent that the pattern will be the most easily molded with its body and branch both lying horizontally in the mold, so that, if we suppose the surface of this paper to represent the surface of the mold, the engraving shows just how the pattern will lie in it. It will be advisable, therefore, to make the pattern in halves.

We first prepare the body and flanges, in the same manner as described for the body of our gland, the only difference being that we have, in this case, to fit a flange on each end. The same method is pursued in making the branch, with the exception that we only require a core print on one end, the other end abutting against the body. The first question that arises is how long shall we make the branch; and this depends upon how far the branch follows the curvature of the body. In our example, the branch and body are of the same diameter, and therefore the branch will follow exactly half way around the body. We turn up the branch piece, then, to its requisite diameter, and make its length equal to the diameter to which it should stand out from the body, added to half the diameter of the body. The pieces we have made, then, are those shown in Fig. 114, in which A represents the piece for the body, and B the piece for the branch. Our next proceeding is to cut out the abutting end of the branch to fit to the curvature of the body, and this we perform as follows: We first set the bevel square to an angle of 45° by the process shown in Fig. 109, and then, taking the branch halves apart, and placing the bevel square with its back across the end face of the branch (the blade lying on the joint face of the half branch), we mark the two lines, A B, in Fig. 115, which must meet exactly in the center of the branch and at the extreme end, as shown in Fig. 116. We then pare off the angular piece, C D, down to the lines, A B. If, before we do the paring, however, we give our half branch a quarter turn around, it will appear as shown in Fig. 116; the curved formed by the intersection of the plane surface (just made) with the round surface of the piece is the true curve of the body of the T.

Turning to the other half of the branch, we perform upon it the same operation; and we may then cut away with the

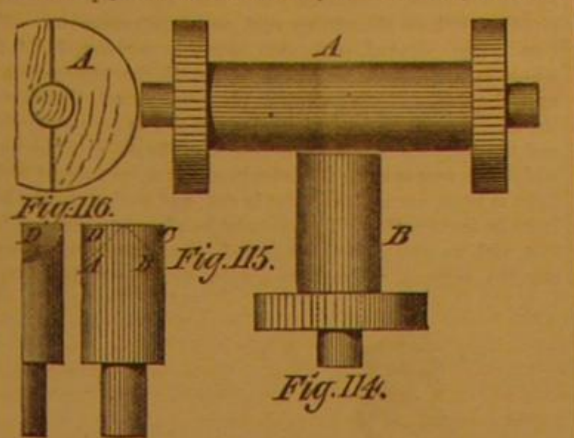


Fig. 116. Fig. 115. Fig. 114.

gouge the intervening timber from between the curve lines. Our two halves will be of the proper curve at the end to fit exactly to the body of the T, as shown in Fig. 117, in which

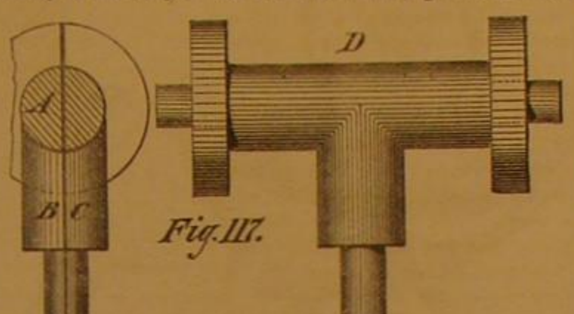


Fig. 117.

A represents a sectional view of the body of the T, and B C are the two halves of the branch; while the view, D, shows the body of the T lying horizontally with the branch attached.

We have now to fasten the branch to the body of the T; and here we must pause to consider whether the pattern is required to serve simply for the production of a few castings, whether it is to be cast aside after the first casting, never to be used again (which is often the case), or whether it is intended for standard or continuous use. For a temporary purpose, a few screws will be sufficient; but for a permanent pattern, a much stronger joint may be made as follows: Brush with hot glue the ends of the branch piece, and let them stand until the glue has been absorbed into the pores of the wood. This is called sizing, and is always necessary in gluing end wood, as it is called, meaning the end grain of wood. The reason that sizing is, in that case, necessary is that the pores of the wood all meet the surface in the end grain, and the sizing is necessary to fill them. We then take a truly planed piece of board, and lay one half of the body down upon it, placing a piece of thin paper between the body and the board so that any glue that may run out may not touch the board: otherwise it may glue the work so fast to the board that, in parting them, some of the fibers of the wood may get torn out. Then we fasten temporarily the half body to the board, and lay one half of the branch with its flat surface on the same board, and glue it to its place, drawing it well up to the body piece with dogs or clamps, at the same time observing that it is close down to the board, and fixing it temporarily there, as shown in Fig. 118, and allowing it to remain until the glue is dry. In put-

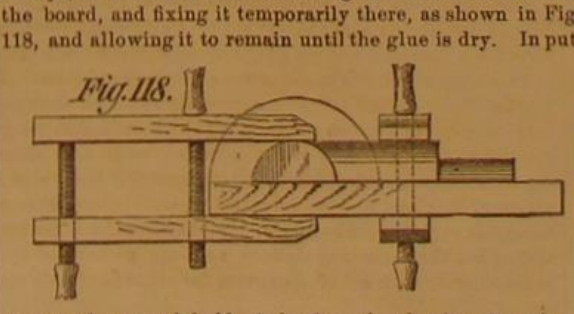


Fig. 118.

ting on the second half of the branch, the board need not be used, since the first half, already in position, will serve as a guide. A piece of paper must, however, be placed between the two halves of the branch to prevent them from adhering together. When all is dry, put a strong screw in the position denoted at A, in Fig. 119, cut out a recess on the flat face of each half, and let in a piece of hard wood, as shown by the dotted lines in the same figure.

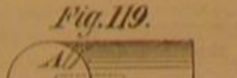


Fig. 119.

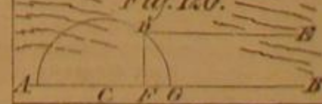


Fig. 120.

Let us now suppose that, in our example, the diameter of the branch had been smaller than that of the body of the T. In that case we must first ascertain its proper length by the process illustrated in Fig. 120, which represents a piece of board, upon which we strike the line, A B; and from the point, C, we mark the semicircle, D, which must be of the same radius as the body of the pattern. Then, parallel with the line, A B, we draw the line, D E, the distance between these two lines being equal to half the diameter of the branch of the pattern. Then from the junction of the line, D E, with the semicircle, D, we strike the line, D F, at a right angle to A D; and then from F to G, added to the distance which the branch requires to stand out from the edge of the body, is the length we require to make the branch.

To draw the curve on this branch so as to cut it out to fit the body, we proceed as follows: Fig. 121 represents the application of a peculiar trammel designed for this and similar purposes. It enables the operator to strike a true circle upon a round or uneven surface. It is composed of the

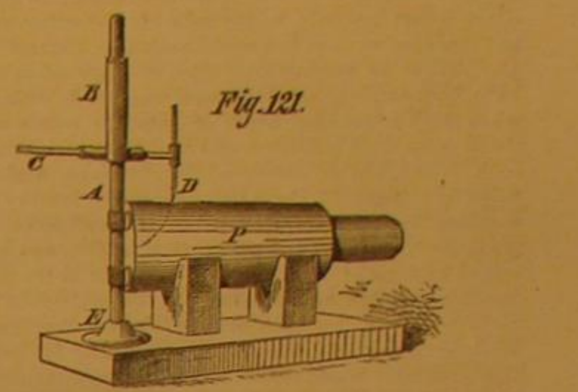


Fig. 121.

turned bar or rod of metal, A, of about half an inch diameter, and upon it slides the piece of brass tube, B, upon which is contrived a support for the sliding arm, C, as well as a set screw for fastening the arm, C, in any desired position. At the end of the arm, C, is placed an arrangement for fastening the scriber, D, so that we may set the scriber at any requisite distance from the rod, A, by adjusting and fastening the arm, C, and revolve it about while lifting or lowering it upon the rod, A. When properly made, this is a most useful tool; and if not in use, it may be taken apart in an instant, and it occupies but very little room in a tool box. If the stand, E, pierced with holes for screwing down, is provided, it will be a very useful addition, but it may be dispensed with; whereas the tool proper, or some improvised substitute for it, is absolutely necessary, for the curve must be struck somehow. If the pipe or branch is large, say even six inches in diameter, to attempt to fit it by guessing and trying is the work of a novice and not of a workman. To apply this tool to our branch, we proceed as follows: Taking a planed board, we gage a line upon it; and at a point on this line, we describe a circle upon it of the size of the foot of the instrument. We then make two V blocks, such as shown in Fig. 122, to carry the branch. We then place

Fig. 122.

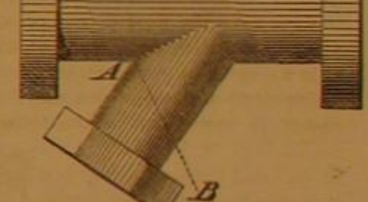


Fig. 123.

these V blocks with the apex of the V exactly over the gaged line, and place the branch in the Vs. We then set the point of the scriber at a distance from the rod of the trammel equal to the diameter of the branch, which may be readily done if the size of the rod be known. We next mark upon the top of the branch, as it lays in the Vs (with the joint of the two halves standing vertically), the distance it requires to be cut out to form the curve, which distance will correspond to the distance of F G, in Fig. 120. We then draw the branch forward until this mark falls exactly under the scriber, keeping the joint faces vertical; and this adjustment being made, we fix temporarily the branch to the piece of board whereon it and the Vs rest. Then we move the arm, C, in Fig. 121, a half circle; and letting the point of the scriber contact with the branch, we draw the necessary line. It will be found, however, that it is requisite to mark the lines while lifting the arm to prevent the scriber from digging into the wood. Thus one side of the branch will be marked, and we must then turn it upside down on the Vs, set the joint vertically again, adjust the mark to the scriber point, and proceed as before to mark the other side of the branch. We may then cut out the corners to the lines, which may be most rapidly performed by a band saw, sawing exactly to the line: the branch being held on a board, as it was when being marked. In fact, a piece of wood should be fitted underneath, where the saw cut will come, so as to prevent the fibers of the wood from being torn out at the edge, showing a ragged cut: as it is very apt to do, especially if the band saw is not in first class order.

Should the branch be required to stand obliquely to the body of the pattern, as shown in Fig. 123, it may be struck out in the same manner; but instead of being set square with the rod of the trammel, as in the former case, it must be set at the bevel at which it is to be fixed upon the body of the pattern. When marking one side, the branch must make an angle with the upright equal to the angle at A, in Fig. 123; while, when marking the other side, it must form an angle equal to that at B, in the same figure. It will pay, where two or three pattern makers are employed, to have this marking apparatus always standing ready for use upon a board, with the degrees of angles marked thereon; so that a workman could mark off his job in five minutes, and cut it out with a band saw. Cutting out with a gouge and trying to its place may take four or five hours. It must be borne in mind that too much care cannot be given to striking out the pieces accurately and to sawing them true to the lines. The saw must be sharp and of a width suitable to the curve, and not tremble, or "dither," as band sawyers say. By attending to these matters, a fit may be obtained with a minimum of labor to the workman; and this is desirable in itself and is an item of profit in the cost of the pattern

ANTIQUE GOLD AND SILVER WORK.

It was the custom among rich men in the middle ages to invest a considerable portion of their wealth in gold and silver wares: not only for the sake of possessing valuable and rare specimens of art workmanship, as a means of display, but as an investment. Men of large revenue must have been sorely puzzled to know what to do with money when stock companies, bonds of corporate bodies, and national debts were unknown; and even bankers, as known as such to-day, had no existence, the custom of banking not being introduced till about the seventeenth century. This consideration, probably, furnishes an explanation of the great wealth in gold and silver plate which was possessed by some of the European monarchs in the thirteenth and following centuries. As the goldsmiths became dealers in this form of property, and frequently received it for safe keeping or as security for loans, they gradually became bankers; and many of the oldest banks in London were originated in this way.

