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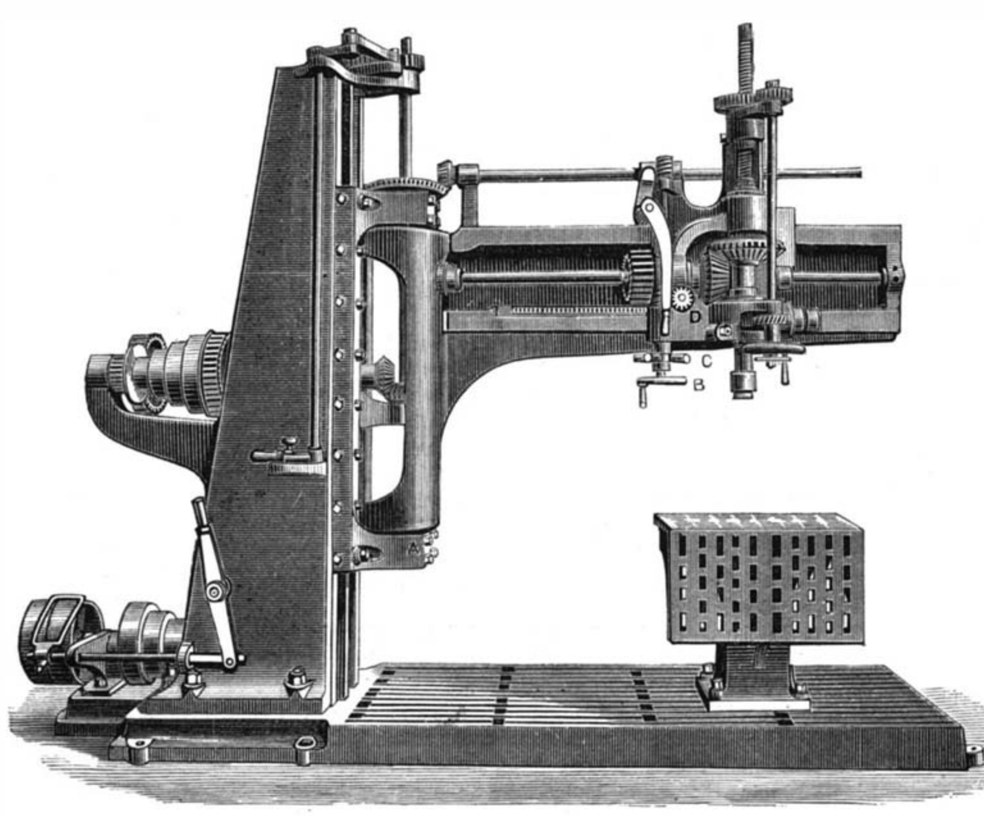
RADIAL DRILLING MACHINE.

We annex, from *Engineering*, an engraving of a radial drilling machine, the special feature of which consists in the means provided for shifting the radial arm. Usually, in radial drills, the arm is swung round approximately into the position required by pulling or pushing against the end, a worm wheel, however, being in some cases fixed to the lower trunnion on which the arm swings. This latter arrangement is an improvement, but it is open to the objection that in order to operate the worm wheel the driller has to leave his work, and he is thus not able to perfect the adjustment without going backwards and forwards, this of course involving a loss of time.

Referring to the engraving it will be seen that the gear for moving the slide on the arm, and also that for swinging the arm itself, is placed under the immediate control of the workman, who can shift either the slide or arm without leaving his work. Thus by turning the handwheel, B, motion is communicated, through the worm gear shown, to the horizontal shaft at the top of the radial arm, this shaft carrying a bevel pinion which gears into a bevel wheel fixed on the frame of the machine concentric with the trunnion of the radial arm. By turning the handwheel, B, the radial arm is thus caused to move round the fixed bevel wheel, and its position can be thereby accurately adjusted. In the earlier machines constructed on this plan a clutch lever was provided, as shown, this lever enabling the worm wheel on the horizontal shaft to be disengaged, and the arm to be thus left free to be pushed round by hand. This provision was made to enable the arm to be quickly moved through large angles.



IMPROVED RADIAL DRILLING MACHINE.

The cross handles, marked C on the engraving, enable motion to be given to a worm gearing into the worm wheel, D, this being fixed on the same spindle as a pinion gearing into the rack shown. By means of the cross handles, C, the slide carrying the drill spindle can be shifted radially along the arm, and the workman is thus enabled to adjust the drill readily in both directions.

The machine is self-acting by power for raising or lowering the arm, and the extreme radius of the spindle on the arm is 6 feet. The spindle works in conical bearings which are adjustable and keep the spindle always at right angles to the base plate, while the feed screw is provided with a double nut which can be adjusted to take up wear.

FIRE ENGINE.

The accompanying engraving illustrates a novel engine for extinguishing fires, which consists of a couple of receivers for carbonic acid gas and a pump mounted on wheels and fitted with hose and nozzle, the whole being arranged so that the gas can be employed as a motive agent for the pump; and at the same time, the exhausting gas can be used separately or together with the water for extinguishing fire.

In the engraving A represents the chargers; B the gas generators; C the receivers; and D the pump. The generators are connected by gas chambers, E, and pipes, F, having cocks, G, so that one can be shut off while the other is filling, and the receivers are connected with the pumps by pipes, H and I, having cocks, J, to shut off one while the other is communicative with the pump. K is the exhaust from the steam or gas cylinder, to which a hose and nozzle can be attached for applying the gas to the fire; and L represents connections for the water hose. The gas is to be generated in the usual manner from carbonate of lime (or any of the carbonates) and sulphuric acid, by the use of strong cylinders as receivers, to be filled with this elastic gas to the pressure of 200 to 400 lbs. per square inch, more or less. This gas is to be used to operate the engine and pump, which are of no prescribed form or kind, but are like any efficient steam pump. The water from the pump is to be conducted and applied in the usual way for the extinguishing of flames.

The exhaust of the carbonic acid gas from the engine is conducted in suitable hose, to be used for the extinguishing of flames, as it can be applied in buildings, partitions, under the floors, in cellars, in attics, or in any difficult place of access, and thus confining the fires to the limits in which they originate. It will not freeze at 100° below zero, will be instantaneous in its work, as the cylinders are always to be charged with the gas up to their proper capacity at all times; therefore the engine will always be ready to work at its greatest capacity. As one cylinder is exhausted the generator can be set in operation to replenish it, and thus a steady supply is attained. These cylinders can be made of any number or capacity, as the demand may require. These engines will be lighter, consequently more portable, for manufactories, warehouses, public buildings, and ships. They may be made either stationary or portable in every and all cases, and will be efficacious and instant in their work and operation. The carbonic gas can be conducted into the holds of ships, and, if entirely filled, would do no damage other than extinguishing any active or smoldering fires. The gas is generated, in retorts lined with lead, in quantities, at a trifling cost, from marble dust and sulphuric acid. Though it costs more than steam, yet its efficiency and promptness more than compensate for the extra cost.

Patented through the Scientific American Patent Agency March 14, 1876. For further particulars address Clinton W. Clapp, Wappinger's Falls, N. Y.

CLAPP'S NEW CHEMICAL FIRE ENGINE.

Scientific American.

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NEW YORK, SATURDAY, AUGUST 25, 1877.

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DEAD WEIGHT IN RAILWAY CARS.

To the student of railway economy the subject of dead weight in cars tends to call up something more than a common-place discussion. It was one of the subjects brought up at the meeting of the Master Car Builders' Association, but the members were reticent in expressing their views and to offer suggestions. It was considered by some that to increase the size and carrying capacity, especially of freight cars, would produce the result of decreased weight, but the committee to whom the subject was referred did not feel qualified to advise, and did not unanimously recommend such a change. They did say, however, that timber and iron is used in excess of strength. They thought by a careful selection of timber as to quality, and a careful judgment of its proportions, together with the same selection in regard to iron, associated with good and careful workmanship, lighter cars equally as serviceable could be produced.

Proportions of materials and good workmanship were especially descanted upon. In experience the only parts of car frames brought to notice in which proportions had been reduced were window posts and roof carlines. The former had been made two inches thick, but had been reduced to one inch and one eighth. The service and life of the reduced proportions was declared equal to the former. Roof carlines had formerly been made two inches thick and now were made only one half that thickness. Iron carlines used to support monitor roofs were formerly made 2 x $\frac{5}{8}$, but were now made 2 x $\frac{3}{8}$.

In conclusion, the committee advised to not materially lessen the bottom timbers, but they thought that above the sill an excess of timber and iron had been employed. They advised to discard all unnecessary timber and use skeleton construction in all places possible. For inside work, where strength was unimportant, wood as light as could be obtained should be preferred. One of the main things to be borne in mind was to place timbers of all kinds so that it should be strong in the direction of the strain, and to reduce the thickness as much as it would bear and do the service required.

In the discussion that followed, it was thought by some that it would be economy if box cars were increased in size and made so as to carry a load of fifteen or sixteen tons. If this could be done by only adding five hundred or two thousand pounds to each car as now constructed, it would reduce the number of cars per train, and also be advantageous by bringing the weight hauled nearer the power that moves it. In a report of an experiment made of a car that had been constructed with increased length and capacity, of twenty-five tons, and loaded with that weight, the result was the springing of the axles about three sixteenths of an inch.

It was thought that nearly all of the car bodies, as now made, would easily carry fifteen tons, but it was a settled conviction that the ordinary axle would not bear the load. There were not enough of standard axles in use to justify the variation of the old rule of ten tons as a load for a car. It was thought that if fifteen tons was to be made the maximum of load, in addition to strength demanded in axles, the drawhead timbers and framing of the trucks must be strengthened and more securely fastened.

PENS, INK, AND PENCILS.

Some little excitement has of late been created among the manufacturers of and dealers in stationers' wares by the introduction of pens, sold under the name of "miraculous pens," "cold water pens," etc., which by simply dipping the pen in cold water will enable one to write without the use of an inkstand.

The first instance that we find of this class of pens is that shown in the English patent No. 3,946, of 1873,, which describes a pen made of thin plates overlapping each other, between which is to be placed "ink paper," or the plates are to be coated with "chemical matters" that will, when dipped in water, produce fluid ink; but the methods of preparing the "ink paper" or the "chemical matters" are not given.

Another pen of this class was patented in this country by L. B. Bertram, Nov. 14, 1876, No. 184,319 (who also has an English patent for the same, No. 3,187 of 1874). This pen has a barrel so shaped as to receive and hold a "cartridge" of solid ink, the ingredients of which are not stated.

A third solid ink pen was patented in this country by Leon Fargue, June 12, 1877, No. 191,950 (patented in France Aug. 30, 1876), and is sold, we believe, by Faber, under the name of the "miraculous pen." It is, however, simply an ordinary pen having its concavity filled with solid ink prepared of coloring matter derived from coal tar products mixed with any sufficiently adhesive substance, such as gum, honey, glucose, or glycerin.

The pens sold under the last patent are being extensively introduced into the market, and are therefore imitated by other manufacturers. One of these imitations, prepared with ink of various colors, we find sold with a printed slip bearing the words: "Inks patented, March, 1865," but the only ink we find patented in "March, 1865," is that described in the patent 46,684, which is for the use of one of the salts of aniline, known as "rosine," for making red ink. Nothing is said in the specification about solid ink, or of any other color than red. There is also another solid ink pen sold having stamped upon it, "Pat'd 13th Dec'r, 1870," which patent, upon examination, proves to be for a peculiar form of fountain attachment, and has nothing to do with solid ink.

Within the last three or four years several inkstands provided with solid ink have been introduced under the name of "Inexhaustible," "Magic," etc., one of which we fully described, with an illustration, on page 306 of vol. 30. The use of solid ink in this manner was not new at that time, but simply a revival of an old idea, as an inkstand to be filled with solid ink is described in the English patent, No. 4,435, of 1820, and the following recipe is given therein for a suitable ink: 8 ounces of honey, 1 yolk of egg, 1½ pints extract of galls, 3 ounces gum arabic, 1 ounce sugar candy, 1 ounce indigo, ½ pint decoction of logwood, 2 ounces lampblack, 2 ounces willow wood charcoal, 3 ounces sulphate of iron, and 2 ounces blue galls in powder.

Another English patent, No. 8,175, of 1839, describes a solid ink prepared as follows: A thick paste is made by pouring a decoction of Campeachy wood upon 3 drachms of catechu, 1 drachm of extract of hœmatoxylon, 10 grains of acetate and hydrate of deutoxide of copper, 1 scruple of sulphate of alumina and potash, 1 drachm of gum arabic, 1 drachm of sulphate of protoxide of iron, and a variable quantity of sulphate of indigo. This paste when dried may be cut into blocks of suitable shapes and sizes, which, when dissolved in water, will form a good ink varying in color according to the amount of indigo employed. To make a semi-solid ink there should be added from a half to one drachm of sugar or molasses to the above compound.

Besides these English patents, we find one granted in this country to J. B. F. Jud, of New York, Feb. 10, 1874, No. 147,384, for writing inks of various colors in the form of pastes, from which the following formulas are extracted:

"To prepare my improved concentrated black ink, take 4 parts of bichromate of potash, pulverized, and mixed with 25 parts of acetic acid, 50 parts of liquid extract of logwood, ¼ part of picric acid, 10 parts of pulverized sal sorrel, 10 parts of mucilage, and ¼ part of citrate of iron, and mix well. The liquid extract of logwood is prepared by mixing 3 parts of an extract of common commercial quality with two parts of water.

"My improved red ink is prepared by taking 1 part of red aniline mixed with 10 parts of acetic acid, 5 parts of citric acid, and 25 parts of mucilage, all well mixed. For use, mix 1 part of the paste with 16 parts of water.