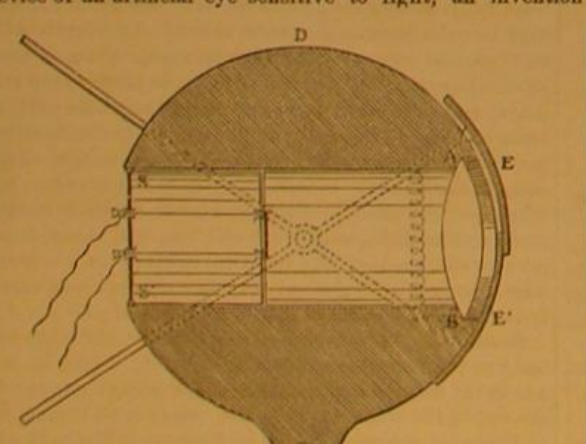
The practice called into existence some of the very greatest artists that the world has ever known. Benvenuto Cellini may justly be called the chief even of the most renowned workers in the precious metals; and the demand for his services spread to all the courts of Europe. His works are very numerous, and the smallest authentic specimen of his handiwork is sure to fetch an enormous price when offered for sale, and to be highly prized by its purchaser, and closely studied by the connoisseur, as well as by the aspirant for fame in the beautiful art of metal working. Cellini founded the *rénaissance* school of design and ornamentation of the precious metals; and his contemporaries and followers extended the influence of the newly revived classical forms, till the goldsmith's art, as we now know it, was formed. The progress since made was studied by tens of thousands of people at the recent Centennial Exhibition; and the magnificent exhibits of Messrs. Elkington & Co., Tiffany & Co., and other firms have well shown the present condition of the craft.

The accompanying engraving delineates a very remarkable salt cellar, being part of a collection of antique plate formed by the late Lord Londesborough. This curious example (the engraving of which we select from the pages of the *Silversmith's Trade Journal*) of the quaint designs of the old metal workers is considered to have been the work of one of the famous Augsburg goldsmiths at the latter part of the sixteenth century. It is a combination of metals, jewels, and rare shells, in a singularly grotesque general design. The salt was placed in the large shell of the rare pecten of the South Seas, which is edged with a silver-gilt rim, chased in floriated ornament and further enriched by garnets; to it is affixed the half-length figure of a lady, whose bosom is formed of the larger orange-colored pecten, upon which is fixed a garnet, to represent a brooch; a crystal forms the caul of the head dress, another is placed below the waist. The large shell is supported by the tail of the whale on one side, and on the other by the serpent which twists around it; in this reptile's head a turquoise is set, the the eyes are formed of garnets, and the tongue of red onyx. The whole is of silver-gilt, and within the mouth is a small figure of Jonah, whose adventure is thus strangely mixed with the general design. The sea is quaintly indicated by the circular base, chased with figures of sea monsters disporting in the waves. It would not be easy to select a more characteristic specimen of antique table plate.

AN ANTIQUE SALTCELLAR.

SIEMENS' SENSITIVE ARTIFICIAL EYE.

We have already alluded to Dr. William Siemens' curious device of an artificial eye sensitive to light, an invention



based upon the action of light upon the electric conductivity of selenium. The construction of the eye is shown in the annexed engraving.

A hollow sphere, suitably supported, is provided with two openings, in one of which is placed a converging lens, A B, and in the other a selenium plate, S S', the latter in communication with an electric current and a galvanometer. The lens being covered with two movable screens, E E', the whole is comparable to an eye, in which the screens represent the lids, and the selenium plate the retina. Whenever the screens are removed, the galvanometer is seen to deviate and the degree of deviation depends on the color of the light which converges upon the selenium. It is very slight if the light is blue, more if the light is red, and still more if white light be transmitted. The eye may be placed in communication with an electro-magnet, which may automatically operate the screens, in manner similar to lids. "Here," says Dr. Siemens, "is an artificial eye, sensible to light and to differences in color, which gives signs of fatigue when it is submitted to the prolonged action of light, which regains its strength after resting with closed lids," and which, by an electro-magnet attachment, may be made to close itself, as does the human eye involuntarily, on the occurrence of a vivid flash.

Trade Marks in Great Britain.

Hon. R. H. Duell, Commissioner of Patents, has received a communication from the Commissioner of Patents of Great Britain, informing him that by act of Parliament foreigners have been accorded the privilege of registering trade marks in that country on the same terms as British subjects. The United States Patent Office has recently declined to register trade marks for British subjects for the reason that no provision had been made by treaty or act of Parliament extending the reciprocal privilege to our citizens; but in view of the action of England now communicated, our Patent Office will hereafter register trade marks for them on the same terms and under the same regulations as those prescribed by it, in accordance with act of Congress for citizens of this country.

The letter from the London Patent Office calls especial attention to the fact that prior registration in the country of which a foreign trade mark owner is a subject is not necessary before registration in Great Britain; but in case a trade mark has been used before the date of enactment of the new law (which date is not, however, stated in this communication) it will be necessary in the application for registry that a description of the goods in respect of which it has been used, and the length of time during which it has been so used, be given.

New Remedy for Boiler Scale.

Zinc has been shown to be an excellent anti-corrosive in those cases where decomposed grease or fatty acid is the destroying agent of boiler metal; but its usefulness is mainly confined to boilers in which sea water is not used. Filtering the feed is an excellent precaution and should be universally adopted. To prevent the corrosive action in marine boilers, of substances which no filtering can arrest, Mr. Rowan, in a paper recently read before the British Association, proposes forming on the interior surfaces of the boiler, an artificial coating of calcium sulphate and magnesium hydrate, in proportions varying with the pressure carried by the boiler. It is claimed that, when once hardened by heat, the artificial scale thus made with fresh water cannot be dissolved by fresh water, and is not likely to be affected by the small quantity of sea water which may leak in: that its thickness is quite under control, and that it is free from the trouble attending the keeping up of a salt scale.

Sawing Granite.

Among the interesting things that were shown to the architects in Philadelphia, during their convention, was the patented process of Messrs. Struthers & Sons, for sawing granite. Hitherto it has been found impracticable to cut granite with a saw, since the ordinary sand process would cut only an inch and a half or two inches per day. The inventor of the Messrs. Struthers' process hit upon the idea of using chilled iron, finely divided, instead of sand. A jet of steam is directed upon a fine stream of melted iron, and blows it into spray, just as in the common atomizer a jet of air pulverizes, so to speak, the stream of liquid upon which is turned. The iron, divided into fine globules of, say, a fortieth or a fiftieth of an inch in diameter, falls into cold water, and is chilled into excessive hardness. It is used under a saw of soft iron, and with a stream of water, as sand is used in sawing marble. Most persons would have supposed that the scratching of angular grains of sand would be more efficient than the rolling friction of globules of iron; but it would seem that the sand is speedily crushed into dust, while the tough iron, simply wearing down into smaller and smaller globules, crushes its way through the felspathic and other crystals of the granite (which with us is usually sienite, by the way, and not granite). The rolling of the globules is curiously shown by fine channelings or flutings, which score the under edge of the saw from end to end. By this device granite can be sawn at the rate of three or four inches per hour, and at small expense: the waste of the iron being about three pounds for every square foot of kerf, or two square feet of sawn surface. For small blocks, where a saw can be used that is short enough and therefore stiff enough to bear a heavy pressure without buckling, it is found possible to cut at the rate of twelve or fourteen inches per hour. The surface obtained by sawing is vastly better prepared for polishing than a hammered surface, not only because it is smoother, but because by hammering the surface of the stone is "stunned," as it is termed: that is, the crystals are so bruised and shattered below the surface that it is necessary, before the polishing can begin, to grind away an eighth of an inch or more, which is unnecessary with a sawn surface.—*American Architect and Building News.*

A NEW BLOWPIPE.

We illustrate herewith a novel blowpipe, which consists of a fire chamber, connected with an air-forcing apparatus, and provided with nozzles of various forms for directing one or more jets of heat and flame. The object is to provide a portable blowpipe, the flame of which will have sufficient power to heat objects of considerable size. The fire chamber consists of a cylinder, B, of iron, having conical ends. To one of these ends the blast pipe, C, is attached; and to the other a nozzle, D, is attached by screws, so that it may be removed and replaced by nozzles of different forms. E is an aperture in the top of the fire chamber, for the introduction of coal, etc. The chamber is lined with a coating of fire clay.

Fig. 2 represents a flat or elliptical nozzle, and Fig. 3 a double nozzle, capable of directing the flame on both sides of an object. In use, the chamber, A, is filled with burning charcoal, coke, or other suitable combustible substance, and the blast pipe, C, is connected by a flexible pipe with a blower or bellows. A blast being created, a jet of flame and heated gases issues from the nozzle, D, which is directed against the object to be operated on. The heat generated in this manner is said to be so intense that heavy irons, like the frame or braces of a locomotive or other large objects, may be heated in their places and bent. With a nozzle having several jets arranged in an arc, the tire of a locomotive wheel

Fig. 1.

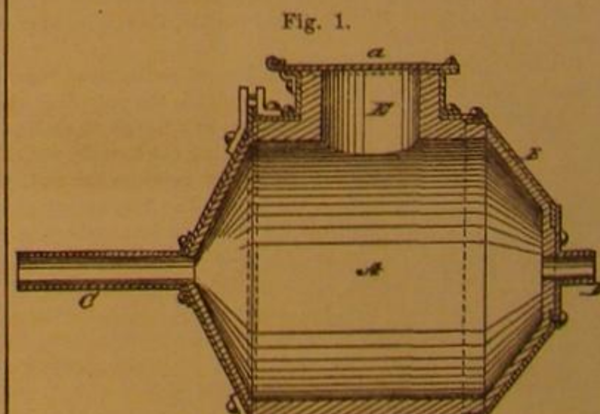


Fig. 2.

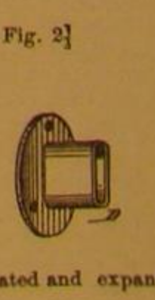
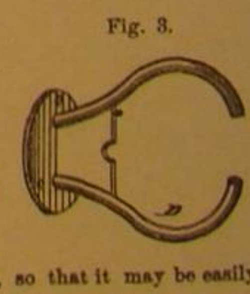


Fig. 3.



may be heated and expanded, so that it may be easily removed.

The apparatus is the invention of Messrs. O. G. Dodge and William Gushurst, of Omaha, Neb., and was patented through the Scientific American Patent Agency, September 26, 1876.

ACHMEA PANICULATA.

The *achmea paniculata*, represented in the fine engraving herewith (which we extract from *La Nature*), belongs to the *bromeliaceæ*, a small family of endogenous plants, which includes the pineapple, and is quite nearly related to the canna, ginger, and banana families. The plants are usually stemless, scarcely woody, and nearly all tropical. They are mostly epiphytes in the forests of Central and South America, growing in trunks of trees (though they are by no means parasites) and in clefts in rocks. The leaves are dry or fleshy and channeled, sheathing at the base, and usually covered with scurf. The flowers are hermaphrodite and regular, and are crowded on the stalk, which grows to a hight of two or three feet. Each flower consists of three outer divisions or calices, and three inner, much longer, with petal-like divisions all attached to the inferior three-celled ovary. Each flower is likewise placed in the axil of a bract, the upper bracts, which are without flowers, developing at the top of the stem as a group of small leaves, ending in a point or spur.

The six-cleft perianth is the distinguishing feature of the family to which the *achmea* belongs, and thus curiously enough allies to the wholly dissimilar appearing *Tillandsia* or long gray moss, so common in our Southern States.

ACHMEA PANICULATA.

Knowledge Made Useful.

In a recent address to the students of the School of Pharmacy, London, by Mr. Barnard S. Proctor, he illustrated as follows the idea that not only must the mind have received an ample store of useful facts, but all those faculties must also have received a large development before one can be regarded as in any complete sense well educated and intelligent. "To make a carpenter you want wood and tools, and skill to use them. So to make a learned man you should have knowledge of facts and laws, and power to use them. Probably many of you are not aware how imperfectly you exercise these faculties upon facts or circumstances which are presented to you. I will take an illustration. Suppose I write down in a vertical column two series of units 0, 1, 2, 3, etc., up to 9, thus:

0	9
1	8
2	7
3	6
4	5
5	4
6	3
7	2
8	1
9	0

"Some would be noticed by all of you if you regarded the figures long enough, but you would not all observe them equally soon; it would depend upon the innate faculty and the degree of educational development of the individual. The first thing you would notice is that the double column represents the nine column in the multiplication table; next you might notice that, if we place a *plus* mark (+) between these two columns, and an equal mark after them, we should obtain a third column all nines, thus: $0+9=9$, and the same with all the others down to $9+0=9$. Next, if you draw diagonal lines from the 0 to the 8, and from the 9 to the 1, and so on, you will see that the products are all eights one way and all tens the other. In making these observations we should not say you had discovered a law, though we might say you had detected a rule applying to the arrangement, and you would naturally say: 'Where there's a rule there's a reason." And in the search for the reason you exercise the higher faculties of the mind. You do not continue your observations upon these figures alone; you commence considering, speculating, and testing speculation with experiment. You may extend the column upwards and downwards, and find nine times nine tenths is 8·1, and nine times eight tenths is 7·2. So the remainder, the sum of the two figures continues to be nine. You may then carry your extension downwards, and find nine times eleven are ninety-nine, the sum of which two figures is not nine but eighteen. Then nine times twelve equal 108, in which case the sum of the three numbers gives us nine, as also is the case with the following numbers: 117 and 126, etc. You will observe the hitch at eleven times nine in the sum taken horizontally, and that there is no hitch in the sums taken by the right hand diagonal, and three hitches in the left hand diagonal. This will lead you to observe that in stepping from decimals into units the rate of progression is altered, and that it is not altered in passing from units to tens, because we take in the teens between ten and twenty."

Indian Manufactures.

According to the English papers, a great change is coming over India in the matter of manufactures. The old indigenous industries are in many places dying out, first through the competition of English looms, and latterly through the introduction of machinery into India itself. The delicate-handed natives, however, conform to the altered circumstances, and show a great readiness and aptitude for mechanical work. In jute, cotton, and sugar factories they find employment by thousands; but the traditional excellence of their work has not yet in all places succumbed to the invasion of steam, for in Orissa and in Patna the hand loom still holds its own; and the muslin (the finest in the world, of which fabulous tales are related in connection with the most charming of princesses), though very costly, is even now to be obtained from the weavers of Dacca.

A Substitute for Ivory Billiard Balls.

Probably the best known substitute for ivory billiard balls is the celluloid composition made by the Albany (N. Y.) Billiard Ball Company. There has been no material yet discovered that equals ivory for this purpose, but the latter is expensive; and the production of large tusks, which are required for full sized balls, is growing gradually less, so that increasing necessity exists for a substitute which possesses the requisite weight and elasticity. The celluloid balls cost about 25 per cent less than ivory at the present price, and are a fair substitute for the latter; but it would seem as if some of our ingenious inventors might discover a new material or improve on the present artificial substance. A billiard table manufacturer in this city writes to us "that if any man can invent a perfect substitute for ivory, his fortune is made." We have no doubt of the correctness of the last assertion, notwithstanding the absurd statement of some of the foreign journals that billiard balls are now made of ebonite, by a firm in Berlin, superior to ivory. We quote:

"Ivory balls are objectionable, on the score that they are not of equal density throughout, and that by falling on a hard substance they are easily broken; further, it is frequently necessary to color the ball afresh, as any deep penetration of the color produced in the ivory would affect its quality, and give rise to more frequent fractures. The center of gravity of the ebonite ball lies exactly in the middle, as the material is perfectly homogeneous. The hardness of these balls is such that they may be thrown with all one's force against a granite plate without being injured, and they have also great elasticity, springing to a hight of 60 or 90 feet. The price of the balls (notwithstanding their superior qualities) is about one third less than that of the ivory balls."

It might be worth while to test balls of glass, hardened by the Bastie process, as substitutes for ivory.

Cryolite and its Uses.

Cryolite was discovered toward the end of the last century in a bay in Arksut Fiord, West Greenland, where it constitutes a large bed or vein in the gneiss, of about 300 feet in length and 80 feet in thickness. The name is derived from two Greek words meaning "ice" and "stone," and is applied because of the fusibility of the mineral in the flame of a candle. It was supposed to be sulphate of barytes until examined by Abildgaard, who found it to contain fluoric acid. Subsequently Klaproth detected soda in its composition. It was not, however, until 1850, when Jules Thomson discovered that the mineral could be easily decomposed either by the dry or wet way with lime and the calcareous salts, that it came into industrial use. In appearance cryolite is snow white, partially transparent, of vitreous luster and brittle texture. Its hardness is 2·5, specific gravity 3; and it cleaves in three directions, two of which are rectangular.

From cryolite, aluminum, alum, caustic soda, and glass of a peculiar quality are obtained. About 6,000 tuns of the mineral are yearly brought to this country for soda manufacture. The glass is produced in Philadelphia under the name of "hot cast porcelain," and, when made of pure cryolite, is milky white in hue and slightly transparent. Impure cryolite yields an opaque glass closely resembling marble. The mixture for milky glass consists of oxide of zinc 1 part, cryolite 4 parts, and sand 10 parts. This is melted in pipe clay pots, which are not attacked by the fluo-silicic acid disengaged. The glass is very hard, remarkably solid, and is not attacked by strong acids even when pulverized. These properties are doubtless due to the presence of undecomposed cryolite. With a small quantity of the mineral, the glass is brilliant and refracts light strongly; with a greater quantity it becomes opalescent, and finally, on more cryolite being added, the glass turns opaque and closely resembles porcelain.

A New Weapon of War.

According to the San Francisco *Chronicle*, another terrible instrument of war has been invented, by a resident of that city. The new gun, patented by Leonard and De Vry, and christened "Peace Conservator," was exhibited at the Pacific Iron Works. The prompt action of the instrument, delivering seventy shots in four seconds, and ten hundred and fifty shots in one minute, through a thick oak barricade, proves that it is one of the most terrible death-dealing inventions ever known. The machinery is simple and easily worked, requiring but few attendants, who are perfectly protected from their adversaries' bullets; and it can be transported with much greater ease than an ordinary six-pounder. The bullets from this terrible machine will, it is claimed, diverge 300 feet in 1,000 yards—the distance claimed at which it will effectually deliver shots—and the gun can be easily worked by one person in any direction, or made to shoot almost solid.

HALL'S *Journal of Health* advises over stout people not to seek to reduce flesh by drinking vinegar or smoking, but to maintain as perfect a digestion as possible and avoid fat-making foods, such as starch in the shape of potatoes, flour bread, and rice. Spirits, malt liquors, and sweets are to be abjured. The gluten of wheat is the best food. It will sustain life in full vigor, but it will not add an ounce of fat to the body.

HOUSE BUILDING.

Bricks, girders, various types of masonry, metallic laths, and chimney-cowls, subjects all connected with house building, are illustrated in the accompanying engravings, which we select from Knight's "Mechanical Dictionary."*

HOLLOW BRICKS

are made for purposes of warming, ventilating, and removing moisture from walls.

Fig. 1.

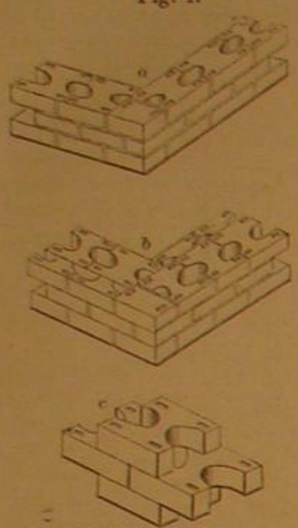
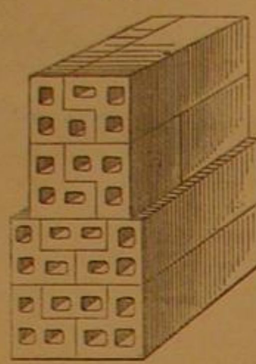


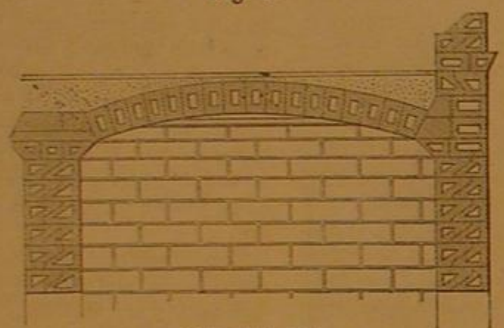
Fig. 2.



Ventilating Bricks. *Hollow Bricks.*

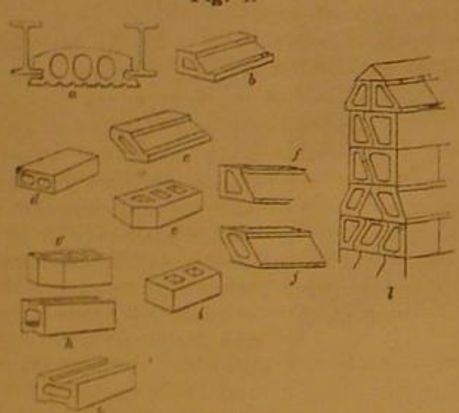
In some cases the hollows form flues or shafts, either for ventilation or for the discharge of dust from upper stories; in others the orifices form air chambers, the imprisoned air being a very poor conductor of heat. At *a*, Fig. 1, is represented a 9-inch wall of hollow brick finished with solid brick at the angle; *b* shows a 14-inch wall, a half ventilating brick being used alternately in the courses; *c* shows the relation to each other of the ventilating spaces, so as to render the openings continuous. Figs. 2 and 3 represent the construction adopted in Prince Albert's model houses. It is stated that there is an advantage of 29 per cent in favor of the hollow bricks over the ordinary bricks, in addition to a considerable diminution in the cost of carriage and transport, and a saving of 25 per cent in mortar and labor. In Fig. 4, *a* is a hollow brick for ceilings, having lips which rest on the lower flanges of the girders. The bricks indicated by letters, *b* to *k*, are external and internal, quoin, jamb, and splay bricks. Fig. 5 shows

Fig. 3.



Hollow-Brick Arch.

Fig. 4.

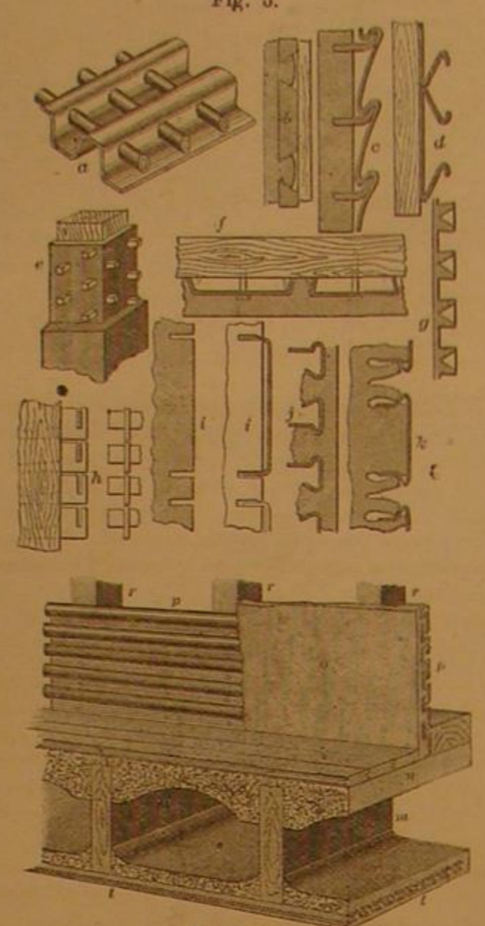


Hollow Bricks.