"My improved blue ink is prepared by taking 2 parts of aniline blue mixed with 10 parts of acetic acid, 5 parts of citric acid, and 40 parts of mucilage, all well mixed. For use, mix 1 part of the paste with 8 parts of water.

"My improved violet ink is prepared with the same ingredients, in the same proportions, as blue, with the difference that violet aniline is used instead of blue aniline.

"My improved green ink is prepared by taking 1 part of aniline blue, 3 parts of picric acid mixed with 10 parts of acetic acid, 3 parts of citric acid, and 80 parts of mucilage. For use, 1 part of this paste is mixed with 8 parts of water.

"To prepare my concentrated copying ink, take 6 parts of pulverized bichromate of potash, mixed with 10 parts of acetic acid, and 240 parts of liquid extract of logwood, and add a pulverized mixture of 35 parts of alum, 20 parts of sal sorrel, and 20 parts of mucilage. Mix well. For use, 1 part of this paste is mixed with 4 parts of hot water."

These inks are described as leaving no sediment, as drying quicker on paper than the ordinary inks, and as being non-corrosive.

As connected with this matter of pens and inks we may mention that, after considerable litigation before the Patent Office authorities, extending over two years, a patent was issued June 26, 1877, to C. Walpuski, of Yonkers, N. Y., for an indelible or copying pencil, of which the writing made with it can be as readily copied as if written with copying ink.

Indelible (not *copying*) pencils have long been known and patented both in this country and in Europe. The English patent, No. 2,316, of 1858, describes a compound for indelible pencils designed for marking clothes, etc., which consists of 1 part of wax, 1 part of hard stearine or spermaceti, 2 parts of powdered plumbago, and 1 part of vermilion. These ingredients are to be heated and ground together to form a base, to 1 part of which is to be added 3 parts of nitrate of silver.

Another English patent, No. 2,771, of 1859, gives seven different compositions for making indelible pencils, as follows: 1st. Nitrate of silver, anhydrate of potassa, carbon, and olive oil; 2d. Caustic potassa, nitrate of silver, steatite, carbon, and olive oil; 3d. Caustic potassa or soda, nitrate of silver, fuller's earth, steatite, carbon, and olive oil; 4th. Caustic potassa, nitrate of silver, talcose slate, carbon, camphor, and olive oil; 5th. Anhydrate of potassa, iodine, oxide of lead or litharge, vegetable carbon, steatite, pipe clay, and camphor dissolved in oil; 6th. Anhydrate of potassa, iodine, carbon, nitrate of silver, steatite, pipe clay, fuller's earth, and camphor dissolved in oil; 7th. Carbon, steatite, fuller's earth, nitrate of silver, iodine, caustic potassa, and oil saponified, oil of tobacco, and neat's foot oil.

On May 31, 1859, an American patent was granted to E. P. Clark for an indelible pencil for marking clothes, made by dissolving 1 oz. of glue in 1¼ ozs. of water, and adding ½ oz. of nitrate of silver, 6 to 10 drops of nitric acid, ½ oz. of lampblack, and ½ oz. of brown sugar.

The same inventor obtained another patent July 10, 1866, for a different compound for the same purpose, made by melting 1 part of nitrate of silver in a crucible, to which is added about ⅛ part of black lead, and from ¼ to ½ part of calcined gypsum. A small quantity of lampblack or asphaltum may be added or wholly omitted.

Another compound for an indelible pencil was patented May 14, 1867, to S. C. Pruden, which consisted of 1 oz. of alum, 1 oz. of sugar, ¼ oz. of gum arabic dissolved in water, mixed by slowly melting in a greased pot, and adding as much lampblack as will be found necessary to make the compound of the required degree of blackness. Instead of the lampblack, any other suitable coloring matter may be used, according to the colored pencil it is desired to produce.

From this time the Patent Office records appear to show no patent in this line, until the English patent No. 4,090, of 1874, was issued to J. L. Petit, for a copying pencil compound of aniline dyes, mixed with powdered plumbago or colored chalks, cemented together by gum water, dextrine, or other adhesive matter soluble in water. If preferred, the adhesive matter may be omitted and the compound united by pressure in dies suitable to form it into sticks of the necessary form for pencils.

The next patent granted for a copying pencil was No. 4,473, of 1874, issued to Jensen (for Dr. Jacobson of Bavaria), which describes a compound of two classes of substances, one insoluble in water and the other soluble. The first may be as follows: Sulphuret of antimony, graphite, metallic powder, or other suitable base, 10 parts; tannic acid, 7 parts; peroxide of iron, 2 parts; and dextrine, 1 part. The second may be made of graphite, 5 parts; violet of aniline, 4 parts; and dextrine, 1 part. These ingredients may be mixed with as much acidulated alcohol as will dissolve the soluble part of the mixture, then steamed off until dried, next pulverized, and finally pressed in hot moulds to form suitable sticks for pencils.

During the year 1875, we find four English patents relating to this subject, Nos. 178, 440, 460, and 1,236; but the first three of these have only provisional specifications and are rather meagre as to details. The first (J. L. Von Faber's) describes the use of four compositions of various degrees of hardness, ranging from 52 parts of aniline, 39 of graphite, and 9 of kaolin, for a soft pencil, to 25 parts of aniline, 25 of graphite, and 50 of kaolin, for a hard one. The second provisional specification (J. Flackfield's) gives a compound of wax, aniline, clay, and white of egg or albumen. The third (H. Volmer's) mentions "chemicals and black lead," without further description. The fourth on the list is the patent of F. Wirth, a communication from G. Schwanhausser, who obtained an American patent October 26, 1875, for the same invention. The following is the mode of preparing pencil compounds given in this patent: Simmer 10 lbs. of logwood chips in 100 lbs. of water until one tenth has evaporated. Strain and heat again to boiling point; then add small quantities of the nitrate of oxide of chromium until the bronze precipitate that first appears has again dissolved with a deep bluish-black color. The liquid should be next evaporated to the consistency of syrup. To six or seven parts of this add two parts of finest elutriated fat clay and a small quantity of slime of gum tragacanth. Other coloring matter may be substituted for the logwood.

The next patent is that issued to C. Walpuski, above referred to, who, in the course of his litigation before the Patent Office, proved his invention to antedate all of the above patents on copying pencils. His compound consists of 100 parts of aniline dissolved in alcohol and water, 50 parts of white clay, and 10 parts of a solution of gum tragacanth. It is stated that any other suitable coloring matter that will give a copy may be substituted for the aniline.

For the benefit of those of our readers who are not familiar with the subject of pencils and their manufacture, we may state that the ordinary pencil is filled with a preparation of graphite, commonly called black lead or plumbago, both of which are misnomers, as there is no lead or plumbum in it. Until quite lately it has been considered by chemists as a carburet of iron, but it is now generally acknowledged that, although it shows traces of iron, this metal is only mechanically mixed with it—there being no chemical combination between the two.

Pencils were originally filled with square sticks cut from blocks of graphite found in the famous Borrowdale mine, in Cumberland, England, which contained the purest ever found, but on the exhaustion of that mine the impure materials to be found elsewhere were pressed into service, after proper purification. The process adopted by the Dixon Company at Jersey City, who use a graphite found at Ticonderoga, N. Y., is as follows: The graphite is first ground fine in water, treated with sulphuric and nitric acids, and, after washing clean, heated to a bright red. Then it is mixed with sufficient water to make it run freely and allowed to pass slowly through a series of tanks arranged in steps, until the water leaves the last one of the series almost clear, having left the graphite deposited and graded in the tanks—the deposit in that nearest the overflow, being the purest, is used for the finest pencils. The graphite after being taken from the tanks is dried, and then mixed with pipe clay obtained from Rotterdam, Holland, which has been purified in the same way as the graphite, only the very finest being used for pencils, as the coarse can be utilized in the manufacture of crucibles. Upon the amount of clay used depends the hardness of the pencil—the more clay the harder the grade—about 7 parts of clay to 10 parts of graphite, by weight, forming a medium. The clay and graphite is thoroughly mixed with water and ground like paint, but is passed repeatedly through the mills, as many as twenty-four times being considered as necessary for the finest grades. When ground sufficient the pasty mass is inclosed in a canvas bag, and the water is squeezed out by a powerful press, leaving the compound in the form of a stiff dough, which is placed into a cylinder of a forming machine, and, by means of a piston driven down by a powerful screw, is forced out at the bottom of the cylinder in the form of "leads" that, after being heated in a crucible to a red heat, are ready for insertion in the wooden blocks to cut into pencils.

The blocks are formed by sawing the wood into pieces as long as a pencil, six times as wide, and half the thickness, which are afterwards run through a planing machine that not only smooths them but cuts in each block six grooves half the thickness of the "leads." In the grooves in one block the leads are laid, a second block previously coated with glue is laid on the first, and a pile of these compound blocks are placed in a press, where they remain until dry. The blocks are next cut apart into six pencils each by passing through a machine like a moulding machine, having two sets of cutters operating on opposite sides of the blocks, each of which cuts half way through the wood. The cutters in these machines are so accurately arranged and run so true that when the pencils leave the machine there is no mark to show the line of separation from the block other than the joint of the two pieces of wood inclosing the lead, and are said to be so smooth that sand papering would roughen them. The shaping machine turns out about 72 per minute, or over 43,000 per day. The pencils are then varnished or colored by another machine, at the rate of 120 per minute, or 72,000 per day; and then polished in another machine at the rate of 106 per minute, or over 63,000 per day—all by unskilled labor.

SOME NEW INVENTIONS NECESSARY FOR FUTURE ASTRONOMICAL OBSERVATIONS.

Persons who have never seen a first-class astronomical observatory, nor read a detailed description of the same, can have no idea of the peculiar difficulties which are encountered and have to be overcome at any cost. One of these is that when a telescope magnifies the size of any object, it magnifies also its motion, whether real or apparent, in the same proportion. Any one who ever looked through a spyglass knows that it must be held perfectly still, and that any motion communicated to the same, causes an apparent motion of the object observed, and that this motion is larger in proportion to the power of the glass. So in an opera glass, which never magnifies beyond 3, 4, or 5 diameters, the motion of the hand in which it is held is of not much consequence; but when using a long marine spyglass, it is necessary to hold it quite still, and some improvised support is necessary, among which one of the most convenient is the shoulder of a person standing in front of the observer. For large spyglasses or small telescopes a footpiece is necessary, and this must have more stability in proportion to the power of the glass, as the least tremulous motion in the instrument causes a strong vibration of the objects seen, so much, indeed, that observations are often interfered with from this cause.

This is the reason that it has become no longer customary to establish observatories on the top of buildings, as was done in olden times, but on the ground floor. So the old observatory of the University of Leyden, situated on the top of a high building, possessed a large Newtonian telescope constructed nearly a century ago by a maker who had attained a great reputation in this line, but the instrument was rendered perfectly useless by the continued vibratory motion, either by wind, passing carriages, movement of persons in the building, etc. The objects observed were almost always seen in a condition as if tossed by waves. Some two years ago this telescope was still in existence, and shown as a curiosity, when the writer of this article could not help but admire the useless ingenuity with which it was mounted, and which, for an instrument of that power, was entirely out of place.

By the general revival of astronomical science, which became very active at that period, it was superseded by a modern refractor, mounted equatorially on a solid base, placed at a lesser height.

And here we must explain what is meant by equatorial mounting. The apparent motion of the heavenly bodies caused by the earth's rotation around its axis, and which increases along the celestial equator, which is the principal region for observation, to about a quarter of a degree for every minute of time, is of course magnified in proportion to the power of the instrument; so for a telescope magnifying say 120 diameters, it will be 120 times as much, or 30 degrees for a minute, or half a degree for a second of time. It is evident that in such a case no object would remain in the field of the telescope long enough to be seen or studied, but stars and planets would move through the field at too rapid a rate. The equatorial mounting thus is intended to cause the telescope to follow that motion, and is accomplished in this way: in place of mounting the joints by which the free motion of the instrument is obtained, to a vertical solid pillar, they are attached to an axis placed parallel to the earth's axis, and this axis is rotated by clockwork at the rate of once in 24 hours, in an opposite direction to that in which the earth is revolving, so that these two movements neutralize one another, and the telescope, if left to itself, is rendered immovable in space, except following the earth's yearly orbit, which, however, does not influence the direction of the instrument to any perceptible degree.

The apparent motion of the sun is slower than that of the fixed stars, for one day per year, or nearly one degree for every 24 hours; the apparent motion of the moon is again slower to an amount of nearly thirteen degrees for every 24 hours. The clockwork regulating the rotation of the telescopic axis has to be set in accordance to the intention to use the telescope to observe the fixed stars, sun, or moon, and this movement must be more minutely regulated in proportion to the power of the instrument.

Lately a great pressure has been brought to bear on those having the power or means of managing or founding astronomical observatories, so as to induce them to have large powerful telescopes constructed. Million dollar telescopes have been spoken of, but the difficulty of their mounting and the absolute necessity of regulating their proper motion to follow the objects observed appears not to have been thought of, while it is one of the most important mechanical problems with which the utility of such instruments will stand or fall.

Suppose a telescope could be constructed which would bring the surface of the planet Jupiter to within an apparent distance of ten miles. Then not only the motion of the earth herself, but also that of the planet in his yearly orbit, and the immense velocity of rotation around his axis in ten hours, would have to be compensated for by the clockwork attached to the telescope, as without it the objects would fly across the field with the velocity of a railroad train. To realize the truth of this assertion we have only to consider that the circumference of that planet amounts to a quarter of a million miles, so that every point of its equator moves through that distance in a little less than ten hours, equivalent to a velocity of about 29,000 miles per hour. Seeing objects moving with such a velocity at a distance of ten miles is equal to seeing objects move with $\frac{1}{500}$th part of that velocity at a distance of $\frac{1}{500}$th part of ten miles, which corresponds to observing a velocity of 50 miles per hour, at a distance of 34 feet. Looking therefore with a telescope bringing the surface of Jupiter to an apparent distance of ten miles would be equivalent to looking at a distance of only 34 feet at a railroad train moving at a velocity of 50 miles per hour. Of course nothing could be distinguished. The problem is therefore not alone to make the lenses and the tube of a gigantic telescope, but an equally important problem is the mounting and clockwork required to make observation possible. And this becomes an interesting problem because with such high powers the earth's yearly and daily motion, not alone but also the velocity in orbit and rotation of planets must be taken in account, as well as the inclination of the axis, of planes of orbits, and of rotation.