METALLIC LATHS

for wooden or iron partitions which are very much in use for fireproof and partially fireproof buildings. *a* has a corrugated plate and transverse rods; behind the latter the plaster makes its lock. *b* has plates with dovetail holes in which the plaster fastens. At *c* are corrugated plates which catch upon hooks on the studding. The plates at *d* have bent prongs; those at *e* are inverted frustums; those at *f* have flanged corrugated edges. At *g* there are sheets with projecting studs of frustral form; at *h*, iron slats, which are held by slotted iron plates driven into the studding. At *i* is shown a form in which the edges of bent slips enter slots in the studding; at *j*, bent strips occupy depressions in the same; *k* has means for pinching the edges of the lath. The lower figure represents a portion of a structure in which the wooden joists and studding are so isolated from each other and protected externally that the wood cannot be readily fired by exposure to flame. *m m* are the wooden joists, *n* protecting bodies of concrete, and *t* the corrugated lath. *o* is the wall plastering, which is spread upon similar metallic lathing on the studding, *r*.

Fig. 5.

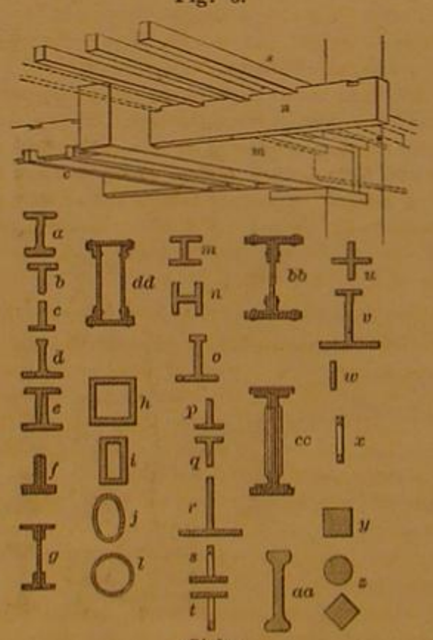


Metallic Lath.

GIRDERS

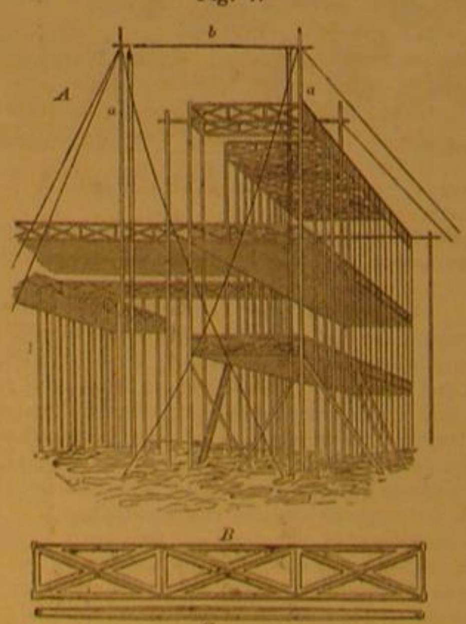
are the principal beams of floors, spanning the distance from wall to wall, and affording a place of attachment for the binders, to which the floor and ceiling joists are applied. In double framed floors the binding joists, *n*, Fig. 6, instead of resting on the walls, rest on the girders, *m*. The bridging joists, *s*, rest on the binding joists, and the ceiling joists are secured beneath the girders. *a* to *l* are forms of wrought iron, and *m* to *z* forms of cast iron, girders. *b b* is a compound I girder. *a a* is rolled in one piece, and *c c* is a compound beam built of several layers of plates riveted together and to angle irons. In Fig. 7, A represents a portion of the framing of the London Crystal Palace, showing the means adopted for getting it into position. This was effected by upright poles, *a a*, connected by a crosspiece, *b*, and steadied by guys. The supporting columns were, by means of tackles, attached to the crosspiece, hoisted into vertical position, and there bolted, after which the girders were raised and secured to the columns. B is an elevation, and C a plan, of one of the cast iron girders. They were 23 feet 3½ inches long and 3 feet deep. Their great comparative strength enabled the columns to resist great lateral thrust, and imparted extreme stiffness to the structure. D is a form of wooden truss employed in the same building. Figs. 8 and 9 are arched girders for bridges.

Fig. 6.



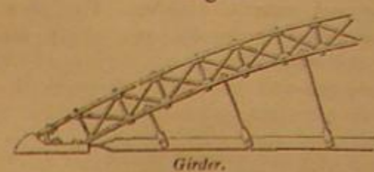
Girders.

Fig. 7.



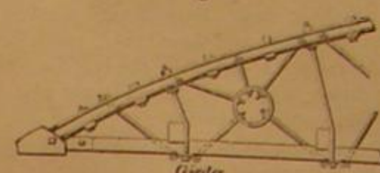
Paxton's Girders (Crystal Palace, London, 1851).

Fig. 8.



Girder.

Fig. 9.



Girder.

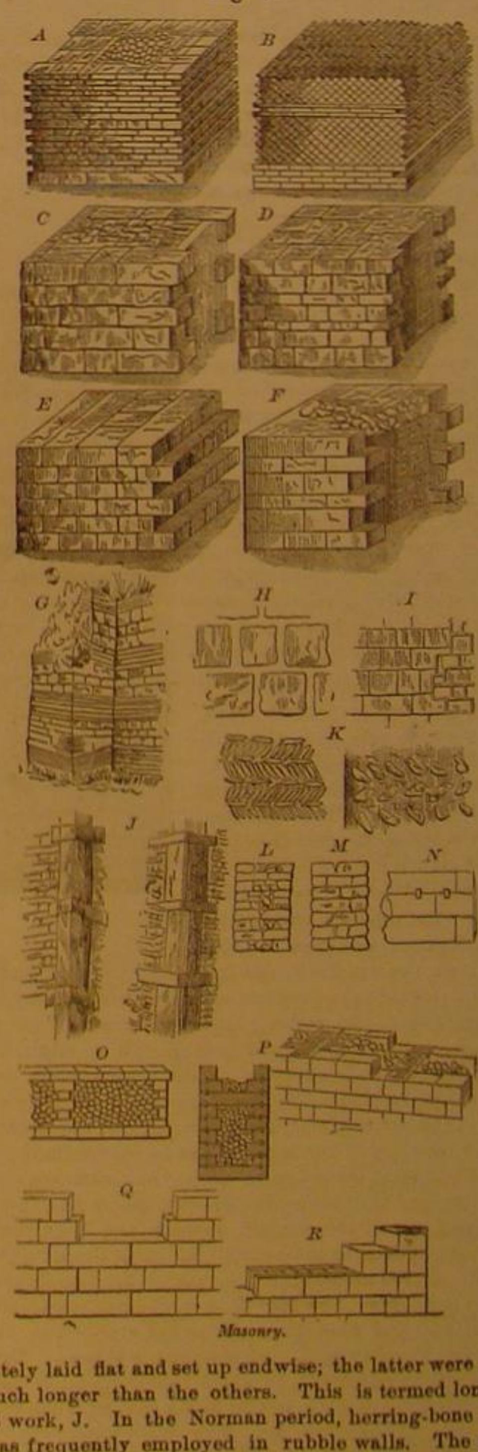
An interesting series of illustrations of ancient and modern

MASONRY

is given in Fig. 10. The Greeks and Romans used several methods for walling, as the *opus incertum*, A, Fig. 10; B, *opus reticulatum*, formed of square stones laid diagonally; C, *isodomon*, in which the courses were of equal hight, D, *pseudisodomon*, in which they were unequal; E, Greek *emplectum*; F, Roman *emplectum*, of coursed work on the outside, the interior being of rubble. In these the stones were small and laid in mortar. Where large stones were used, no mortar was employed. The Roman *emplectum* found in England has sometimes courses of tiles built in, as shown at G. H represents wide-jointed masonry, and I a combination of wide and close joints.

In a few of the earlier English buildings, considered by some to be Saxon, the quoins, the door and window jambs, and occasionally some other parts were formed of stones alternately laid flat and set up endwise; the latter were usually much longer than the others. This is termed long and short work, J. In the Norman period, herring-bone work, K, was frequently employed in rubble walls. The stones used during the Middle Ages were seldom larger than could be lifted by two or three men. The various kinds of masonry employed in modern practice may be divided into three principal classes: Rubble work, L, in which the stones are

Fig. 11.



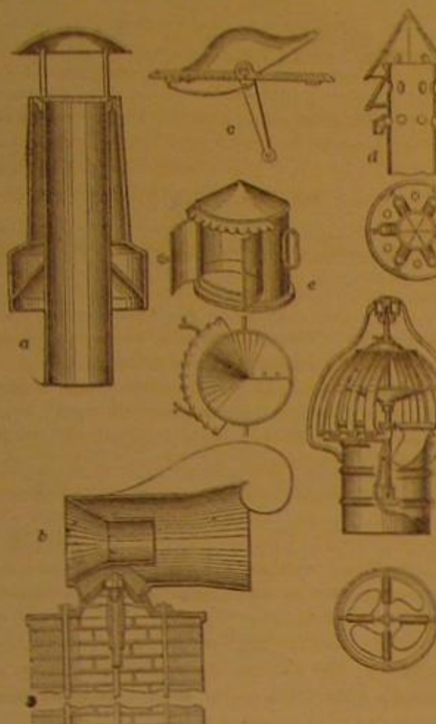
Masonry.

not squared. Coursed work, M, in which the stones are squared more or less and set in courses. Ashlar, N, where each stone is squared and dressed to given dimensions. O is rubble with cut stone plinth, quoins, piers, and coping. P is ashlar facing filled in with rubble. In Q the stones are of equal thickness laid alternately header and stretcher. The length of each stone is double its width. R is a kind of masonry met with in Italy, composed of alternate courses of headers and stretchers.

Fig. 11 represents various forms of

CHIMNEY COWLS.

As shown at *a*, the flue has enveloping side passages which assist the draft by induction. At *b* the spindle of the cowl is stepped in a socket, the collar revolving in flanges upon the upper side of the cap plate. *c* is a cowl for a car roof; its mouth may be adjusted in either direction. *d* has a cir-


Cowls

cular series of openings to encourage upward draft, a deflecting frustrum, and conical cap. *e* is a cover for a marine stovepipe. The side wings are held open by the top shield. In *f* the issuing current of air and smoke is deflected outward by the cone, and, impinging on the obliquely set plates of the fan cap, causes the latter to revolve.

CENTENNIAL NOTES.

The work of removing exhibits is still in progress, visitors are few, straw and packing boxes are everywhere, the screech of the locomotives and the noise of the cars have replaced the music of the chimes and of the band, the storms have beaten down vegetation and converted the neatly kept flower beds into puddles, the fall weather renders the buildings chilly and damp, and altogether there is an air of desolation and faded glory about the Centennial grounds, which, when contrasted with the magnificent scenes presented during September and October, leaves one with a well defined depression of spirit, and a tendency to moralize over the mutability of human undertakings. There is, and probably will be, a dearth of news regarding the future of the Centennial remains until after the sale of the buildings, now close at hand. Then will follow the speedy elimination of State edifices, annexes, etc., and only those structures which are in some wise connected with the projected permanent exposition of art and industry will be left.

Our still well filled note books remind us that the end of the great fair came upon us almost unawares; for we have much that is interesting yet to describe. To those who have seen the Exposition, our notes will serve as useful reminders; to those who have not, the details of the good things exhibited are always of timely interest.

THE FRENCH WOODWORKING MACHINERY

was an admirable display, principally from the works of M. F. Arbey, of Paris. Three machines, which won awards from the judges, are novel in construction. One of these is a planer with helical knives and a permanent sharpening apparatus. The spiral cutters present many advantages over the straight knives, always cutting equally and making the operation of cutting continuous. Very thin knife blades are used, so that but a short time is taken to sharpen them, and this is done with the utmost accuracy by an emery wheel, permanently attached to the machine, which has only to be set and then allowed to run, when it does the work automatically. A stave-cutting machine is exhibited, in which the revolving circular saw (which cuts the stave of any desired lateral curve and of any bevel) is brought up to the stave, instead of the stave being carried to the saw. It is constructed for the special purpose of economy in the use of wood. A lathe for copying sword handles and other small articles of irregular shape is also an ingenious machine. A feeler follows the original, as in a carving machine or pantagraph, and reproduces it by the cutter, which is set in the same relative planes over the stock to be turned or carved. A lathe for turning the legs of tables, etc., also exhibited, does excellent work, and cuts a spiral groove down the body of the leg. All the exhibited machines are marked by beauty of form and solidity, and, in ingenuity of combination, more nearly resemble American machinery (though different therefrom) than any others of foreign production.

THE FRENCH MOTORS.

The Gramme electric machine was used for driving an electric engine, which was exhibited pumping water, being connected with a pump by belting. It has no connection with other machinery, except the copper wire leading to the generator of electricity. As in this double conversion of power into electricity and electricity into power, less power is obtained than is expended, the machine is apparently of no practical value, but is interesting as showing the relations existing between power and electricity.

Mignon & Ronart, Paris, exhibit a domestic motor, which is a steam engine with vertical tubular boiler of novel construction. Steam is generated by a gas flame, automatically regulated according to the requirements of the engine.

Bischof's gas machine reminds one of the German gas machines, which attract considerable attention by their explosions of a mixture of gas and air. The explosion drives up a piston, the descent of which by gravity furnishes the motive power, and prepares the way for a new explosion. Bischof's machine appears to be made on the same principle, and is of $1\frac{1}{2}$ horse power. These machines are made from $\frac{1}{10}$ horse power to 100 horse power. They are said to be noiseless, an advantage which cannot be claimed for the German engines.

Another interesting French exhibit was the novel

SOAP AND CANDLE MAKING MACHINERY.

The blocks of rough soap to be made into toilet soap are first cut into thin shavings in a planing machine, and the shavings are then ground with coloring matter, essential oils, and scents, until they form a homogeneous paste. The machine for grinding contains granite cylinders, which pass the paste automatically between them, and finally into the upper portion of the hopper, so that the services of only one attendant are required for several machines. After the paste has been ground, it passes to a machine called the *peloteuse*, or mixing mill, which stretches and draws it out and prepares it for being molded and stamped. The *peloteuse* does instantly what at one time required several weeks of scraping, washing, and drying. It is a mortar, in which the soap paste is packed until it is freed of air, and from which it is then forced by increase of pressure, passing through draw plates of any required cross section. A self-acting cutter divides the stream of soap into blocks of any desired size or weight, just as cutters on brick machines divide the continuous streams of clay into bricks. The blocks of soap are then taken to a press, which shapes or molds them, and impresses on them the name of the maker. In the candle-making process, a double hot press, with iron cylinder and forty hollow plates, produces from 150 to 165 pounds of stearin in twenty minutes—the time necessary for pressure to be applied. A double horizontal cold press contains 175 loaves, and may be loaded, operated, and unloaded in an hour and a half.

A NOVEL SAFETY APPARATUS FOR BOILERS

consists first of a combination of safety valve and of a float, which, under certain conditions of pressure or water level, acts upon the second part of the apparatus, which is a damper in the draft flue. When the limit of calculated pressure is reached, the clapper rises, the steam fills the apparatus, the whistle sounds, and the piston goes down, carrying with it the damper, which closes the flue. When the pressure has fallen, a counterpoise re-opens the damper. When the water falls below a determined level, the float raises the valve, and the same results follow.

THE FRENCH ENGINEERING EXHIBITS

offered abundant material for study. M. de Lesseps' proposed system of ascending Mont Blanc, by railway, was shown in a sectional drawing of the mountain side and the engineering works. The cars under this system would be run for a short distance on a level, then raised by hydraulic pressure to a new level, and run a short distance to a new station, from which they would be again lifted, and so on, until, ascending the mountain by forty-nine such lifts, they reached the top. The plan, in other words, proposes the building of a series of platforms or steps, up which the cars should be lifted by hydraulic pressure. With the display of patterns of steel rails, used on French railways, are given the details of experiments upon iron rails, which showed that those of the best quality did not resist the wear and tear of a traffic of twenty million of tuns, while those of ordinary quality succumbed to a circulation of fourteen millions. With regard to steel rails, all the trials show that the flange wears in a uniform proportion of 0·039 inch of thickness for a traffic of twenty millions of tuns; and as they are constructed for a wear of 0·39 inch, it may be calculated that the duration of the steel rails will correspond to a traffic of at least two hundred millions of tuns, that is, that they will last ten times as long as the best rails in wrought iron. The weight of the rail, if of steel, can be reduced so as to bring the cost of steel rails to about that of wrought iron rails, and considerations like these have led to the general introduction of steel rails on the French railroads. Drawings of the elevating machines for the water supply of the canal from the Aisne to the Marne were also exhibited. This canal establishes water communication between the metal mines of Saint Dizier and the coal mines of the north of Belgium. It passes through a permeable stratum of white chalk formation, and there is no adequate supply of water at a convenient level. The water must, therefore, be raised from the Marne by the aid of powerful machinery. Five turbines placed in a line, and about 30 feet apart, are used. The three central ones work vertical double action pumps, and one system is connected with another by coupling gear joining the crank pins. The turbines at either end serve as a reinforcement, taking their share of the work only when the crank is put in gear with the adjacent system. The mechanical product in water raised, that is, the relation between the actual work done by the system and the gross power furnished by the fall, amounts to 0·67, and the cost of delivering 32,700 cubic feet of water at the summit level was calculated in 1871 at about 20 cents.

THE FRENCH ART ENAMELS

embody several wonderful copies of paintings by the ancient masters. The metals used to enamel on are gold, silver, and copper; and the enamels or vitrifiable paints, with which the metal is covered and decorated, are peculiar preparations of glass to which metallic oxides impart the required colors. In general, three parts of lead and three parts of tin are oxydized by continued heat and exposure to the air. To the mixed oxides thus obtained are added ten parts of powdered quartz or flint, and two parts of common salt. The whole is then melted in a crucible together, and produces white enamel and the basis of colored enamel, which latter is made by the addition to the white enamel of other metallic oxides. Yellow is produced by the addition of the oxide of lead; red by the oxides of gold and iron mixed together; green by the oxide of copper; blue by the oxide of iron; violet by the oxide of copper, and black by the combined oxides of copper, cobalt, and manganese. With his plate, or piece of gold or copper, prepared to receive the enamel, the workman sets about his work by breaking up and pulverizing his small cake of enamel. When this substance is thoroughly reduced to powder, it is made into a pasty form by the addition of water. The moistened mass is then laid smoothly on the metal with a spatula, and, when dried, is melted or fired under a muffle in a small furnace. This process is repeated if the enamel is desired of extra thickness; but for art purposes the first or surface enamel has seldom more than two coats. With his white or black surface, as the case may be, ready for his drawing or decoration, the artist transfers to it the outline and shading of his picture in chalk or charcoal. Guided by this, he adds enamel from time to time, with his spatula, to make the required shadings and lines, by piling it up in some places and thinning it down in others. When a certain figure or object is partially completed, it is fired and then again covered with enamel, until it is completed to the satisfaction of the artist. So with the whole picture, which undergoes sometimes as many as fifteen or twenty firings before it receives its last firing and polish.

THE FINE LACE MADE BY MACHINERY

was one of the most remarkable exhibits in the entire French Department. Hand made lace of almost cobweb texture is exceedingly expensive, and in the cases devoted to its display there was a large robe valued at $800, a single handkerchief at $200, lace flowers at $400 per yard, and so on through a superb collection. Yet all this exquisite material could be found in another case, perfectly imitated by machinery. There was a complete dress in *point d'Alençon*, in which the famous stitch peculiar to that lace was accurately produced. It would have required a skilled connoisseur to to detect the material from that made by hand labor, yet the latter would be worth probably $5,000, while the price asked for the machine lace was but $250.

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 December, 1876.

Mercury.

Mercury cannot be seen until late in the month. On December 4, it is in what is called superior conjunction; its path is nearly that of the sun, and it is at the part of its orbit farthest from us. After the 27th, Mercury may be seen in the southwest, just after sunset, a little north of the sun's place. Mercury sets on the 31st at 5h. 43m. P. M.

Venus.

The planets Venus and Mars keep nearly the same diurnal path in the early part of December. They can both be seen in the morning. Venus rises on the 1st at 4 A. M., and sets at 2h. 44m. P. M. On the 31st, Venus rises at 5h. 9m. A.M., and sets at 2h. 33m. P. M.

The rapid motion of Venus carries it east, and on the 31st of December it is about 20° from Mars in that direction.

Mars.

On December 1, Mars rises at 3h. 55m. A. M., and sets at 2h. 34m. P. M. On the 31st, Mars rises at 3h. 38m. A. M., and sets at 1h. 28m. P. M.

Mars can easily be found on the 1st, by its nearness to Venus, being a little west of that planet. The star Spica can be seen, on nearly the same parallel, still farther west.

Jupiter.

Jupiter is very unfavorably situated. It rises at 7h. 23m. A. M. on the 1st, and sets at 4h. 36m. P. M. On the 31st, it rises at 5h. 57m. A. M., and sets at 3h. 3m. P. M. Its satellites cannot now be seen.

Saturn.

Saturn is the only planet which, through the whole month, can be seen in the evening. It is still moving very slowly among the small stars of *Aquarius*. On December 1, it rises at 1h. 19m. P. M., comes to the meridian at 5h

34m., and sets at 10h. 49m. P. M. It can easily be found, as soon as twilight is over, at an altitude of about 36°, when it souths, and changes little in position during the month. If the motions of Saturn are watched for the whole month, it will be seen that it moves in an easterly direction, and toward the zenith. On the 31st, Saturn rises at 10h. 26m. A. M., and sets at 9h. 2m. P. M. A telescope of ordinary power will show the ring of Saturn, but it requires a good one in order to see its numerous satellites.

Uranus.

Uranus is coming into better position for observation. It rises on the 1st at 10h. 11m. P. M., and sets at 11h. 54m. the next morning. On the 31st, Uranus rises at 8h. 11m. P.M., and sets at 9h. 54m. the next morning. Uranus is a few degrees west of Regulus and farther north in declination. It moves very slowly among the stars. toward the west.

Neptune.

Neptune rises at 2h. 41m. P. M. on the 1st, and sets at 3h. 59m. the next morning. On the 31st Neptune rises at 0h. 42m. A. M., and sets at 1h. 59m. P. M.

Sun Spots.

The report is from October 18 to November 18, inclusive. The photograph of October 18 shows a small spot coming on. On October 19 two small spots appeared following this, and around the group faculæ were seen. From October 19 to October 30 photographing was interrupted by clouds. In the picture of this latter date, the disk appears to be free from spots. On November 18, when the next observation was made, a very small spot was seen on the eastern limb. The observations of November 16 and November 17 showed the small spot moving across the disk and a pair of large spots coming on. These large spots will, no doubt, be in sight until the 25th of November.

During the past month photographing and observations have been much interrupted by clouds.

The American Climate and the Voice.

Dr. Lenox-Browne, surgeon to Her Majesty's Italian Opera, in a paper recently read before the London Musical Association on "the Voice as a Musical Instrument," says that the notion that our American climate is destructive to fine voices is unfounded. People who never learned to sing properly may complain; but the well trained vocalists do not suffer. He also combats the idea that alcoholic stimulants or voice lozenges are beneficial to the singer. The latter are merely irritating, and the numerous pots of beer, which some celebrated operatic artists are reputed to indulge in, are useless to assist the voice. A glycerin lozenge, Mr. Sims Reeves states, is useful, and on very rare occasions a small quantity of claret and water may be necessary; but all alcoholic stimulants are detrimental.

Two New Explosive Compounds.

Lignose, invented by M. Falkenstein, is the name of a new blasting agent, and is made of woody fiber prepared with nitroglycerin. It is stated to have about three times the force of block blasting powder, but is very irregular in its action and is very sensitive to moisture. Pantopollet is produced at a dynamite manufactory at Opladen, on the Rhine, and consists of naphthaline dissolved in nitroglycerin. The blasting action is quite good, and the force equal to about three times that of ordinary blasting powder. It yielded, however, during the experiments a very unpleasant smoke and odor, and produced severe pains in the heads and chests of the workmen.

One-Handed Bricklayers.