HEREDITARY AS A FACTOR IN PAUPERISM AND CRIME.

Dr. Edward H. Parker recently read a paper of the above title before the Medical Society of the State of New York, at Albany, in which he reviewed the question of hereditary as an element in the production of crime and pauperism. He claimed to do this simply as a physiologist and with no sentimental, biasing notions. The elements for his line of argument he obtained from the Report of the Prison Association and the Report of the State Board of Charities of New York. He does not deny that anatomical, physiological, mental and pathological peculiarities of parents *may* be transmitted, but that they *will be* is not so absolutely certain. Strength, pluck, and skill may all be inherited, which when turned in one direction makes the skillful mechanic, and when by circumstances diverted from their legitimate channel, produces the expert criminal. He declares the mental characteristics of the two to be much the same, except that the criminal—a burglar, for instance—needs physical strength and reckless audacity, all of which may be inherited by both, but which the former can do without. The qualities that may be attributed to hereditary do not make the one more a criminal than the other an expert mechanic.

In reply to the question if there is not a certain base propensity, a lowness of character, which may be transmitted, he replies that physiology knows no such peculiarity in the human animal. He advocates that the cure for unbalanced lives is training, and that the general phenomena of crime is due to surroundings, or, to use his own words, to environment. Let the pure and moral mind come in contact with and become enveloped by morbid and immoral tendencies, and the result will be immoral. Environment makes generation after generation of thieves, burglars, prostitutes, criminals, etc., and a different environment makes generations of learned persons, mechanics, tradesmen, etc. Observation, he says, teaches that environment determines for the most part how capacity shall be trained and how used.

He denies that the evil tendency to crime is corrected by correcting physiological tendencies, nor has he any confidence in the training of a bare morality. Men can only be restrained from crime by deep, profound religious training, a feeling that goes down into the depths of the soul, which makes it a part of one's self to know that certain things must not be done because they are sins.

Mr. Parker says, as a physiologist, he is unable to see any heredity as a factor in pauperism, with the exception of feeble mind and body, and these are rather indirect factors. The State must be made to change this radically, rather than to lament the impossibility of making physiological changes over which the State can, from the nature of things, have no control.

KEELY MOTOR STOCK AT A DISCOUNT.

A well-known circus man named James Kelley has failed, and the public are favored with a schedule of his debts and assets. The former amount to nearly a quarter of a million dollars. Among the latter are seventeen cages of wild animals, one hundred and twenty performing horses, five royal tigers, an intelligent zebra, a double-humped camel, five elephants, and, bigger show than all, forty shares of Keely Motor Stock. The bankrupt alleges that the latter is worthless; but only a few months ago the financiers of the motor concern claimed that that number of shares was worth at least four millions of dollars.

The Precious Metals of the Land of Midian.

On the eastern coast of the Gulf of Akaba runs the ancient land of Midian, and for long years past that country has been supposed to teem with mineral wealth. The Khedive, whose viceregal rule extends to Midian, had long a desire to put rumor to the test, and asked Captain Burton to make a visit of inspection. The party, which included a secretary and an able mining engineer, M. George Marie, left Suez on the 21st of March last, and proceeded by way of Moilah to Eynounah Bay, at the entrance of the Wady, or Valley of Eynounah, on the eastern side of the Gulf. These wadies are curious. The coast is divided from the interior by a range of granite and porphyry mountains running about parallel with the sea; but water has worn its way as usual, and these gorges, each with its mountain torrent, occur at frequent intervals. They are barren, rocky places, with no possibility of much culture, and yet they all bear signs of abundant population in times gone by.

Large towns, built not of mud, as Arab towns so often are, but of solid masonry such as the Romans always used, roads cut in the rock, aqueducts five miles long, remains of massive fortresses, artificial lakes—all these signs of wealth and numbers are reported by Captain Burton. According to him the reason of it all is not far to seek. The rock is full of mineral wealth. Gold and silver they found, and the former seems to exist in quantity sufficient to repay the labor of acquisition. Quartz and chlorites occur with gold in them just as they are found in the gold districts of South America. The party tested both the rock by crushing and the sands of the stream by sifting, and each with good result. Tin and antimony they also discovered, and they had evidence of the existence of turquoise mines. Each ruined town had its mining works; dams for washing the sand and crushed rock were frequently seen; scoriæ lie about near ancient furnaces; in short, the traces are numerous of a busy mining population in a country which seems to be full of mineral wealth. From Makna, or Mugna, the capital of the land of Midian, up to Akaba at the head of the Gulf, Captain Burton reports the country as auriferous, and he believes the district southwards as far as Gebel Hassani—a mountain well known to geographers—to possess the same character. He even goes so far as to say that he has brought back to life an ancient California.—*London Times.*

Dogwood.

There are eight species of dogwood in North America, but only one is entitled by its size to be classed with the forest trees. It is the most interesting, too, for the value of its wood, the properties of its bark, and the beauty of its flowers. It is generally known by the name of dogwood, and in Connecticut it is also called boxwood. The dogwood is first seen in Massachusetts, between the 42d and 43d degrees of latitude, and in proceeding southward it is met with uninterruptedly throughout the Eastern and Western States, to the banks of the Mississippi. Over this vast extent of country it is one of the most common trees, and abounds particularly in New Jersey, Pennsylvania, and Virginia, wherever the soil is most gravelly, and somewhat uneven; further south, in the Carolinas, Georgia, and Florida, it is found only on the borders of swamps, and never in the pine barrens, where the soil is too dry and sandy to sustain its vegetation. In the most fertile districts of Kentucky and west Tennessee, it does not appear in the forests except when the soil is gravelly and of a middling quality. The dogwood sometimes reaches 30 or 35 feet in height, and 9 or 10 inches in diameter, but it does not generally exceed the height of 18 or 20 feet, and the diameter of 4 or 5 inches. The trunk is strong, and covered with a blackish bark, chapped into many small portions, which are often in the shape of squares, more or less exact. The branches are proportionately less numerous than on other trees, and are regularly disposed, generally in the form of crosses. The wood is hard, compact, heavy, and fine-grained, and is susceptible of a brilliant polish. The sap is perfectly white, and the heart is of a chocolate color. The tree is not large enough for works which require pieces of considerable volume. It is used for the handles of light tools, such as mallets, small vises, etc. In the country some farmers select it for harrow teeth, for the hames of horses' collars, and also for lining the runners of sledges; but, to whatever purpose it is applied, being liable to split, it should never be wrought until it has been perfectly seasoned. The shoots, when three or four years old, are found proper for the light hoops of small portable casks. It will also make good cogs for mill wheels, and its divergent branches are taken for the yokes which are put upon the necks of swine to prevent their breaking into cultivated inclosures. Such are the profitable uses of this tree, which also affords excellent firewood.

TO MAKE cementing putty for gas or water pipes, take red and white lead, equal parts, and mix with boiled oil.

MACHINE FOR FORGING SCREW THREADS.

We illustrate from the *Engineer* a machine manufactured by Bouchacourt & Delille, of Fourchambault, Niévre, France, and used by them for forging screw threads on rods and screws, a specimen of the latter of which is illustrated in

Fig. 2.

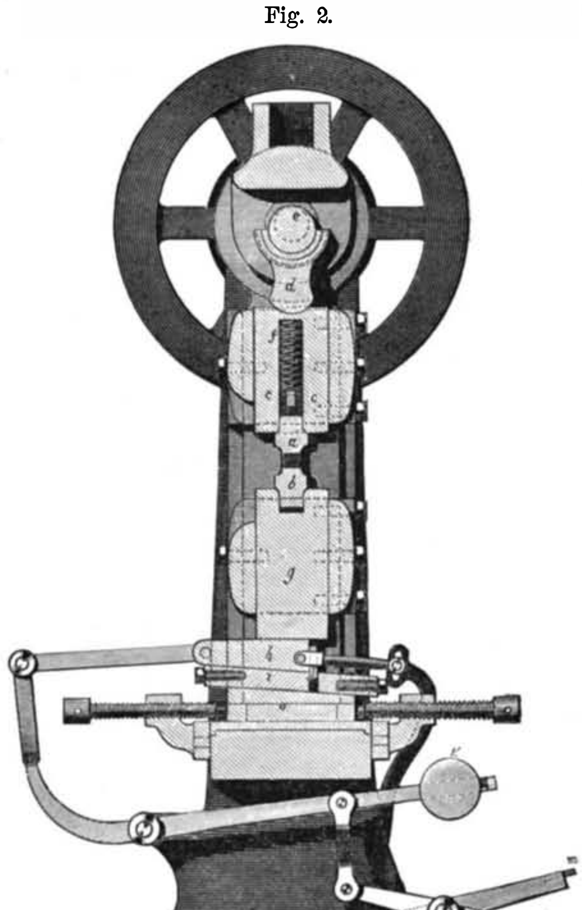
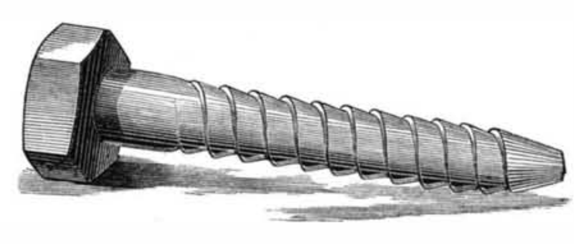
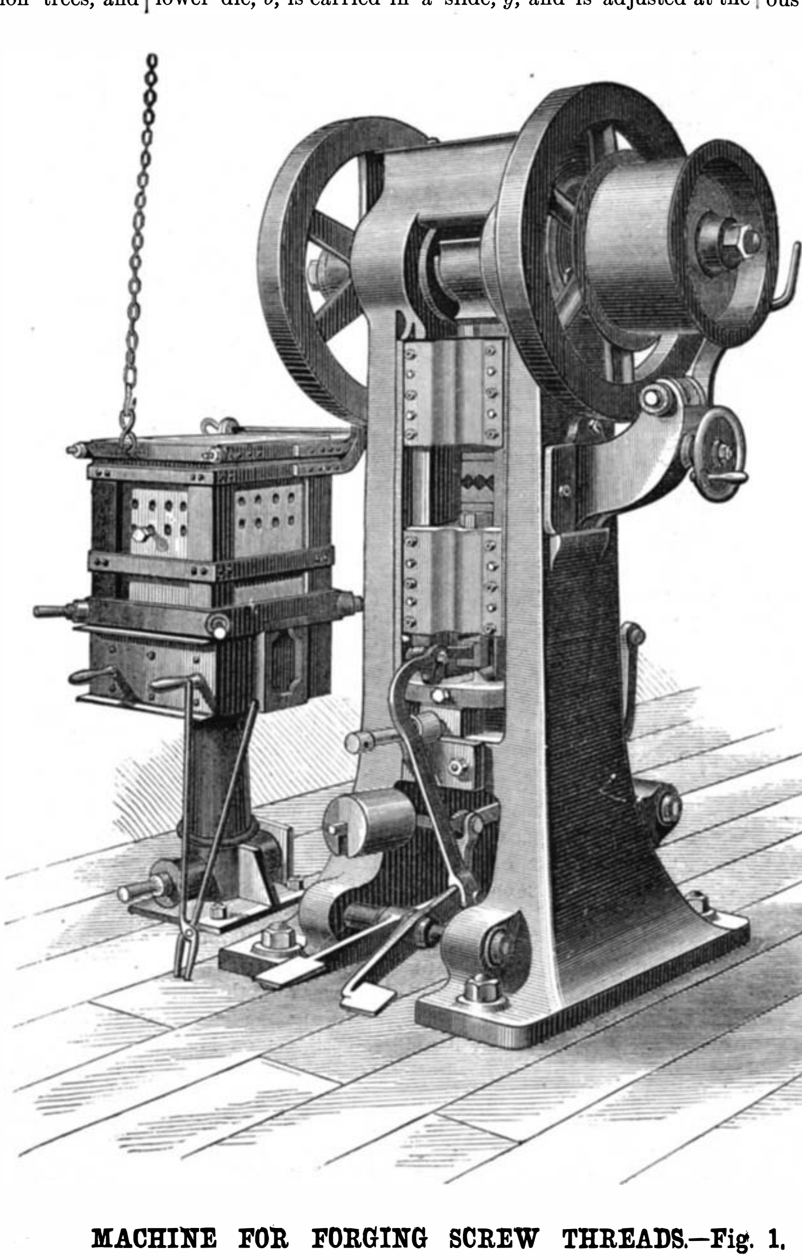


Fig. 3. As forgings, the threads are beautifully clean, and for the general work of coach screws much stronger than the cut threads. A perspective view of the machine is given in Fig. 1, and a vertical section of it is shown in Fig. 2. In the latter figure, *a b* are the screw dies. The rod or bolt to be threaded is placed upon the lower die, *b*, and fed forward whilst screwing it. The upper die is mounted on a slide, *c*, which is actuated in the downward direction by an eccentric, *e*, on the main shaft and the toggle bar, *d*, the upward motion being obtained by an internal spiral spring, *f*. The lower die, *b*, is carried in a slide, *g*, and is adjusted at the proper distance from the upper die by means of wedge, *h*, and the inclined plate, *i*, beneath the slide, *g*. The wedge, *h*, is operated by a pedal, *l*, and secured in its highest position by a bolt, *j*, received in a mortise made in the plate, *i*, the bolt being operated by a pedal, *m*. In order to release the wedge and return it to its lowest position, the bolt is raised by pressing down the pedal, *m*, whereby the wedge is free to be returned by the counterweights, *k*, in connection with pedal, *l*; slide *g*, carrying the lower die, then descends by its own gravity and so separates the two dies sufficiently

Fig. 3.



to allow of the removal of the screw bolt or rod therefrom. To compensate for the wear of the dies, and admit of their adjustment, another wedge, *o*, with screw adjustment, is disposed below the inclined plate, *i*. It is not, of course, pretended that there is anything new in forging screw threads, but the machine here described gives an idea of the best machinery now in use in France for that work.