The rule of the British Bricklayers' Association, by which the bricklayer is made to do his work with one hand in his pocket, is perhaps as efficacious a means of degrading work as has yet been devised. But, if we had the ear of the lawgivers of the union, we should be inclined to suggest the advantage of a rule requiring that all bricklayers in good standing should have the left hand amputated. This would make it easy to distinguish everywhere at a glance, with very little danger of mistake, between a unionist and a nonunionist. It would cheapen trousers by making the left hand pocket unnecessary, and so leave more money for beer and tobacco; and it would be the strongest possible guaranty against forgetfulness of the cardinal rule. It would not interfere with anything the bricklayer might want to do, for one hand is enough to fill a pipe or lift a beer mug. The loss of convenience in dressing and undressing would be a small matter, for, since this has to be done at home, the bricklayer's wife could be made do it for him; and for disciplining a wife, one hand is probably almost as good as two, besides which the cherished privilege of kicking and stamping on her would be left unimpaired. Moreover, the sacrifice, or perhaps we should say the riddance, of the left hand would have the serious advantage of unfitting its owner for military service, while the resource of turning a hand organ would remain.—*American Architect and Building News.*

Magnetism and Carbon.

MM. Treves and Durassier have recently shown that the distribution of magnetism in a magnet is strongly influenced by the proportion of carbon in the steel. On comparing steels containing 1, ½, and ¼ per cent of carbon, it was noted that, the less the percentage, the more uniform the distribution. Carbonization tends to concentrate magnetism toward the poles.

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Recent American and Foreign Patents.

NEW AGRICULTURAL INVENTIONS.

IMPROVED PLOW.

John R. Newton, Rusk, Tex.—By suitable construction, by removing the scraper and the mold board, the plow can be used as a subsoiler. By removing the scraper, the plow can be used as a turning plow for breaking up land, throwing up beds, etc. By removing the mold board, the plow can be used as a scraper and cultivator. When all three parts are attached, the plow will scrape, cultivate, and hill the plants.

IMPROVED ROTARY CULTIVATOR.

Sevier Tadlock, Hope, Tex.—This is an improved machine for opening ditches to drain land and form fences, and to grade railroads, etc. Upon the rim of a large wheel, apart, are attached cross spades, and hinged right-angled spades, which form three sides of a series of rectangular boxes. A chute covers the open tops and sides of the boxes, and extends to below the wheel to cut the bottom and one side of the slice of soil while the spades cut its other side, thus dividing it into cubical blocks. As the machine is carried forward, the spades carry up the blocks of soil through the chute and discharge them into the trough. A carrier screw is operated by the advance of the machine, to move the soil deposited in the trough outward and drop it to the ground.

IMPROVED CULTIVATOR.

Garland A. Parsons, Dover, Ark.—This embodies a novel contrivance (consisting mainly of adjustable bars carrying the plows) for adjusting a gang cultivator to set the plows at various distances apart, for adapting them for different conditions of the plants, and other conditions.

IMPROVED PORTABLE FENCE.

George F. Stevens, Schuyler, Neb.—The panels of this fence are so connected that the fence may be conveniently put up and taken down. The panels are secured by interlocking rods which enter the ground. Over the connecting portions of the rods, grooved blocks are fitted and detachably fastened.

IMPROVED PLOW.

George W. Parish, Savannah, Ga.—The object of this inventio is to provide a plow separate and distinct from the beam, stock and handles, as an article of manufacture, which shall be so constructed as to be quickly, easily, and substantially attached to the ordinary scooter stock now in common use. To this end, the invention consists in constructing the plow with a plate extending from the moldboard to the landside at an angle corresponding to the inclination of the stock, and slotting the said plate with an opening into which the bolt of the scooter stock passes, so as to engage with the plate and hold the plow securely to the stock.

IMPROVED RICE CULTIVATOR.

George W. Parish, Savannah, Ga.—The object of this invention is to provide a cultivator for rice, in the early stages of its growth, which will not sod the rice, and which may be readily adjusted to the width of the rows. To this end, it consists mainly in the construction of the cultivator teeth, and the combination of the same with a pivoted metallic frame, consisting of four loosely pivoted bars, forming a variable parallelogram, which may be adjusted to bring the teeth closer together in oblique lines, or farther apart.

NEW HOUSEHOLD INVENTIONS.

IMPROVED CARPET SWEEPER.

Samuel F. Leach, Chelsea, Mass.—This invention consists in mounting the brush cylinder on a self-adjusting spring-pressed center or pivot and a fixed gudgeon, so that it will run without noise and permit of its removal from the top of the case or box without emptying the dust receptacles.

IMPROVED FOLDING CHAIR.

John A. Ware, Morris, Ill.—This invention relates to certain improvement in folding chairs, and it consists in the peculiar arrangement of the back, seat, arms, and legs, whereby the chair may be adjusted for various positions in an easy and convenient manner, or be folded up into a small compass and made more readily portable. It also consists in the means for connecting the seat to the back so as to permit them to be upholstered and still successfully folded.

IMPROVED CLOTHES DRYER.

Finley H. McMartin, Big Grove, Iowa.—This is a novel combination of jointed end pieces and horizontal rods, forming a clothes rack that may be spread for drying clothes, or folded closely together when not in use. It also consists in a quilting frame of peculiar construction, to be used in connection with the clothes rack, which forms a support for one of its ends.

IMPROVED WASHING MACHINE.

Henry P. Lentz, Somerset, Ohio.—This invention relates to certain improvements in that class of washing machines called pounders, the same being adapted to pound the clothes in an open tub with a vertically reciprocating movement for the purpose of cleansing the same by an agitation of the water produced by the impact of the plunger and the production of air currents. The improvement consists in the peculiar construction of the plunger, whereby the clothes may be more readily and thoroughly cleaned, and the splashing of the water outside of the tub more effectually prevented.

IMPROVED FOLDING CHAIR.

ohn A. Ware, Morris, Ill.—This invention relates to certain improvements in folding chairs designed to render the use of this class of chairs more reliable by imparting a greater degree of stiffness and rigidity to the same when disposed for use, while at the same time permitting the ready folding of the same into convenient dimensions for easy transportation. It consists mainly in constructing the arms with a limited toggle or knee joint adapted to fold upwardly when the chair is folded, or lie straightened out to form a brace when the chair is disposed for use, which automatically locks the back in proper position against its forward movement.

NEW TEXTILE MACHINERY.

IMPROVED SPOOLER.

Samuel F. Cobb, Alberton, Md.—This invention relates particularly to the form or construction of a slotted cam cylinder and the combination of the same with traversing bars carrying the thread guides and working horizontally in slats formed in the sides of the arches or frames, in which the spool spindles are journaled. A spur gear is attached to, or formed on, one end of the cam cylinder and meshes with a pinion on the driving shaft. The pinion is elongated to allow the cam cylinder to be adjusted lengthwise, to compensate for wear of the cam slot and other friction surfaces. The machine can be so changed as to increase or decrease the traverse simply by removing the gear, thereby enabling the operator to make as even and regular layers, when spooling number four yarn, as when spooling number fifteen—presenting, all the while the spool is being filled, a smooth even surface to the thread, so that the spool must be finished as commenced. In other spooling machines, the traverse is generally worked without this provision, and changing them from fine to coarse numbers produces an uneven ridgy surface, and the difficulty increases as the spool increases in size.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED WAGON BRAKE.

Josiah B. McAfee, Topeka, Kan.—This invention is an improvement in that class of wagon brakes in which two levers are employed, the same having a common fulcrum and being so connected by a dog or pawl that, when the levers are pressed together, said pawl is released from a curved ratchet bar. The improvement relates to the construction and arrangement of parts, whereby the brake lever may be held locked, and thus prevented from rattling when the brake is thrown back out of action.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED CAR BRAKE.

David H. Levy, New York city, assignor to himself and Edward W. Linzner, of same place.—This is an arrangement of clutches or wrenches attached to a sliding bar and capable of being instantly thrown forward by a spring to engage with a squared portion of the car axle, or to a square block bolted to the axle, the object being to stop a car in case of emergency in the shortest possible time.

IMPROVED CAR AXLE.

Ezra J. Bowen, Kent, O., assignor of one third his right to Orange E. Page, and one third to Thomas Egbert, of same place.—This is a car axle provided with grooves between the journal and its shell, together with inlets and outlets for the air, whereby it is claimed that much of the heat generated by friction in the shell will be carried off by a circulation of air.

IMPROVED VELOCIPEDE.

James Fishwick, Cincinnati, O.—This invention is designed to provide a simple, cheap, and substantial velocipede, more especially designed for the use of girls, but equally adapted for use by boys. It consists in an improved construction of the driving mechanism, the connection of the main axle to the reach, and the connection of the front guide wheel and lever to the reach.

IMPROVED DOUBLE-ACTING PUMP.

William B. Farrar, Greensborough, N.C.—This is a double-acting pump having but half the usual number of valves. It consists in two cylinders of different diameters, opening into each other and having a check valve at the bottom, combined with an upper piston fitting in the smaller cylinder, and a lower piston fitting in the larger one, and both connected by a pipe also provided with a valve. The two pistons are operated simultaneously and together by the piston rod, so that upon the upward stroke the water above the smaller piston is lifted out at the spout, and water is drawn beneath the lower large piston into the larger cylinder, while upon the downward stroke the water beneath the large piston is forced upwardly through the tubular opening into the upper cylinder, and by reason of the difference in the capacity of two cylinders is also forced out of the spout.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED FACING HAMMER.

Edgar F. Lemoine, Emmerton, Va.—This invention relates to certain improvements in facing hammers for dressing stone, and especially millstones. It consists in the particular construction and arrangement of the tool, in which the handle is constructed with a shoulder and a squared or rectangular stem screw, threaded at its end, upon which squared portion cutting blades with corresponding perforations are held by double inclined plates which are clamped between a screw nut upon the threaded end of the stem and the shoulder of the handle.

IMPROVED BEAM SCALES.

George W. Grove, Linnville, O.—When the tare is to be weighed, as, for instance, in retailing butter, the vessel is weighed first; a bar, which is graduated to correspond with the small beam, and which slides on an upper beam, is moved outward until its inner end corresponds with the pointer of the link of the counterpoise weight. The butter is then put in, and is balanced by adjusting the weight, and the net weight of the butter will be read from the bar opposite the pointer. If the gross weight is to be obtained first, the article and its package are weighed, and the sliding bar is moved inward until its outer end corresponds with the pointer. The article is then taken out of the package, the package is then weighed, and the net weight is read from the bar opposite the pointer, counting from the outer end or said bar. The bar will count up any number of pounds by adding or subtracting the extra weights, as is done in common scales.

IMPROVED STIRRUP.

Ransom Sabin, Shelby, Mich., assignor to himself and John Magee, same place.—This stirrup is made open at top and side, and provided with a bar and tongue, pivoted to the side flanges at the upper end to receive the supporting strap. This offers an easier rest to the foot, and prevents the same becoming entangled in the stirrup in case of accident.

IMPROVED POISON BOTTLE.

James W. Bowles, Louisville, Ky.—This is an improved bottle for storing and keeping poisons in such a manner that the peculiar shape of the bottle serves as a warning against the careless use of the contents; and the invention consists of a bottle made in the shape of a coffin resting on the head end as a base. The neck is applied to the upper or foot end.

IMPROVED CARTRIDGE BOX.

Solomon T. Satterwhite, Nashville, Tenn.—This consists of a circular case composed of two detachable parts, forming a central and an annular compartment. In the annular compartment fits and revolves a frame divided into two transverse chambers, in each of which is contained a cartridge, while the central compartment is intended for extra ammunition. The outer case is provided with an opening upon its periphery through which the cartridges drop, and it is also provided with a spring detent to determine the registration of the cartridge chambers with the opening in the outer case, and is slotted so as to permit the introduction of the finger to turn the ammunition frame.

IMPROVED DEVICE FOR TEACHING MUSICAL TRANSPOSITION.

Thomas J. Allison, Gladewater, Tex.—This consists of a key board with sliding instruments, which afford an easy and graphic means of explaining transpositions of musical scales.