MACHINE FOR FORGING SCREW THREADS.—Fig. 1.

Mechanism of Chemical Reactions.

M. Berthelot has observed some novel facts regarding the direct oxidation of haloid salts and of the sulphurous and arsenious acids. The haloid salts, if slightly moistened, absorb ozone at the common temperature—a fact well known as regards iodide of potassium, which yields iodate of potassa and a little free iodine. It is the same with the chloride of potassium, which produces chlorate, and with the bromide, which yields bromate, though both in small quantity. The absorption of ordinary oxygen by iodide of potassium disengages the heat, say + 44·1 for IO_6K, and a *fortiori* the absorption of ozone. On the contrary, the conversion of chloride of potassium into chlorate by ordinary oxygen absorbs — 11·0, and that of bromide into bromate — 11·1. The superior energy residing in the ozone, + 29·6 for O_6, a quantity greater than 11·0, is consumed by the direct synthesis of the chlorate and the bromate of potassa. In the case of sulphurous acid we find that the production of anhydrous sulphuric acid liberates—

$$SO_2+O=SO_3 \;.\;.\; +17{\cdot}2.$$

But this reaction, by means of dry bodies, does not take place at common temperatures, and even if the two gases are kept in contact at 100° for forty-eight hours, we have still no indication of combination. But if water is added the reaction is gradually effected, and the dissolved sulphurous acid is converted into sulphuric acid. This corresponds to a liberation of heat double that of the for mer—SO_2 dissolved $+HO+O=SO_3HO$ dissolved +32·2. Even in the cold, when dry sulphur and oxygen (or rather ozone) combine under the influence of the electric effluve, a certain quantity of anhydrous sulphuric acid is also produced.

A Wooden Observatory Dome.

The authorities of the College of New Jersey, at Princeton, in that State, have decided to substitute a wooden dome for the present iron structure upon their astronomical observatory, because of the confusion of magnetic currents occasioned by that material. It was agreed that a boat-builder would be the best person to make it, as it is to be composed of lap-work; and Mr. James Beetle, a veteran boat-builder of New Bedford, Mass., has already begun upon the model. The dome is to revolve on iron balls, operated by machinery whose motion is regulated by a clock-work attachment. It will be constructed of oak, maple, chestnut, and cedar, copper fastened, and divided into equal sections by fourteen chestnut ribs, rising from the base at intervals of about four feet, and meeting at the top. The outside will be covered with cedar clapboards, showing four inches and lapping seven eighths of an inch. The dome will be eighteen feet in diameter; the base, to a height of ten and five eighths inches, is perpendicular.

A Novel American Export.

It is said that Jabez W. Abbott, employing mason of Passaic, has received orders from R. Neill & Sons, builders of Manchester, England, to send between 200 and 300 skilled carpenters and joiners to Liverpool. Every man must have a complete kit of tools. Steady work is to be guaranteed to good men. Wages are at the rate of 8½*d.* an hour; fifty-one hours a week is the working time. Of 150 masons who went over last year, only six have returned to this country. A new detachment lately sailed from New York.

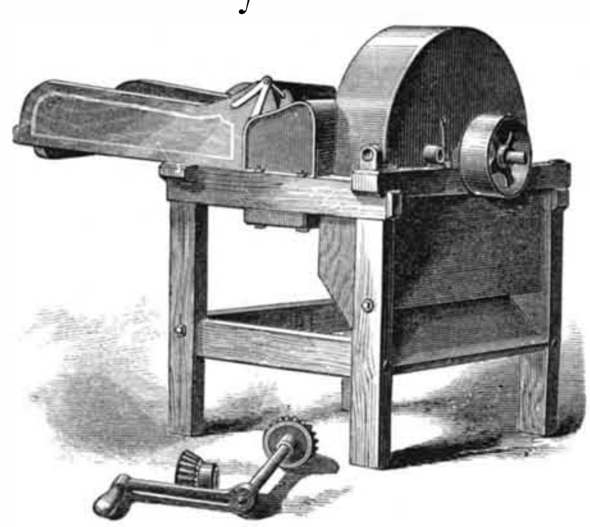
The Use of Balloons in Warfare.

The *Pall Mall Gazette* says: "It appears from the report of the result of a series of experiments to determine the utility of balloons for reconnoitering purposes recently carried on in Germany, and extending over a considerable length of time, that after repeated trials a balloon was constructed that could be packed in a comparatively small space and carried about without being damaged or rendered in any way unfit for immediate use. A second difficulty arose in providing a portable apparatus capable of supplying a sufficient quantity of gas for the inflation of the balloon whenever and wherever it might be required to use this latter. But this impediment was likewise overcome, and an apparatus was designed which could generate in from two to two and a half hours enough hydrogen to raise a balloon carrying three persons. Unfortunately, however, there has been found to be yet another obstacle in the way of using balloons for reconnoitering purposes for which no remedy can as yet be devised. From the height to which the balloons must ascend, useful observations can only be made by the aid of telescopes. The balloons must, however, necessarily be 'captive,' that is, they must be confined by a rope and prevented from drifting away, perhaps only to fall into the hands of the enemy; and it is found that when there is the slightest current of air such a captive balloon begins to rotate about its vertical axis, and this so rapidly as to prevent observations being made with the necessary accuracy and detail. Consequently the conclusion has been arrived at that captive balloons cannot at present be used for reconnoitering purposes, and that, therefore, the employment of balloons in war must be limited to carrying dispatches and information." Perhaps, however, some Yankee inventor can discover a practical method of preventing the rotation.

IMPROVED FODDER CUTTER.

The accompanying engravings give views of an improved fodder cutter, designed to reduce to a more palatable condi-

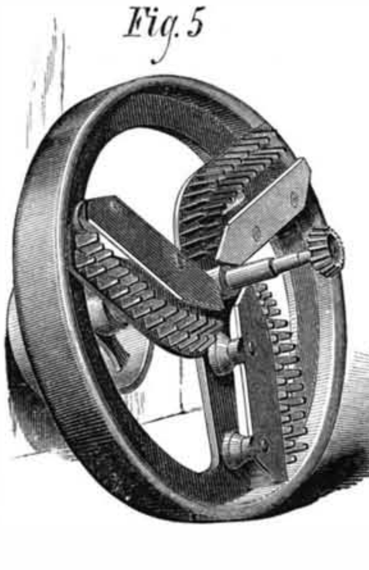
Fig. 1



tion the coarse food for stock usually found upon a farm. It is also claimed to meet the requirements of paper manufacturers, egg packers, and others, who have occasion to use finely cut material for their purpose.

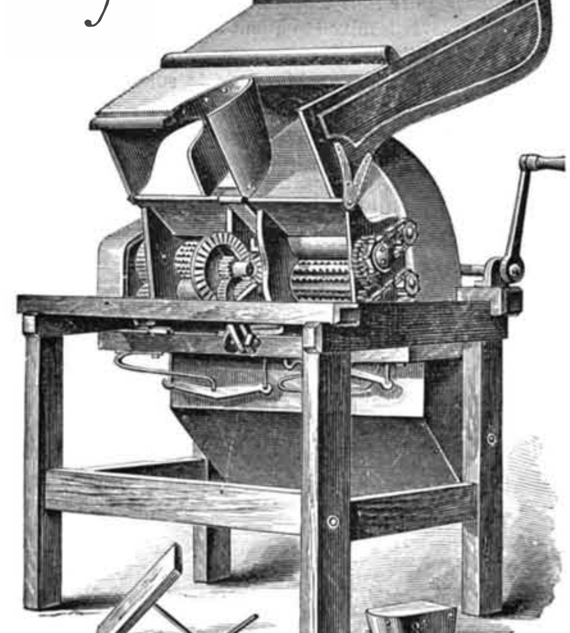
In Fig. 1 is shown a view of the machine arranged with a pulley on the main shaft to receive motion from a belt. The machinery is enclosed to prevent accident or the material to be cut from coming in contact with the working parts. The circular cover over the fly wheel is independent of the frame and can be readily removed for the purpose of sharp-

Fig. 5



ening the knives, etc. This style of machine has two feed boxes and two sets of feed rolls, both feeding to one set of knives. In Fig. 2 is given a view of the machinery and the arrangement for folding up the feed boxes for the purpose of oiling and changing the length of cut. The boxes are hinged to the top girder plates and can be folded over the machine and rested on the circular cover over the fly wheel. This can be done while the machine is in motion. The two sets of feed rollers are driven independent of each other by means of an endless chain. This arrangement gives the feed rolls perfect freedom in adjusting themselves to the varying thickness of the material that passes between them. Tension springs are so made and arranged as to give the required pressure to the feed rolls regardless of their ever

Fig. 2.



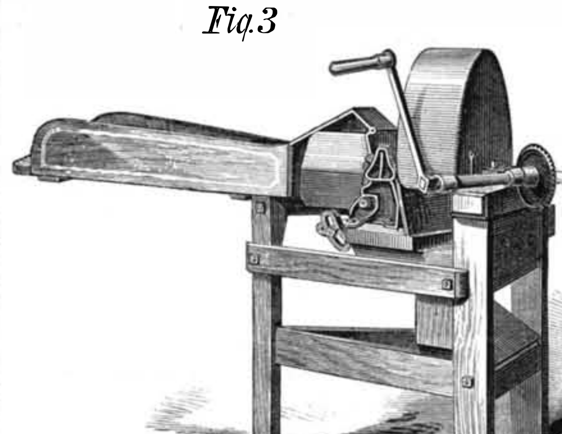
changing position. These springs press on the center at cross beams on which are hinged iron rods passing upwards and attached to the bearings of the feed rolls. A bevel wheel is attached to the fly wheel shaft which through intermediate wheels gives motion to a wheel placed on a small shaft extending from side to side of the frame. On each end of this shaft is placed a spur and sprocket wheel, which communicates motion to the feed rolls by means of the endless chains. For the purpose of changing the length of cut a spur wheel is placed on the hub of the bevel wheel and a second spur wheel engaging into it is made interchangeable, and can be changed *vice versa*, being of different diameters. Should it be desired to make more than two different length of cuts, additional wheels are added. The stationary shear or throat plates are made adjustable by means of set screws, and are provided with inclines on each end to prevent them from slipping on the edge of the knives. They are also provided with a guard on the inner end for the purpose of guiding the knives and preventing them from striking on the shears. Attached to the shears is a scraper that extends to the feed rolls and prevents the material from crowding in between the rolls and the stationary shears.

Fig. 3 represents the machine constructed with one set of feed rolls and one feed box. This style of machine embraces the same feature as Fig. 1 with the exception of cutting only on one side of the fly wheel shaft. It is arranged with a set of bevel gears and a crank to operate it by hand power. The end of the main shaft outsid3 of the bevel gear is attach a second hand crank in case it is desired to have two operators.

Fig. 4 represents the same style of machine arranged with pulley to receive a belt for the purpose of driving it by steam or other power. A hand crank and bevel gear can be readily attached by detaching the pulley, when it is arranged as shown in Fig. 3.

In Fig. 5 is given a view of the fly wheel and the main shaft. Upon this shaft is mounted the driving pulley and

Fig. 3



small bevel pinion that gives motion to the feed gear. On this wheel is also mounted the whole cutting apparatus. The knives, three in number, are placed on adjustable supports which are provided with inclines and arranged to revolve on similar inclines on the spokes of the wheel. By a partial revolution of these inclines the knives can be adjusted to a position nearer to or from the shear plates. Two strong bolts pass through each knife as well as the supports and the spokes of the fly wheel. By this means the knives are firmly secured in their proper position. Preceding the cutting knives are arranged, on curved bars, a series of small steel blades set closely together, so as to split and crush corn stalks, ears of corn, and all coarse material into small portions. The blades operate at a right angle or nearly so with the cutting knives which are arranged in a curved line from the center of the fly wheel.

These machines are manufactured in various styles and sizes from a small hand power cutter to a large power machine requiring steam or other power to drive it.

For further particulars relative to the sale of rights, territory, or the sale of machines, address the manufacturers, Joseph Dick & Bro., Lock Box 33, Canton, O.

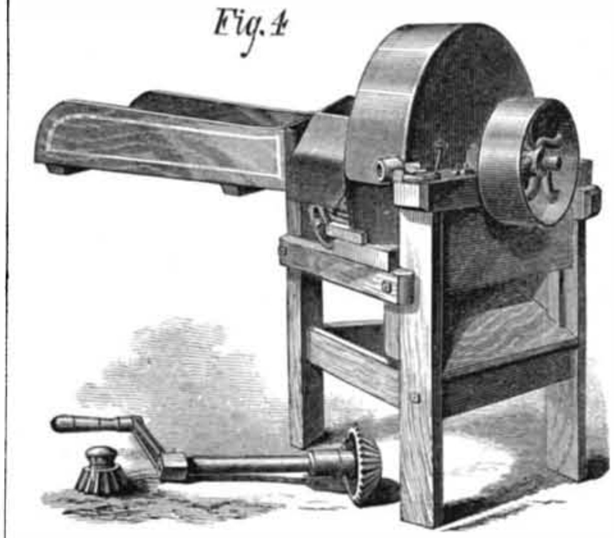
Foreign Textile Improvements.

Certain modifications are announced as made in the Swiss needle embroidery machinery, by M. L. Marliere, for embroidering of furniture stuffs, and new applications of gold and silver work. There is no change in the main parts of the machine, but the number of needles and cards is largely increased. Each of the new machines measures 4·50 meters by 3·50, and has 450 nippers, or 650 when they hold and let go the needles by mechanical pressure on the nippers, which arrive in the opposite direction at the back of the material underhand and then seize them again by means of a to-and-fro movement which the attendant gives to the carriages.

M. L. Neveu has introduced a new method of weaving galloons, etc., with thick wefts. He so arranges his loom that two shuttles pass at the same moment from the opposite sides of the loom, each carrying half as many threads as are required for the weft, which thus become thoroughly united, and produces tissues of the same thickness as by the ordinary process.

A French engineer has introduced the covering of weaver's reeds with nickel by electro-plating to preserve them from oxidation; the leaves may be acted upon before mounting,

Fig. 4



but the inventor recommends the coating of the complete reed.

Another inventor has produced imitations of Utrecht velvet in flax, hemp, and jute.

Sacks without seams are being made by Mr. Cerfornt in ordinary looms, we are told, with two warps, one above the other, and a single shuttle which passes through both warps; but we are not told how this is managed without complication. The sack is finished by weaving the two warps together.

An improved loom is reported, the invention of M. Gulcher, for three or five shuttles as required, the principal features being a new arrangement for withdrawing the brake ever during the changing of the boxes, rendering the operation simple and safe, and improved movement of the jacquard.

A teazel machine called "velvet pile engine," invented by M. Fecken, is said to produce a remarkably downy pile; its peculiarities are described as working with rolling instead of fixed teazels, and mounted on oblique spindles, some in one direction and some in the opposite, which are described as gliding and rolling over the surface of the cloth without tearing the wool, and producing a pile finer than can possibly be got up by any other method.

The application of the continuous principle to metallic dividing engines is thus summed up by M. Nockin, the inventor. "The apparatus consists: 1. Of a dividing cylinder, into which penetrate the saws, and which cylinders are covered with leather or other material; 2. Endless metallic card bands working in grooves of the cylinders; 3. Circular saws assisting in the division; 4. A circular brush; 5. Disks which detach the material from the cylinders; and 6. Drawing cylinders."

A Novelty in Competition.

The Ayr (Eng.) Town Council, in the competition for the new town hall, intend to give a premium of £25 to each architect whose design is rejected, while the accepted design is paid for in the usual way. It is barely possible that this may prove a somewhat costly competition for the town of Ayr.

MESSRS. KOHLER & SILBERZOHN, Sheboygan, Wis., are the manufacturers of the improved feed cutter illustrated in our last issue. Parties desiring information will address them as above.

Communications.

Hydraulic Cement, Stone, etc.

To the Editor of the Scientific American :

Hydraulic limestone consists of common lime, with an admixture of clay and sand, often interspersed with small particles of iron and mica. Where hydraulic limestone cannot be obtained, take the following composition: 3 parts fine unslacked lime, and 2 parts potter's or strong joint clay or slimy loam. If the clay contain iron and mica, all the better. This composition must go through the water process, or what is commonly termed washed, so that the particles of lime and those of the clay will become amalgamated, forming hydraulic matter. The solution must then be sifted through a thin horsehair sieve, sufficiently coarse to admit of the fine particles of sand passing through with the solution into the evaporating pan. The water being evaporated will leave the hydraulic matter in a soft plastic condition, which can either be cut up into chunks or moulded into bricks or blocks in the usual manner. These burnt at a high pitch of fusing heat, in a kiln or furnace built expressly for fusing the great portion of the material, for about 36 or 40 hours, will when ground fine, the finer the better, form an hydraulic cement equal in every respect to the best Portland, in some respects even preferable, inasmuch as it can be manufactured so that it will immediately set in water when newly mixed, which the Portland cement will not admit of.

For making hydraulic stone for building purposes, take 1 part cement, 2 parts fine, clean, sharp sand. For paving blocks, tiles, etc., say 6x6x2, 9x9x2, and 12x12x2, take 1 part cement, 1 fine sand, 1 coarse sand, pass through ¼ sieve. For bricks, take 1 part cement, 2 parts fine, clean, sharp sand. These must be pressed. Blocks moulded. Roofing, paving and the like require to be pressed.

Austin, Texas. DIMELOW LABORATORY.

Pumping with Tight Connections.

To the Editor of the Scientific American :

In your issue of August 4, J. R. Smyth gives some experimental data in regard to pumping with tight connections, but gives no data bearing upon the subject of my query in your issue of June 9, as he admits having bored two holes only 100 feet apart, one of which would operate as a vent for the other. The case to which I referred is that of a well 1,200 feet deep, cased with tubing to a depth of 735 feet, there being no other well of similar character nearer than 16 miles. An attempt was made by the local engineers to pump with tight connections which utterly failed, as did also the attempt for about 12 hours hard labor by the foreman of a large establishment in Chicago, from whom the machinery was purchased, but as soon as the suction pipe was placed inside the tubing, there was not the least hesitation in taking water.

Morrison, Ill. E. W. PAYNE.

A Reminiscence of Nail Making.

To the Editor of the Scientific American:

I notice your article on "nail making" in the last number of the SCIENTIFIC AMERICAN. You do not make a distinction between the nail made with or without heads. I believe up to about 1816 nails were cut and headed by hand in two operations. I think it was about 1816 (not later) that Richard Reeve of this place invented the first known machine for cutting and heading the nail at one time. He sold the right to a Pittsburgh Company, he (Reeve) retaining the right of Ohio. He began the manufacture by horse power, the old-fashioned large cog wheel pulled around by the horse attached to a lever. About 1820 he and his brother George built a nail factory and a rolling mill for rolling their own nail iron. The iron made at or near the place did not prove a success for nail purposes, and they could not import iron from Pittsburgh and make the nails to compete with the Pittsburgh Company. After several years of struggle they had to succumb to competition.

Zanesville, O. A. C. R.

The Sea Monster.

To the Editor of the Scientific American :

In your issue of August 4, 1877, I saw an account of a sea monster given by Lieut. W. P. Haynes, of H.M.S. Osborne, and thinking it might be of interest to inform you that I have seen the above mentioned corresponding with the description given of the same. The head I did not see, as the sea was running very high at the time. I saw the same about mid ocean on my trip from Bremen to Baltimore in the year 1851, on board the ship Schiller.

Fredericksburg, Va. CHAS. F. BARLOSIUS.

A Wise Decision.

At a late meeting of the New York Board of Health, a communication was received from the Board of Police in respect to a proposition from a firm of disinfectant manfacturers to disinfect the garbage and street dirt, with a mixture of carbolic acid and copperas, at the place of final deposit, and requesting the opinion of the Board as to whether the garbage and street dirt so treated is suitable for filling purposes within the city limits. The Board decided that the disinfection of the material with the preparation referred to renders it less offensive, and that it may be safely used in the filling-in of bulkheads and docks; but it cannot, they say, be safely used in localities likely at any time to be oc cupied by dwellings or factories.

Architectural Science.—Questions and Replies.

Describe the meaning of "coarse stuff" and "fine stuff."— "Coarse stuff" is a rough mortar formed by mixing one or one and a half of sand to one of lime by measure, and about one pound of beast hair (which should be strong and free from grease or dirt) to every 3 or 4 superficial feet of mortar. Coarse stuff is put on the walls or ceilings to form the first coat, and is scored to form a key for the second coat. "Fine stuff" is pure lime slacked with small quantity of water, and afterwards mixed to about the thickness of cream; the water is then allowed to evaporate until thick enough for use. A small quantity of white hair is sometimes mixed with it. It is used for the second or finishing coat, and should be applied when the coarse stuff is stiff.

In first rate work, what are the proper number of coats required for walls and ceilings?—Three, namely, 1st coat, coarse stuff; 2d coat, fine stuff; 3d coat, fine stuff mixed with a little hair if to be papered, or plasterer's putty mixed with sand if to be colored.

Describe the mode of finishing walls.—1. For paint.—Surfaces which are to be painted are finished with a coat of bastard stucco, consisting of ⅔ fine stuff and ⅓ fine sharp sand. 2. For paper.—The finishing coat is a kind of inferior fine stuff or stucco, mixed with hair to form a firmer coat. 3. Colored walls are properly washed with size before the application of the color. 4. Cement walls.—In some positions it is advisable to have a cement finishing coat to form a hard surface. It is essential that the cement coat be grounded out with cement, as it will not properly adhere to plaster. It is finished with the trowel, and when a pure white surface is required for marbling, Parian cement is used. 5. Tile walls. —Tiles, or thin squares of marble, etc., are used as dadoes, and are set and jointed in pure cement.

What is the best cement for internal walls left for decorations? —The Parian cement is the best for such purposes. It may be procured of two qualities, known as coarse and superfine. For an under coat the coarse quality may be used, with an equal quantity of fine sand, finishing with a thin coat of pure cement of the same quality on surfaces to be wholly covered with paint or paper; or with the superfine quality when to be tinted or polished. The superfine gives a pure white surface capable of taking a brilliant polish, and is rendered non-absorbent and washable. This cement may be tinted with any colors required—either mixed with the finishing coat—worked as scagliola, or, after the cement is applied to the wall surface, it sets sufficiently hard within 24 hours to admit of painting or papering. As no efflorescence is given off, the most delicate tints may be applied with safety. It is more economical to use Portland cement and sand as an under coat, or selenitic cement if quicker setting is required. Martin's and Keene's cements are also white and quick setting cements, and may be used for similar purposes as the Parian; but the latter is considered to be most easily worked. Johns & Co.'s cement may also be used as a finishing coat on common plaster, for surfaces to be painted, etc.

In designing cement or plaster cornices and ceilings, what principles should be observed?—The outline or profile of cornices should be designed so as to suit the apartments in which they are formed; the members must be proportioned so as to give the best gradations of light, according to the position of windows, keeping in view the friable nature of the materials to be employed, and avoiding thin edges with deep under-cuttings. The arrangement of mouldings in a cornice will be regulated by the relative height of various rooms, or the proportion that height bears to length and breadth of apartments. Where the ceiling appears too high for the size of the room, the apparent height may be diminished by forming the cornice chiefly on walls, or by introducing a coving springing from walls to ceiling, with any curve suitable. If the ceiling is low, apparent height may be obtained by forming a cornice with nice projections thrown chiefly on ceiling—a hollow being worked at junction of walls and ceiling so as to give a lighter appearance, and prevent excess of material at that point. Increased projections require to be supported by "dubbing out"—by driving in flat-headed nails—or by bracketing; or, what is more substantial, by corbelling out the brickwork approximately to the profile required. A section of the intended cornice may, with advantage, be tried in position, and the effect of adding enrichments, or the cutting-in with different colors noted, before a final selection is made. In designing ceilings the form and height of rooms will regulate the construction; when of a good height ceilings are best formed in panels. If arched or domed the panels should be arranged to accord with direction of rafters, etc. For flat ceilings the divisions formed by roof trusses, or by girder floors, with binders between, may be advantageously used, the laths or battens being fixed to fillets nailed to sides of same. Single floors with deep joists at intervals are also well adapted for such a construction. The projecting timbers may either be wrought or covered with wood casing or plaster, adding mouldings or enrichments as required. The main divisions of ceiling should range so as to come over the solid parts of walls and not over openings. On ordinary ceilings a "key" may be obtained for the required projections in forming panels, by using flat-headed nails or bracketing. The number, size and shape of panels formed will depend on the extent of surface to be covered and shape of room. The center panels—especially with coved ceilings—may be more deeply recessed than the others, and should be finished with a center piece. Deep recesses should not be given to panels when the ceiling is low, as the shadows formed tend to darken the room. In such positions the ceiling should be flat, or with slight projections formed in the plaster.

Give a specification for general plastering.—The internal plastering to be executed with well burnt chalk lime of good quality, well mixed with clean, sharp drift, or river sand, and strong hair. The laths to be strong laths and half laths, nailed at both ends with cast iron nails. Lath the partitions and ceilings, render the walls, and float, set, and finish for paper, and whiten the ceilings. Twice lime-white the walls of cellars and stairs leading to them, also outhouses. Run cornices to drawing, dining, and breakfast rooms, 12 inch girt, with one enrichment to each, 2½ inch girt, the cornice to principal entrance and hall to be 9 inch girt; and to the landings, bedrooms, and dressing rooms on first floor, put cornices 7 inch girt. The external work to be run, moulded, and finished in Portland cement of the best quality, in the proportion of 1 of cement to 3 of clean sharp sand.—*Building News.*

Lighting Factories by Electricity.

The application of electricity to the lighting of factories seems at last to be accomplished. For some time the magneto-electric machines of Gramme have been used in the lighting of certain factories in Paris and its neighborhood, and the number goes on increasing, and where the ceilings are lofty, and direct light applicable, the success is perfect. Among the establishments so lighted are those of MM. Cail and Cie., engineers; MM. Sautter, Lemonnier, and Cie., the makers of the Gramme machines, both of Paris; and MM. Thomas and Powell, of Rouen, and at the Fives-Lille Works.

This system of direct lighting, however, is quite inapplicable to weaving or spinning sheds, the ceilings of which are only a few feet from the floor; the light is much too intense, and everything which impedes it, and shafting driving bands, and machines, create intense black shadows.

The problem was to get a light which, like that of the sun, allows objects to be seen in shadow, and this has been achieved by throwing all the light, by means of a hyperbolic reflector, on the whitened ceilings and walls of the loft, and leaving the workpeople in the general shadow, which is sufficiently illuminated by reflection from the whitened walls and ceiling, and everything is seen as in shadow on a bright sunny day, the eye is not fatigued, nothing is painfully brilliant, and nothing obscure.