IMPROVED EAR AND OTHER STUDS.

Anthony Hessels, New York city.—It has become fashionable of late to wear the diamond and other studs or drops in the ears without rings or other suspending parts that may be readily seen. In the present device a recessed shank of the stud is passed through the ear hole and locked to the ear by a fastening spring ring applied to the shank at the rear side of the ear

Business and Personal.

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

Notes & Queries

C. B. P. will find a description of a connection for a clock, to ring a bell, etc., at an appointed time, on p. 335, vol. 35.—W. F. will find a description of Portland cement on p. 199, vol. 31.—F. B. M. will find directions for soldering gold on p. 251, vol. 28.—T. D. D. L. will find the dimensions of the sizes of wire on the British wire gage on p. 263, vol. 28.—J. B. B. will find an answer to his query as to the weight of stone on p. 151, vol. 35.—A. S. will find a recipe for aquarium cement on p. 202, vol. 28.—J. B. will find directions for making spongy platinum on p. 330, vol. 25.—J. H. can fasten leather to rubber with rubber cement. See p. 203, vol. 30.—J. F. M. will find a recipe for shoe dressing on p. 283, vol. 31.—G. H. D. will find a stain to imitate rosewood on p. 154, vol. 30. This also answers P. McC.—W. N. H. will find a recipe for a liquid stove blacking on p. 219, vol. 31.—R. will find directions for washing flannels and other woolen goods on p. 267, vol. 30.—H. D. O. will find directions for making an electric engine on p. 91, vol. 26.—J. M. will find directions for frosting glass on p. 264, vol. 30.—F. S., C. A. S., J. D. H., J. C., S. J., J. W. M., 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) E. L. asks: What is the best way of preparing sensitive albumen paper for printing, so that the paper will keep for at least two months in the dark without turning yellow? A. After the paper has been sensitized, hang it up until the silver ceases to drop, then float it for one minute (with the back down) on a mixture of 1 oz. hydrochloric acid in 40 ozs. water. Dry thoroughly, and keep in a cool, dry place.

(2) C. H. W. H. says: I wish to fuse some tin with copper for a patent article. How can I do it? A. Fuse the copper first, allow to cool until it just begins to solidify, throw a handful of sal ammoniac on the surface of the fused metal, and immediately stir in the fragments of tin with a stick of wood. Heat again and run the alloy immediately into the mold. It is always necessary to add something more than the percentage of tin required in the alloy, as some of the tin is unavoidably lost by oxidation while in contact with the air at a high temperature. Stir well with a piece of wood and remove the scum of oxides from the surface before pouring out the metal.

(3) P. & E. R. R. asks: What is the cause of a locomotive slipping more on a curve than on a straight piece of road? A. Because of the extra friction on the parts, due to the bending of them, which increases the power necessary to move the engine and load.

(4) J. D. P. says: In soldering some work made of steel and iron wire, we find marks of rust after washing. Is there anything we can solder with that will not rust the wire? A. No. Cleaning the rust off afterwards is the only method.

(5) J.T.W. asks: 1. Please give me a recipe for paste, such as is used by paper box makers. A. Box maker's paste is simply flour paste containing a little alum to prevent molding. 2. Please tell me what cement can be used cold by paper box makers, that will remain in solution, and that will stick as well as when hot? A. Use a strong solution of dextrin in water.

(6) E. H. R. says: I have a troy weight scale for weighing vinegar, but it requires too much time. Please give me a simple and correct way for weighing vinegar, to reckon by grains A. The strength of vinegar is ordinarily determined by means of what is called the acetometer, an instrument closely resembling the common hydrometer. If the specific gravity of the vinegar be determined by means of an hydrometer, and the volume of the liquid determined by cubical measurement, a simple proportion of these and the standard weight of a gallon of pure water will be all that is necessary to determine the absolute weight of any quantity of vinegar. You can weigh vinegar in any good balance by weighing the vessel containing the vinegar and then deducting the weight of the vessel: or first counterpoise the vessel and then weigh directly. In the troy and apothecary weights there are 480 grains in 1 oz: in the avoirdupois scale the ounce contains 437·5 grains. In the decimal or French scale the gramme is equivalent to 15·434 grains.

(7) C. B. L. asks: Why is it, that in making centers for lathes, the dead center is drawn to a straw color, while the live is drawn to a blue? A. The dead center is made as hard as is consistent with strength. The running center is made soft enough to turn up. To distinguish, mark them.

(8) L. B. S. asks: Can I purify air by forcing it through a moistened sponge? Can you give me a convenient and inexpensive process for removing impurities from stagnant air, pregnant with human breath and tobacco smoke, before passing it through a small tube? A. Pass the air through the sponge seated in a small vessel of water, and then through a large pipe filled with coarsely pulverized boneblack or charcoal (well burnt) and caustic lime. This, we think, will thoroughly purify the air.

(9) A. G. asks: How can I tell good steel? A. By the closeness of the grain, evenness of fracture, and dulness of color at fracture.

(10) R. B. F. asks: 1. What is the effect of a cement composed of glycerin and litharge, applied on the inside of steam boilers for stopping leaky seams and rivets? A. The cement you mention is a very good boiler cement, having no properties deleterious to the iron. 2. How is the cement made? A. Mix the two ingredients to a thick paste. It should be allowed to stand till dry, the time depending on the temperature of the atmosphere.

(11) D. C. M. asks: How can I blacken, either with paint or varnish, a surveyor's instrument of which nearly all the black color has worn off? A. Use genuine asphalt (free from coal tar) and spirits of wine. Give it several coatings of the varnish, thinned down well with the solvent, and dry each time in a moderately warm oven. The varnish should, after the addition of the alcohol, be allowed to stand several hours before using.

(12) W. H. G. asks: What can I use for coating a wheel with emery or sand, that will harden, and not get soft by the dampness of the atmosphere? A. Try glycerin and white lead, used as a glue.

(13) W. J. H. asks: Do you advise a counterbalance for a piston and connecting rod of the steam engine? A. No.

(14) J. T. H. asks: 1. What are the proportions of coal gas and air required to cause an explosion when ignited? A. Use 5 parts of air to 1 of coal gas. 2. What is the expansive force, and what are the products of the combustion? A. The explosive force of this mixture is very violent, but it depends much upon the conditions under which it takes place; the greater the pressure under which the mixture is ignited, the greater will be the effects of the explosion. If the mixture be in the proper proportions, the products will be only nitrogen, carbonic acid, and water. If pure oxygen be used, the explosive force is much enhanced. In this case the proportion of the gases should be as one to one, and products will be only carbonic acid gas and water. 3. Will a red hot wire ignite the compound instantly? A. It is necessary to raise the temperature of the wire to nearly white heat; the wire will then explode the mixture instantaneously.

(15) A. A. F. asks: Please give me a recipe for cement or glue for end wood, to work without sizing. Will white lead and glue together answer the purpose? A. Yes.

(16) T. A. R. says: I have an upright tubular boiler; it is called an 8 horse, and I have an upright engine called a 6 horse. The engine will do our work, but seems to have just enough to do; for when we throw our heavy machine on, it checks her for a moment or two. We propose to put in a larger engine of same make. Can we do so and get satisfactory results? A. If your boiler gives you a surplus of steam for your present engine with easy firing, you may try a larger cylinder as you propose.

(17) J. H. P. asks: What will harden plaster of Paris and make it set quickly? A. Try a strong alum solution.

(18) C. E. S. asks: Can you give me a recipe for a bright red paste for marking articles with a stencil plate? A. Try making a size with gelatin and striking the color with vermilion.

(19) E W. C. says: I have a window garden, a large box filled with chip dirt, and full of flowers, which it will be impossible to empty and to change the earth from without injury to the flowers. Will angle worms injure the plants, and will carbolic acid destroy the worms? A. They would be beneficial, so far as improving the ground for cultivation was concerned. Carbolic acid would injure the plants. A small amount of Paris green mixed into the ground would be better.

(20) W A. E. asks: Please inform me of some coloring fluid that would change the color of cigars from light to dark, if put on after they are made, without injury to the smoker. A Try coloring the outside wrapping with a suitable vegetable dye, but be sure that your dyestuff has not been made with poisonous ingredients.

(21) C. H. W. asks: Is there anything that will remove scratches from heavy plate glass? The scratches were made with a block of iron pyrites. A. If the scratches are deep, grind down the surface with another block of plate glass, using at first fine emery and oil, and finishing with rouge to restore luster.

(22) H. N. S says: E. H. L. asks if some sounds travel faster than others. I was formerly an organist. In listening to other player's performances across a large hall, I frequently noticed that the high tones came to my ear sooner than the low tones. I was always in doubt whether the manipulation preceded the pedipulation of the keys, and thus caused the want of unity, or whether the high sounds came faster than the low ones or not. Which was it, probably? A. M. Biot found, in his experiments on the conductivity of sound in tubes, that, when a well known air was played on a flute at one end of a tube 1,040 feet long, it was heard at the other end without alteration, from which he concluded that the velocity of different sounds is the same. For the same reason the tune played by a band is heard at a great distance without alteration, except in intensity, which could not be the case if some sounds traveled more rapidly than others. This cannot, however, be admitted as universally true. Earnshaw, by a profound mathematical investigation of the laws of the propagation of sound, has found that the velocity of the sound depends upon its strength, and accordingly that a violent sound ought to be propagated with greater velocity than a gentler one. This conclusion is confirmed by an observation made by Captain Parry on his arctic expedition. During artillery practice it was found, by persons stationed at considerable distances from the guns, that the report of the cannon was heard before the command to fire given by the officer. And more recently the experiments of Mallet and those undertaken at the explosion at Hell Gate go to prove the assumptions of Earnshaw.

(23) F. A W. asks: Have quicksilver and chloride of silver any affinity for each other? A. No. The chloride of silver alone, when heated, melts and is converted into horn silver, except when reducing gases or carbonaceous matters are present, in which case it is converted into the metal.

(24) D. R. W. asks: What should be put into water which leaves an alkali coating on the flower pots and earth, to counteract its effect? A. Send some of the alkaline coating. The best remedy would depend upon its chemical nature, and would have to be determined by experiment.

(25) R. G. asks: Why does smoke ascend at one time and descend at another? A. Smoke (unconsumed carbon) is carried aloft by the rapid ascent of the heated air, which, on reaching a certain elevation and becoming chilled by radiation and contact with currents of colder air, seems to rise, and admits of the gradual deposition of the heavier carbon. If the air is damp and cold, and the barometric pressure has considerably decreased, the loss of heat is more rapid; and as the barometric pressure is less than usual, the particles of carbon are practically heavier than usual, and in consequence their descent is quicker.

(26) W. Z. B. asks: What, if any, deleterious effects would result from using galvanized iron, for evaporating pans in the process of boiling cider for jellies and other domestic purposes? A. Zinc and zinc oxides are soluble in certain vegetable acids, like acetic, and would in solution prove injurious.

(27) S. D. P. asks: What waterproof solution or liquid is cheap, tasteless, and inodorous, and can be practically applied or used to make fruit, berry, and grape straw board baskets waterproof? A. Try gelatin made insoluble by bichromate of potash.

(28) G. H. G. says: I have heard airs played upon goblets which were partially filled with water, for the purpose, as I was informed, of regulating the different tones. What is on the little sticks which are drawn on the edges of the goblets to produce these sounds? A. We have not seen sticks used as you describe; but something of a resinous nature, sufficient to produce a slight degree of equable friction, would answer the purpose.

(29) L. M. H. asks: Please give me a good recipe for cleaning felt hats? A. Try methylic alcohol.

(30) Y. W. W. says: Please explain the chemical action that zinc has upon hard limestone water, in a locomotive or stationary engine boiler to prevent incrustation, and if it will have any effect on the boiler iron at the seams? A. The acid, such as sulphuric, if present in solution, would combine with the zinc to form a soluble salt of zinc. This would not only diminish the amount of acid which would be left free to form insoluble compounds with the bases present, but the zinc would be oxidized and destroyed, instead of the other metal. Possibly, as has been claimed by some, the electro-chemical action and currents set up between the iron and zinc would likewise assist in the prevention of matters being thrown down on the iron, which would be the electro-positive element in the circuit.