Our respected contemporary, *Le Moniteur des Fils et Tissus*, gives the particulars of cases which illustrate the system fairly though not fully. The wool-spinning factory of Madame Dieu-Obrey, at Daours, in the department of the Somme, covers an area of 473 square meters; it is a ground floor, 43 meters long, 11 meters wide, and the ceiling is 3.70 meters from the floor. This ceiling is but fairly even, being composed of planks, the joints covered by means of laths, and it and the walls are lime-washed. In the daytime the light enters by large windows, but at night these are covered with white blinds, which act as reflectors. The machinery consists of nine doubling and seventeen other machines, and fifty workmen are engaged. The machinery is arranged lengthwise, in several parallel lines. Most of the wool spun is colored, but a certain proportion of white serves to show the different effects.

The electric light is supplied by two lamps, placed at the height of two meters from the floor on round wooden platters, suspended from the ceiling by three iron rods, and the light is thrown upon the ceiling by means of conical reflectors, which prevent the diffusion of any direct light whatever. The deflected light is reflected and diffused in all directions from the ceiling and the walls, and without shadows.

This light is much superior to that given by ordinary gas; it is soft, and at once local and general in all parts of the works. The foreman seated at his desk has plenty of light for working at his books, and sees all over the building. Thus the grand intensity of electric light is at once utilized and moderated. The machinery is in a wooden press at one end of the factory, and is driven by a band from a water wheel. This mode of lighting has been in use here for more than a year; the cost of the motive power is almost *nil*; each lamp consumes from eight to nine centimeters of the carbon points per hour, and the cost of them being two francs per meter, consequently the cost for the two lamps is 34 centimes, less than 3½d., per hour. The seventy gas jets by which the same factory was formerly lighted cost 2fr. 10c. per hour.

MM. Richard fils, cotton spinners, light two floors with the electric light; the first floor is 33 meters long, by 21·20 meters wide, and contains ten spinning machines, is lighted by two electric lamps; the upper floor, at least a part of it measuring 16 meters by 21·20 meters, and containing five self-acting machines, is lighted by a single lamp. Both these have worked every night in the week since May, 1876.

MM. Buneda fréres, wool spinners and weavers, have a shed 58 meters by 22, and containing 13 spinning frames, 12 carding, and various accessory machines, which is lighted by three electric lights; 80 people are employed in this factory.

Two other factories in which the light has been adopted are those of M. Ancel, at Fresse, in the Vosges, and the spinning mill of M. Meng, at Epinal.

Besides cheapness, the effect on colors is an important consideration, and it is found that with the electric light even the darkest colors are worked at night quite as easily as in the daytime. Another important consideration is that of fire; an electric lamp replaces from 50 to 70 jets of gas; they require no hand lamps or matches to light them—a most important consideration; and, lastly, the lamps are completely enclosed in glass lanterns. So important are these facts that several insurance offices, we are told, have offered to insure factories lighted by electricity at lower rates than usual.

The electric light requires no long preparations; the necessary machines and lamps can be set up in a few hours; all that is required is to keep the grease boxes of the machines full, and to clean the latter daily. The electric light does not affect the temperature of the factory, and consequently does not dry the air, and the fact of its not altering colors has caused it to be adopted by dyers, among whom are M. Gunydet pére and fils, of Roubaix, and MM. Hannart fréres, of Wasquehal.

The expense of the electric light is given as follows: The cost of a machine with lamp, giving light equal to 500 carcel jets, is about £92, and these will represent from 50 to 70 gas jets, according to circumstances. The power required is equal to two horse steam power, and the cost of the carbon points, as already stated, is 18 centimes per hour for each lamp. When the power is that of water the cost is inconsiderable, and when that of coal has to be taken into account for the steam engine, it amounts to 20 centimes per hour, bringing the total up to 38 centimes per hour, and lubrication is set down at about 2 centimes more, while the wear of the machine is regarded as *nil*. Taking for basis that an electric lamp only replaces the minimum number of gas jets, namely 50, it is seven times cheaper than gas, motive power not included, and four times cheaper, taking the cost of driving as estimated above. These facts compose a strong case, and the success which has been obtained is easily ascertained. A perfect light as regards colors, which neither injures the eyes of the workpeople, nor renders factories unhealthy, while immensely reducing the risk of fire, and which saves 75 per cent on the cost of gas lighting, is a desideratum which requires no recommendation.—*Textile Manufacturer*.

How Cable Telegraph Lines are Worked—Electrical Induction.

In overland lines the current traverses the wire suddenly, like a bullet, and at its full strength, so that if the current be sufficiently strong the instruments will be worked at once and no time will be lost. But it is quite different in submarine cables. There the current is slow and varying. It travels along the copper wire in the form of a wave or undulation, and is received feebly at first, then gradually rising to its maximum of strength, and finally dying away again as slowly as it rose. In the French Atlantic cable no current can be detected by the most delicate galvanoscope at America for the first tenth of a second after it has been put on at Brest; and it takes about half a second for the received current to reach its maximum value. This is owing to the phenomenon of induction, very important in submarine cables, but almost entirely absent in land lines. In submarine cables, as is well known, the copper wire which conveys the current is insulated from the sea water by an envelope, usually of gutta percha. Now, the electricity sent into this wire induces electricity of an opposite kind to itself in the sea water outside, and the attraction set up between these two kinds "holds back" the current in the wire and retards its passage to the receiving station. It follows that with a receiving instrument set to indicate a particular strength of current, the rate of signaling would be very slow on long cables compared to land lines; and that a different form of instrument is required for cable work. This fact stood greatly in the way of early cable enterprise, Sir William (then Professor) Thomson first solved the difficulty by his invention of the "mirror galvanometer," and rendered at the same time the first Atlantic Cable Company a commercial success. The merit of this receiving instrument is, that it indicates with extreme sensibility all the variations of the current in the cable, so that, instead of having to wait until each signal wave sent into the cable has traveled to the receiving end before sending another, a series of waves may be sent after each other in rapid succession. These waves encroaching upon each other, will coalesce at their bases; but if the crests remain separate the delicate decipherer at the other end will take cognizance of them and make them known to the eye as the distinct signals of the message. The mirror galvanometer is at once beautifully simple and exquisitely scientific. It consists of a very long fine coil of silk-covered copper wire, and in the heart of the coil, within a little air chamber, a small round mirror, having four tiny magnets cemented to its back, is hung, by a single fibre of floss silk no thicker than a spider's line. The mirror is of film glass silvered, the magnets of hair spring, and both together sometimes weigh only one tenth of a grain. A beam of light is thrown from a lamp upon the mirror and reflected by it upon a white screen or scale a few feet distant, where it forms a bright spot of light. When there is no current on the instrument, the spot of light remains stationary at the zero position on the screen; but the instant a current traverses the long wire of the coil, the suspended magnets twist themselves horizontally out of their former position, the mirror is of course inclined with them, and the beam of light is deflected along the screen to one side or the other, according to the nature of the current. If a positive current, that is to say a current from the copper pole of the battery, gives a deflection to the right of zero, a negative current, or a current from the zinc pole of the battery, will give a deflection to the left of zero, and *vice versa*. The air in the little chamber surrounding the mirror is compressed at will, so as to act like a cushion and "deaden" the movements of the mirror. The needle is thus prevented from idly swinging about at each deflection, and the separate signals are rendered abrupt and "dead beat," as it is called. At a receiving station the current coming in from the cable has simply to be passed through the coil of the "speaker" before it is sent into the ground, and the wandering light spot on the screen faithfully represents all its variations to the clerk, who, looking on, interprets these and cries out the messsage word by word. The small weight of the mirror and magnets which form the moving part of this instrument and the range to which the minute motions of the mirror can be magnified on the screen by the reflected beam of light, which acts as a long impalpable hand or pointer, render the mirror galvanometer marvelously sensitive to the current, especially when compared with other forms of receiving instruments. Messages have been sent from England to America through one Atlantic cable and back again to England through another, and there received on the mirror galvanometer, the electric current used being that from a toy battery made out of a lady's silver thimble, a grain of zinc, and a drop of acidulated water.—*Good Words*.

PRACTICAL MECHANISM.

BY JOSHUA ROSE.

NEW SERIES—NO. XXXI.

PATTERN-MAKING.—WORM WHEELS.

A worm wheel is a spur wheel somewhat modified to suit the different conditions under which it has to work. The rim is made concave to suit the curvature of the worm; the teeth have also to be set at an angle corresponding to that of the thread. These modifications add much to the difficulty of constructing the pattern. The hollow curvature of the rim makes it necessary to have a pattern in halves, or at least the rim with the teeth must be so divided that the teeth must spring at a certain inclination. In consequence of these complications the spaces between the teeth of worm wheels are mostly cut from the solid metal by machinery.

The construction of the body of the wheel separate from the teeth is a comparatively easy matter, and has been made, we trust, sufficiently clear in the remarks upon the construction of pulleys and sheaves in halves, or with a divided rim. Having turned the body, let the two parts of which it is composed be held together temporarily by screws; pitch off the rim into the number of divisions required. We have now to consider the inclination it is proper to set the teeth at. It may be of some use at this point to reflect upon the conditions governing the working of a wheel in a worm. On account of the curvature of the wheel, its teeth, in traversing the worm, rise and fall and come into contact with all parts of the thread; but the angle of the thread changes according to its distance from the center, the obliquity being greater at the bottom of the thread than at the pitch line, where it is greater at the top of the thread. Therefore the teeth of the wheel, however well fitted, never find a sufficiently extended bearing upon the thread of a worm, and in consequence are rapidly worn away if the speed is great, or the duty heavy. It will now be seen that the best place to take the angle of the thread is at the pitch line, which may be readily done by placing the worm upon a flat surface and applying a bevel to the side of the thread at that part. This angle is drawn on the rim through the several divisions by fitting a piece of wood around it for a short distance, this piece to be cut of the required angle. The arrangement is fully shown in Fig. 219. Fit and glue the blocks to the rim at this angle, using the piece, A, as a guide, each tooth being formed of two pieces meeting at the center.

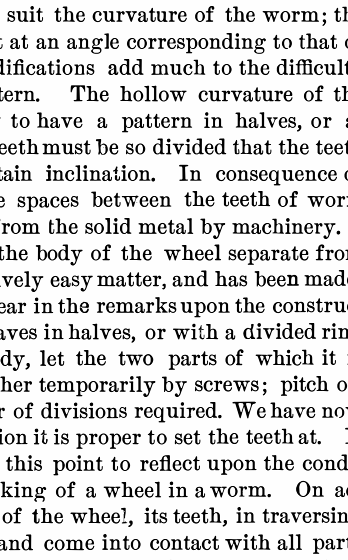


Fig. 219.

Place the wheel in the lathe and turn to the required shape, line off the teeth on both sides and across the top, and shape to a template. A cheaper kind of wheel is often used for light duty by making the rim straight instead of concave.

Ancient Mode of Embalming the Dead.

Herodotus and Diodorus tell of three modes of embalmment prevalent in Egypt. The first was very costly, answering to about $2,000, exclusive of such gems, jewels, and gold as love and prodigality might lavish upon the dead; the second, $300; the third within the reach of all. As to the extent to which gems and jewels were wound up in the cerecloth to deck the dead, there is the instance of the queen lately found at Thebes, whose ornaments were shown in our Exhibition of 1860. They are now in the Pasha's Museum. Their intrinsic value alone, that is, to break up and melt down, is several thousand pounds. It is curious in reading the two historians' accounts of the Egyptian embalmer to observe in divers matters the foreshadowing of the modern undertaker in his ways. The different degrees of woe were then as now sounded according to the depth of the purse. Just as it is now, when the furnisher will undertake for you any gradation of sorrow from the simple elm coffin and pauper funeral up to the flourish and parade of plumed hearse, weeping mutes and prancing steeds, so with the Egyptian. Only the manner was different. When a bereaved mourner, they tell us, went into one of these Egyptian shops, the functionaries would show him different models in wood highly and artistically finished, or otherwise, to represent the mummy and coffin. There were painted patterns of mummies in their multi-colored cases to choose from. The various costs, according to pattern, were then stated. The customer choose his model, and the bargain was struck. He then went home and sent back the dead body, and the body remained with the embalmer until the whole process was completed. The number of days requisite for embalming was, as we gather from both historians, seventy or seventy-two, and this tallies with the Scripture account (Gen. l. 3); for doubtless the immediate process only occupied part of the time, the rest being given to the ritual of mourning. The processes for embalming are related very categorically. In some things they hardly commend themselves to our present sentiment of what is respectful to the dead. The chief secret seemed to consist in certain chemicals injected into the veins and body; in certain washings and steepings in natron, and in the filling-up of the cavity of the body with myrrh and other balsamic substances and spices. The brains were drawn out through the nostrils. Sometimes the face and hands were gilt. Certain jewels were laid on the breast under innumerable swathings of linen. And then a kind of pictured shell received the body—a sort of close-fitting case made to open and shut lengthwise after the fashion of a violin case. But when the mummy was sent home—what then? The family did not immediately part with it. On the contrary, they often kept their dead relative for a long while, guest in his own house. A room was set apart. The mummy, standing upright as in life, was enshrined in a kind of painted cabinet—a tabernacle starred over with innumerable hieroglyphics, and protected with great painted scarabæi and multicolored cherubim, with their overshadowing wings spread athwart the chest. Hither, then, at intervals, the family would come to hold communion with the dead. They would bring fresh lotus flowers to enwreath their silent relative, or strew about the ground blossoms of asphodel and papyrus. Numberless paintings in the tombs of Egypt picture this affecting scene—a mother and her children kneeling in circle with the dead in their midst, or a wife with plaintive face and dishevelled hair embracing the placid-looking mummy of her husband. Listen to what Diodorus says: "A clever embalmer," he writes, "would send back the body perfectly preserved, even the hair of the eyelids and eyebrows remaining undisturbed; the whole appearance so unaltered that every feature might be recognized. The Egyptians, therefore, who sometimes keep their ancestors in magnificent apartments set apart, have an opportunity of contemplating the faces of those who died long before them, and the height and figure of their bodies being distinguishable, as well as the character of the countenance; they may enjoy a wonderful gratification, as if they lived in the society of those they see before them."—*Sunday at Home*.

Award of the Lavoisier Medal.

The Lavoisier medal of the Societé d'Encouragement pour l'Industrie Nationale has just been given to an Englishman, Mr. Walter Weldon, F.R.S.E. In presenting it M. Dumas congratulated Mr. Weldon upon having cheapened every sheet of paper and every yard of calico made in the world; and at the same meeting at which the presentation took place Professor Lamy stated that, whereas at the date of the introduction of Mr. Weldon's invention, seven or eight years ago, the total bleaching powder made in the world was only about 55,000 tons per annum—it is now over 150,000 tons per annum; and that of this vast quantity fully 90 per cent is made by the Weldon process. The Lavoisier Medal has been awarded only once before, namely, in 1870 to M. Henri Sainte-Claire Deville. The only other recipients of this Society's "Great Medal," which bears different effigies according to the class of service for which it is given, are Ferdinand de Lesseps, Boussingault, Jaques Siegfried, Henri Giffard, and Sir Charles Wheatstone.

Pivot Teeth in Dentistry.

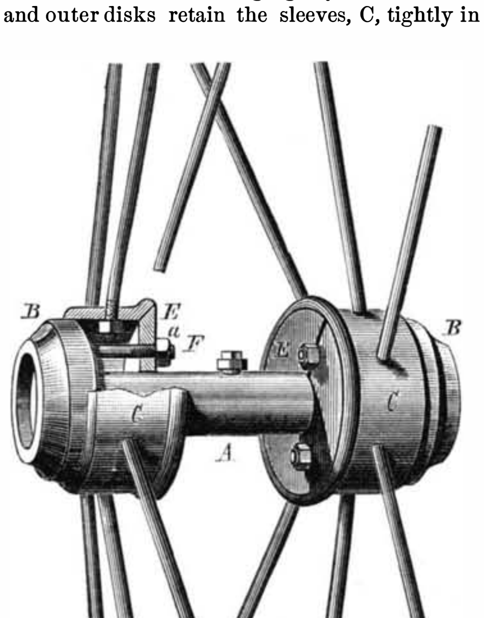
Among the best of the inventions in the way of pivoting is a device of Dr. Bonwill's. The root being cut down, the pulp-canal is reamed out greatly in excess of the size of the pivot that is to occupy it. A pivot made of platinum wire, upon which a screw is cut, is next fitted into the canal, and firmly packed into place through the use of amalgam. When this amalgam is set, the tooth—the pivot hole running through it—is placed upon the pivot, and is screwed solidly into place by means of a delicate nut, made of gold. It will be understood, of course, that the fitting of the tooth in position has been done at the time of setting the pivot into the root. This operation, when well accomplished, holds a pivot tooth so firmly in place that it may be used with the utmost freedom in mastication.

THE authorities in charge of Fairmount Park, Philadelphia, have decided to use a portion of that domain for educational purposes, and have asked the co-operation of the Pennsylvania Horticultural Society. It is proposed to begin with the hardy perennial and Alpine plants, and form as complete a collection as is possible. Every character of soil and location is readily obtained, even for the aquatic plants.

IMPROVED VEHICLE WHEEL.

The annexed engraving illustrates an improved metallic hub for vehicle wheels, by which the tire may be tightened quickly by the expansion or contraction of the spokes.

In the illustration, A represents the journal box that carries on end shoulders fixed rings or collars, B, along the outer circumference of which the spoke-carrying sleeves, C, are moved forward and back. One set of spokes is attached by screw nuts to the sleeve at one end of the box, while the alternating set of spokes is connected to the sleeve at the other end. The inner ends of the sleeves, C, are supported on disks, E, that form a bevel joint therewith, the inner circumference of the disks binding tightly on the box, A. The inner and outer disks retain the sleeves, C, tightly in posi-



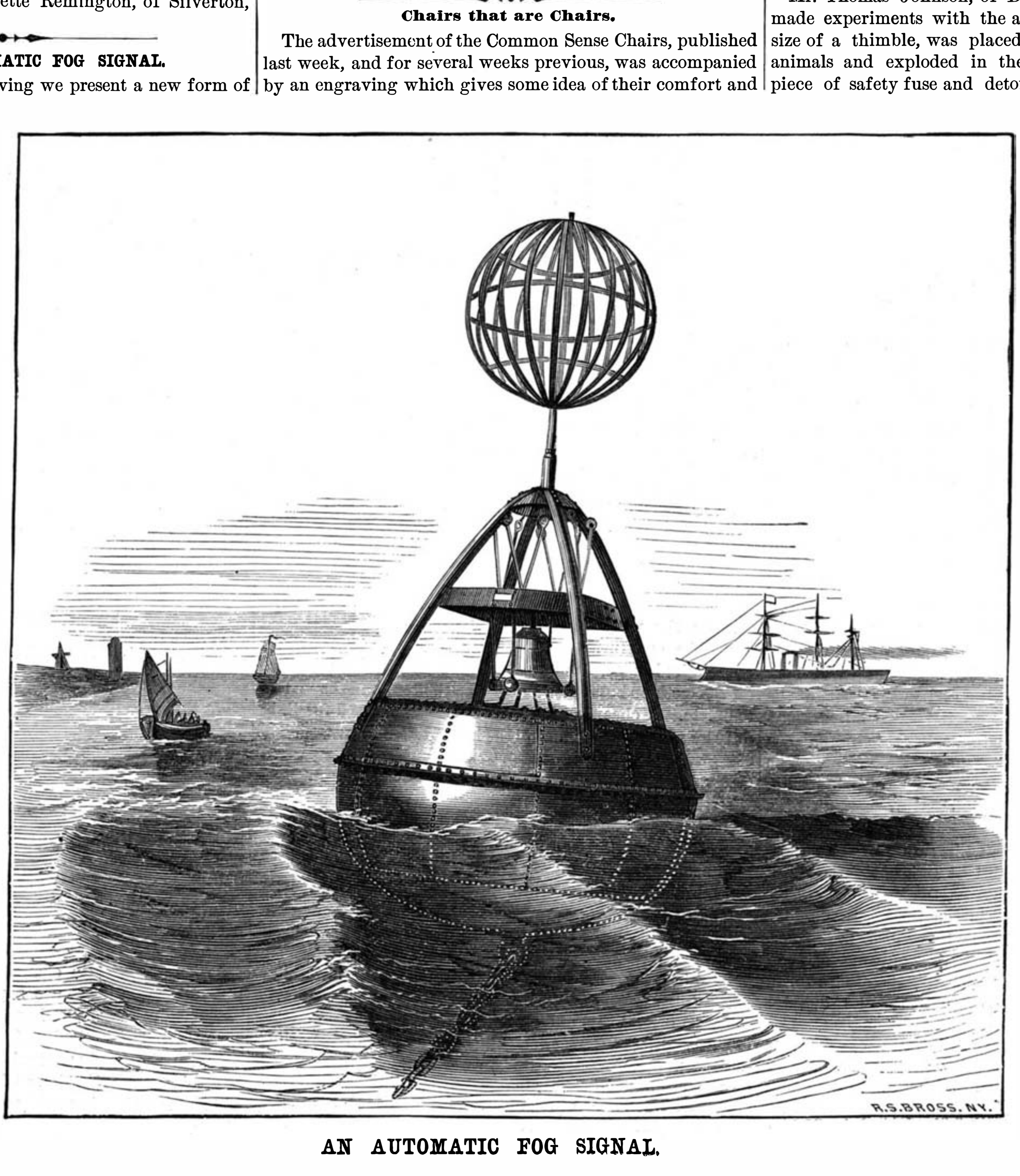
tion and keep the fastening nuts of the spokes firmly locked to the threaded ends of the same on the inside of the bands. A number of bolts, F, are attached to the collars, B, and run back parallel to the axis of the box, A, being extended through the inner disk, E, and threaded at their projecting ends for the screw nuts, *a*. By screwing up the nuts, *a*, on the bolts, F, the sleeve, C, is moved over the end ring, B, so as to bring the spokes together and tighten the wheel.

Patented through the Scientific American Patent Agency, June 19, 1877, by De La Fayette Remington, of Silverton, Oregon.

IMPROVED AUTOMATIC FOG SIGNAL.

In the accompanying engraving we present a new form of combined fog signal and bell buoy, working automatically, which has lately been introduced in Germany. It is intended to be stationed at places where the conditions are such that no better forms of signals, such as cannon and sirens, are available.

The buoy consists of a wrought iron body, spherical below and flat on top, upon which a stout frame is placed, carrying a heavy immovable bell, together with several bell hammers, and above a large metallic basket, to render the buoy more plainly visible on clear days. The iron body is made of sheet metal, one third of an inch thick. It has a diameter of about nine feet, and a height of about six, and is provided below with a strong eye, to which the anchoring chain is fastened. This body is divided in its interior into three compartments by a second bottom placed nearly in its center, and by an annular wall reaching from this bottom to the top, which separates the space above the second bottom into a central circular and annular space. The lower compartment serves as a receptacle for the ballast, while the upper inner compartment is made large enough to prevent the sinking of the buoy, should by any accident the outer shell be rendered leaky. The buoy, after having been towed to its destined station and accurately anchored there, soon acquires an oscillatory motion from the action of the waves. The four freely suspended hammers in the vicinity of the bell are thus made to strike upon the latter and so give rise to the required alarm signal. Rubber buffers are provided to prevent any undue range of motion of the oscillating hammers.



AN AUTOMATIC FOG SIGNAL.

American Institute Exhibition.

The interest evinced in the coming exhibition of the Institute is practically proven by the demand for space, and by the improved character of the exhibits offering. The managers state that the promise of a fine display never was better, and that although business is generally dull and the manufacturing industries are generally depressed, nevertheless the outlook is hopeful and encouraging. For all details address the General Superintendent, room 22, Cooper Union Building, New York.

Applications of the Electric Light.

Lighting experiments with Gramme machines are being tried daily at the Palais de l'Industrie, in Paris. The area of the building is 2½ acres, the elevation of roof 95 feet. This immense space has been lighted *à giorno*, with two electric lusters, each composed of six electric lamps. The motive power required is fifty horse power, and the results are very satisfactory, although it has not been stated whether they are superior to those of the Alliance system, and Jablochkoff electric candle. The Great Northern Railway Company regularly use electric lamps for their luggage room. The Paris-Lyons Railway is preparing an experiment for the illumination of the whole of the large Paris station. All these experiments are conducted with the intention of testing several electric systems, in order to obtain an immense lighting power for the International Exhibition.

Octahedral Crystals of Copper.

M. Sidot has allowed sticks of phosphorus to lie for some months in a cold saturated solution of sulphate of copper, and has obtained a series of copper tubes, the outer surface of which was covered with fine octahedral crystals of the metal. In this reaction the water is decomposed, metallic copper and phosphide of copper are formed, whilst sulphuric and phosphoric acids remain in the liquid.

Chairs that are Chairs.

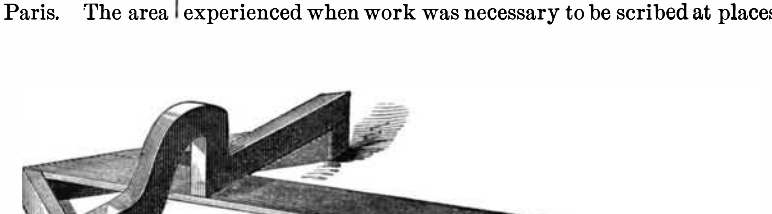
The advertisement of the Common Sense Chairs, published last week, and for several weeks previous, was accompanied by an engraving which gives some idea of their comfort and excellence. They are made by F. A. Sinclair, Mottville, New York. We are happy to be able to say that the chairs in question are all that the maker represents them to be. We have had them in use for a long time with much satisfaction; and judging from our own experience, whoever buys them will be fully satisfied with the purchase.

Laflin's Parlor Rowing Apparatus.

To persons who have not ready access to gymnastic exercise, and desire a means for preserving health and vigor, the rowing apparatus invented by J. M. Laflin, 31 Union Square, New York city, is especially adapted. It can be readily used, even in a small room, and the steady regular movements which can be practised on the apparatus have a direct tendency to give freedom to the flexors, extensors, pectorals, and shoulders. A slight change converts the machine into a health lift. It can also be used in many other ways, and in each and every way furnishes healthy exercise and social amusement.

IMPROVED UNIVERSAL SQUARE.

In the old form of universal square much annoyance was experienced when work was necessary to be scribed at places



that came immediately under the cross-bar. This was particularly the case when small square or round pieces of work were to be centered.

The accompanying engraving represents an improvement upon this square, which consists of a curved or raised portion in front of the cross-bar, and so made that the space formed above the blade is sufficient to admit of drawing or scribing a line along its whole length without removing the square.

Patented through the Scientific American Patent Agency, May 8, 1877, by Charles A. Schrier, of Holyoke, Mass., to whom application may be made for further particulars.

Killing Cattle by Dynamite.