(31) W. M. says: I have just completed a cistern; but during my absence a quantity of lime was mixed with the cement in plastering the inside, so that the water is now thoroughly impregnated with lime, and we cannot use it for any purpose. Is there any remedy besides emptying it all out? Could I neutralize the lime and use the water? A. Take a measured amount of the water, and see how much a solution of alum of a certain strength will, on mixing and allowing to stand, precipitate out the lime. This will give the measure for the whole quantity, if successful, and if after treatment with alum the water is not injured.

(32) C. W. C. asks: Can a hot white metal be soldered to a piece of steel wire by forcing the metal on hot, with sal ammoniac or muriatic acid and zinc? A. No. Use a suitable solder. See p. 251, vol. 28.

(33) W. B. says: Pitch or rosin, with gutta percha, half and half, can be made to stick tin foil or foil paper on to tin. It is difficult and expensive to use. Is there any cheap material you know of? A. Try rectified petroleum or coal tar oil. Ether and caoutchouc would be more expensive.

(34) S. M. asks: What is the ordinary composition on the safety match, and what the composition of the material on the box? A. The match contains chlorate of potash and wax (paraffin) and the material on the box is red (amorphous) phosphorus and gum.

(35) A. J. H. asks: How can I make a solution of alkaline silicates, and of alumina, as described on p. 88, vol. 34, under heading of "A New Mode of Hardening Sandstone?" A. Alkaline silicate is silicate of soda or soluble glass. The alumina or aluminate of soda is composed of alumina and soda, the commercial salt containing 48 parts of the former, 44 parts of the latter, together with 8 parts of chloride of sodium and sulphate of soda, which are present as impurities.

(36) G. H. A. asks: 1. What is carbolic acid? A. Carbolic acid is a body produced in the dry distillation of coal, and, in other ways, forming the chief constituent of coal tar oil. When pure it forms long colorless needles which melt at about blood heat and boil at 356°. It has a very penetrating smell, resembling creosote, which body indeed largely consists of carbolic acid, and has a burning taste. 2. Has it any preservative properties? A. Yes, it is a powerful preservative agent. 3. If so, what is it used to preserve? A. More especially meat and all kinds of animal substances liable to decay, putrefaction, or fermentation. 4. How is it used? A. It is largely used in the form of carbolate of lime: or in small quantities, or diluted, alone.

(37) G. W. R. asks: How can I separate the olein from the stearin of tallow? A. By treating with sulphuric acid. It is performed in

large wooden tubs lined with lead, and heated by steam discharged into them by a perforated pipe. The agitation is kept up for 15 to 30 minutes, and, after reposing for a similar length of time, the water is drawn off by a pipe at the bottom. The fat which has thus been washed is put into a vessel heated by means of a steam jacket, and the water is driven off by evaporation. The fat is then ready to be treated with strong sulphuric acid, which is done in a boiler of copper furnished with a steam jacket. In case the tallow is pure, the preliminary treatment may be omitted. About 10 to 13 lbs. of strong acid are required for every 100 lbs. tallow.

(38) R. J. C. asks: How can I take the smell away from coal oil? A. By careful treatment with acid, alkali, and washing. You cannot do it without suitable apparatus; and well prepared coal oil should be free from any smell except what is natural to it, and which it must have so long as it remains coal oil.

(39) W. B. W. asks: How can I electrotype natural flowers? A. First, dry the flower or leaf as far as may be without causing it to shrivel, and then dip it immediately into a dilute solution of pure shellac in alcohol: allow to dry in a warm place, and repeat the operation several times until a uniform covering of the resin is obtained, then allow to stand for several hours until perfectly dry. This treatment will render the leaf and stem nearly waterproof and rigid. Carefully dip the flower or leaf into the gum water, so as to moisten every part; expose for a moment to the air, and then dust over it very finely ground black lead (pure graphite); be careful to cover every part, and remove any superfluity, as far as possible, with a fine camel's hair pencil. Make a saturated solution of neutral sulphate of copper in pure water, and suspend in this a plate of clean copper connected with the wire from the copper pole of the battery. Wrap the stem of the flower with the finest copper wire, so as to have perfect connection with the carbon covering, and connect, by means of this wire, with the wire from the zinc plate of the battery: then immerse the flower in the electrolyte, and join it so as to remove any bubbles of air that may adhere to its surfaces, but avoid shaking it so as to rupture the thin film of shellac. The current for the first few moments should be quite strong (from two or three good Daniell's cells), but after this the current from one small cell is all that is requisite. The battery should be a constant one, such as is used for local sounders on telegraph lines, and the deposition should be allowed to proceed undisturbed for about 24 hours, or for 48 hours if necessary. We have tried this method and obtained very good results from it; but it requires some patience and practice to obtain uniformly good results. The nitrate of silver method of electrotyping gives very accurate results, but the flowers must be covered first with a film of collodion, which will protect them from injury by the silver solution. We do not know of any conductive pigment or metallic salt that can be substituted for graphite or silver, as in the above recipes.

(40) P. E. S. says, in reply to E. H. H., who asked what is the cause of difference in the travel of the sound of a rifle bullet in striking a canvas target, and then a rock only 7 feet behind it: Sound is conveyed by vibrations of the atmosphere; the canvas being a thin body, the vibrations are put in motion immediately after the bullet strikes. The rock, being a heavier and more inert body, takes some little time in accumulating the blow of the bullet, and does not communicate its vibration to the atmosphere so quickly, hence the difference in the time of the sound. The same phenomenon is noticed on a clear morning by a carpenter driving a nail in a board; the sound seems to be double, the first is made by the hammer on the small head of the nail, and the other by the end of the nail on the larger plank.

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

E. C. C.—It is a piece of hornblende.—B. B. H.—It is mispickle, a double sulphuret of iron and arsenic.—E. C. R.—It is basalt, sandstone, and argillaceous rock, containing iron pyrites (sulphide of iron).—V.—It contains no platinum whatsoever.—E. G. D.—It is sulphuret of iron.—J. J. S. —It is iron pyrites, of no market value.—J. R. Z. It contains no zinc.—A. E. G.—It is sand containing a little oxide of iron.—D. H. C.—It is a piece of greenstone with mica, quartz, and clay.—D. R. Y.—No. 1 is iron pyrites. No. 2 is flint.—T. L.—It is a very compact variety of bituminous coal.—C. J. C.—The specimens sent are oxide of iron containing a small amount of oxide of titanium. —G. L.—The specimens sent are certainly very soft and pliable.—A. M.—It is galena (sulphide of lead) a valuable ore of lead.—J. V.—It is a peaty or vegetable *debris*, yielding a small percentage of mineral ash.—Will H. J. M., of Rochester, Pa., please send full name and larger specimen for examination? The piece sent on October 28 was not sufficient for satisfactory analysis.

C. E. asks: How can I change 14 carat yellow gold into 12 carat red gold?—A. J. A. says: A friend of mine tried preserving natural flowers in paraffin, but they retained their color for only a few days, when they turned quite dark and colorless. Can you tell the cause? How are funeral wreaths prepared so as to remain perfectly white?

COMMUNICATIONS RECEIVED.

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

On Cutting Screws. By E. J.
On Growing Cotton. By R. B.
On Writing Dates. By F. H. R.
On Boiler Explosions. By F. G. F.
On the Planet Vulcan. By J. H. T.
On a Scale of Colors. By B. B.
On Trisecting an Angle. By J. A. T.
On Progressive Thought, etc. By P. F. P.
On a New Electric Light. By G. Q. T.

Also inquiries and answers from the following:
A. G., Jr.—S.—C. W. H.—A. S.—M. E. N.—M. W.—J. J. C.—R. F. B.—W. S. H.—G. E. S.—W. P. P.—L. W. P.—T. J. R.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of inquiries analogous to the following are sent: "Who are the principal needle manufacturers in the United States? Who sells hand knitting machines? Who sells darning machines? Who sells sporting guns? Why do not telescope makers advertise in the SCIENTIFIC AMERICAN?" All such personal inquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

Up to the hour of going to press, the list of patents issued during the week ending November 7, and bearing that date, had not arrived from Washington.

VALUE OF PATENTS,

AND

How to Obtain Them.

Practical Hints to Inventors.

PROBABLY no investment of a small sum of money brings a greater return than the expense incurred in obtaining a patent, even when the invention is but a small one. Large inventions are found to pay correspondingly well. The names of Blanchard, Morse, Bigelow, Colt, Ericsson, Howe, McCormick, Hoe, and others, who have amassed immense fortunes from their inventions, are well known. And there are thousands of others who have realized large sums from their patents.

More than FIFTY THOUSAND inventors have availed themselves of the services of MUNN & Co. during the THIRTY years they have acted as solicitors and publishers of the SCIENTIFIC AMERICAN. They stand at the head in this class of business; and their large corps of assistants, mostly selected from the ranks of the Patent Office: men capable of rendering the best service to the inventor, from the experience practically obtained while examiners in the Patent Office: enables MUNN & Co. to do everything appertaining to patents CHEAPER than any other reliable agency.

HOW TO OBTAIN *Patents*. This is the closing inquiry in nearly every letter, describing some invention, which comes to this office. A *positive* answer can only be had by presenting a complete application for a patent to the Commissioner of Patents. An application consists of a Model, Drawings, Petition, Oath, and full Specification. Various official rules and formalities must also be observed. The efforts of the inventor to do all this business himself are generally without success. After great perplexity and delay, he is usually glad to seek the aid of persons experienced in patent business, and have all the work done over again. The best plan is to solicit proper advice at the beginning. If the parties consulted are honorable men, the inventor may safely confide his ideas to them; they will advise whether the improvement is probably patentable, and will give him all the directions needful to protect his right.

How Can I Best Secure My Invention?

This is an inquiry which one inventor naturally asks another, who has had some experience in obtaining patents. His answer generally is as follows, and correct:

Construct a neat model, not over a foot in any dimension—smaller if possible—and send by express, prepaid, addressed to MUNN & Co., 37 Park Row, together with a description of its operation and merits. On receipt thereof, they will examine the invention carefully, and advise you as to its patentability, free of charge. Or, if you have not time, or the means at hand, to construct a model, make as good a pen and ink sketch of the improvement as possible and send by mail. An answer as to the prospect of a patent will be received, usually by return of mail. It is sometimes best to have a search made at the Patent Office; such a measure often saves the cost of an application for a patent.

Preliminary Examination.

In order to have such a search, make out a written description of the invention, in your own words, and a pencil, or pen and ink sketch. Send these, with the fee of $5, by mail, addressed to MUNN & Co., 37 Park Row, and in due time you will receive an acknowledgment thereof, followed by a written report in regard to the patentability of your improvement. This special search is made with great care, among the models and patents at Washington, to ascertain whether the improvement presented is patentable.

To Make an Application for a Patent.

The applicant for a patent must furnish a model of his invention, if susceptible of one; or if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft or postal order, on New York, to the order of MUNN & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

Foreign Patents.

The population of Great Britain is 31,000,000; of France, 37,000,000; Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; Russia, 70,000,000. Patents may be secured by American citizens in all these countries. Now is the time, when business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Patents obtained in Canada, England, France, Belgium, Germany, Russia, Prussia, Spain, Portugal, the British Colonies, and all other countries where patents are granted, at prices greatly reduced from former rates. Send for pamphlet pertaining specially to foreign patents, which states the cost, time granted, and the requirements of each country. Address MUNN & Co., 37 Park Row, New York. Circulars, with full information on foreign patents, furnished free.

Canadian Patents.

In order to apply for a patent in Canada, the applicant must furnish a working model, showing the operation of the improved parts; the model need not exceed eighteen inches on the longest side. Send the model, with a description of its merits, by express or otherwise, to Munn & Co., 37 Park Row. Also remit to their order by draft, check, or postal order, the money to pay expenses, which are as follows: For a five years' patent, $50; for a ten years' patent, $75; for a fifteen years' patent, $100. The five and ten years' patents are granted with privilege of extension to fifteen years.

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