Mr. Thomas Johnson, of Dudley, England, has recently made experiments with the above. A small quantity, the size of a thimble, was placed on the foreheads of several animals and exploded in the ordinary way with a short piece of safety fuse and detonator, and the cattle were instantly killed, and only required bleeding. Lately other experiments were made at Mr. Bruton's, Red Hill, Dudley. The charges were exploded by electricity instead of the ordinary way, and by this means any number of animals may be instantly killed by the same current of electricity. Two large horses and one donkey, unfit for work, were drawn up in line about half a yard apart, the donkey being in the center. A small primer of dynamite, with an electric fuse attached, was placed on the foreheads of each, and fastened by a piece of string under the jaw. The wires were then coupled up in circuit, and attached to the electric machine. Mr. Johnson turned the handle of the machine and discharged an electric current, which exploded the three charges simultaneously, the animals instantly falling dead without a struggle.—*Land and Water.*

BRONZE PAINT FOR IRON OR OTHER METALS. Take of chrome green, 2 lbs.; ivory black, 1 oz.; chrome yellow, 1 oz.; good japan, 1 gill. Grind all together and mix with linseed oil.

A GOOD black paint may be made by mixing together lampblack and common carriage rubbing varnish.

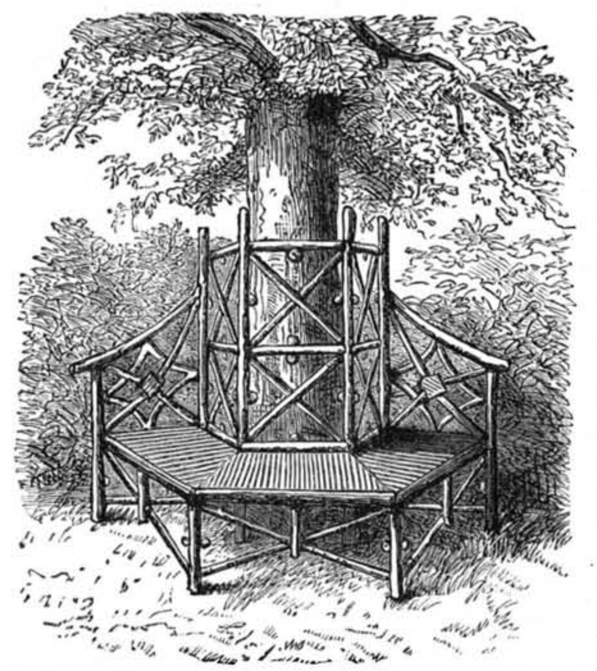


FIG. 13.

HOW TO MAKE RUSTIC WORK.

For materials you need stout branches, two, three or even four inches through, for all the principal parts of the structure you make. For the covering of seats, table tops, etc., branches about an inch in diameter are needed. To prepare these latter for use, cut them into lengths of about eight inches, and, with a hatchet or sharp knife, split them longitudinally in halves. If the wood has been freshly cut from the tree it will work easily; if not, soak it well in water over night. Trim up the pieces with a sharp knife, taking care to remove all the sharp knots where the shoots have grown out from the branches.

FIG. 1.

A good method of rustic work for beginners is to take an old chair, or table, or settee frame, and cover it with bark, or with these split branches. Before driving brads or nails through the bark or branches, bore a hole with an awl, so that the work will not split. The pattern mav be varied to suit your taste. Fig. 2, which is the representation of a pillar table, will give a hint in this direction.

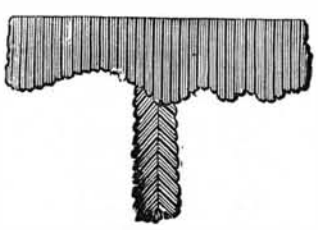


FIG. 2.

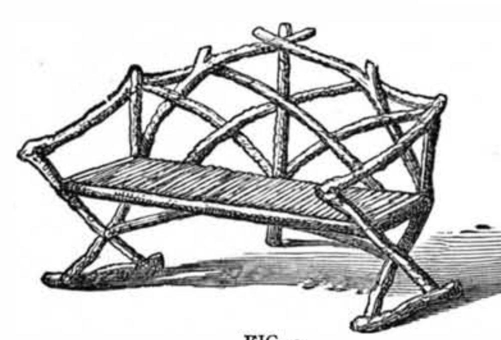


FIG. 3.

For real rustic work, Figs. 1, 3, 5, 9, and 13 will give hints for the general form of some chairs and settees. Figs. 6, 7, 11, and 71 show the principles for constructing the frames. Fig. 11 shows a simple way of making the legs for a seat without a back. When back and arms are desired, this simple structure may be modified by continuing one leg up as far as may be necessary to form the corner post for the back, and the other a somewhat less distance, to support the arm. Fig. 3, by little study, will make this plain. Where the legs cross they should be "halved" together, as at A, Fig. 6. The seat frame should meet the legs, as at B, Fig. 6. To form the seat, use five branches, same size as the supports, of the length required. Cut them as shown at C, Fig. 6. Fasten the outer rails first, nailing them securely, and then fit in the center ones. The whole structure should be well braced.

FIG. 4.

Fig. 7 shows another method of constructing a frame, by the use of mortices and tenons. As shown at B, Fig. 12, the shoulder of the tenon must be cut to fit the curve of the part that has received the mortice.

FIG. 5.

Fig. 10 is the ground plan for the settee in Fig. 13, showing the position of the legs. Fig. 8 shows a method of interlacing split branches, to form the back of a settee. The ends must be well secured to the rails.

Fig. 4 is a table, the support of which is made from the stump of a small tree with the roots attached, the latter forming the feet. The top may be made of rough boards, covered with small split branches, and it may be braced by curved or straight pieces to the supporting column.

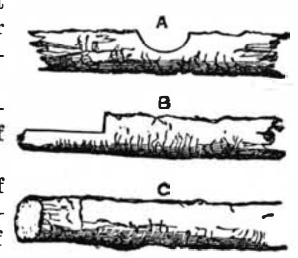


FIG. 6.

Pieces of roots, or grotesque growths of clusters of branches, as shown in the illustrations at the bottom of this page, may be used as ornaments on various parts of rustic work with good effect. When you use smooth-barked wood, a coat or two of varnish will improve its appearance. Do not apply the varnish till the wood is thoroughly dry.

Wood Staining.

The practice of staining woods is much less common in America and England than on the Continent, where workmen, familiar with the different washes, produce the most delicate tones of color and shade. Wood is often stained to imitate darker and more expensive varieties, but more legitimately to improve the natural appearance by heightening and bringing out the original markings, or by giving a definite color without covering the surface and hiding the nature of the material by coats of paint. The best woods for staining are those of close, even texture, as pear and cherry, birch, beech, and maple, though softer and coarser kinds may be treated with good effect. It should be dried, and if an even tint is desired, its surface planed and sandpapered. All the stains should, if possible, be applied hot, as they thus penetrate more deeply into the pores. If the wood is to be varnished, and not subjected to much handling, almost any of the brilliant mordants used in wool and cotton dyeing may be employed in an alcoholic solution; but when thus colored it has an unnatural appearance, and is best used in small surfaces only, for inlaying, etc. The ebonized wood, of late years so much in vogue, is in many respects the most unsatisfactory of the stains, as the natural character and markings are completely blotted out, and it shows the least scratching or rubbing.

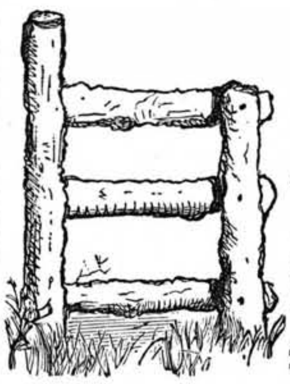


FIG. 7.

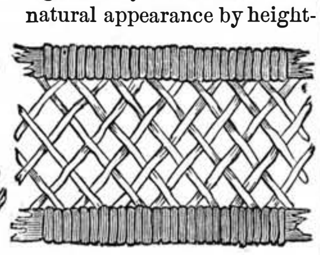


FIG. 8.

The common ebony stain is obtained by preparing two baths; the first, applied warm, consists of a logwood decoction, to every quart of which 1 drachm of alum is added; the second is a solution of iron filings in vinegar. After the wood has dried from the first, the second is applied as often as is required.

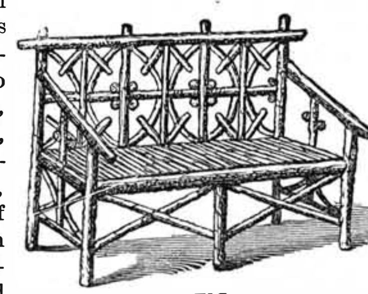


FIG. 9.

For the first named bath, some substitute 16 weight parts of gallnut, 4 of logwood dust, and 2 of verdigris, boiled in a sufficient quantity of water. The writer has seen a peculiar method of blackening walnut in use in Nuremberg. On one of the Pegnitz islands there is a large grinding mill, turned by that classic stream, where iron tools are sharpened and polished. The wood is buried for a week or more in the slime formed by the wheels; when dug out it is jet black, and so permeated by silica as to be in effect petrified. Another way to ebonize flat surfaces of soft wood is to rub very fine charcoal dust into the pores with oil. This works well with the European linden and our own white wood. A brown mahogany-like stain is best used on elm and walnut. Take a pint decoction of 2 oz. logwood, in which ½ oz. of chloride of barium has been dissolved. This gives also, when diluted with soft water, a good oak stain to ash and chestnut. But the most beautiful and lasting of the browns is a concentrated solution of permanganate of potash (mineral chameleon). This is decomposed by the woody fiber, and forms hydrated oxide of manganese which is permanently fixed by the alkali.

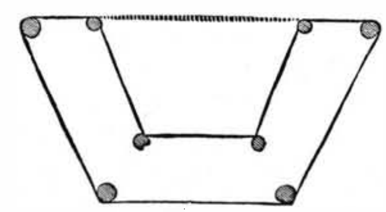


FIG. 10.

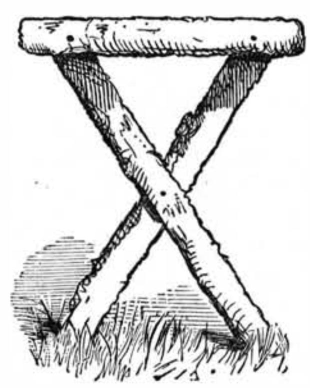


FIG. 11.

A simpler brown wash is ½ oz. of alcanna root, 1 oz. aloes, 1 oz. dragon's blood, digested in 1 lb. alcohol. This is applied after the wood has been washed with aqua regia, but is, like all the alcoholic washes, not very durable. Aqua regia (nitro-muriatic acid), when diluted in three parts of water, is in itself a much used, though rather destructive, yellow. For a red stain, a decoction of ¼ lb. of logwood and ½ oz. of potash in 1 lb. of water is used as the bath, being fixed by a wash of alum water. For scarlet, use 1 oz. cochineal, 6 oz. powdered argol, 4 oz. cream of tartar in 12 oz. of chloride of tin (scarlet spirits). For rose color, iodide of potassium 1 part, water 12 parts, as a first bath; as second, chloride of mercury (corrosive sublimate) 1 part, water 40 parts. Indigo solutions give blue washes, and 1 part of verdigris to 4 parts of water the best green. Soft wood floors are well stained with ½ lb. turmeric, ¼ lb. logwood, 22 lbs. soap-boiler's lye, ¼ lb. potash, to which, after it has been boiled down to about 14 lbs. weight, 1½ lbs. wax and 3 oz. of annotto are added. This is largely used in Germany as a substitute for paint, and keeps the floor in good condition for a year or more. As a curiosity, the bleaching of mahogany to the appearance of

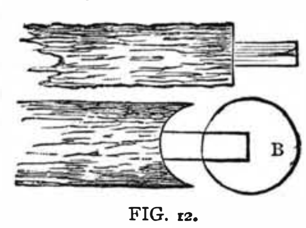
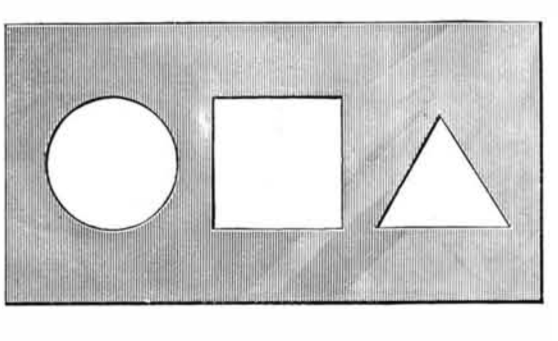


FIG. 12.

chestnut may be mentioned. This was once done to make a dining room table match the other furniture of a room in which it was placed, and was effected by alcohol saturated with sulphurous acid gas. A solution of 4 oz. of sandarac, 1 oz. gum mastic, and 4 oz. shellac, in 1 lb. of alcohol, to which 2 oz. oil of turpentine is added, can be recommended as a varnish over stained woods. Boiled linseed oil should be rubbed into the pores before it is applied.—*Joseph T. Clarke, in American Architect.*

A GEOMETRICAL PUZZLE.

Three apertures, exact size in illustration—a triangle, square and circle—are cut through a piece of cardboard or wood. The problem is to cut from another bit of wood a

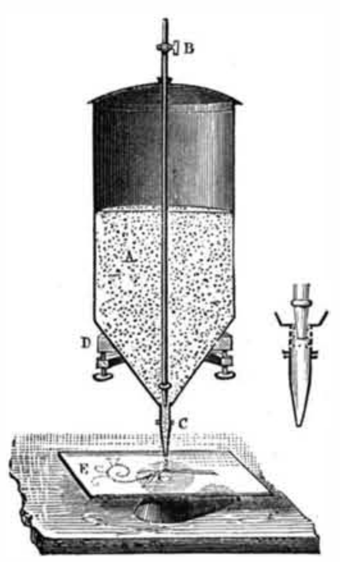


single piece, of such form that it will, in passing through each aperture, exactly fill the same. A correspondent furnishes the above problem, which, though old, may be new to a considerable number of our readers.

ENGRAVING ON GLASS.

The process here described consists in corroding glass by violently projecting sand upon its surface by means of a current of air or steam. It is very probable that it will be found of service in a great variety of ways, and may eventually come to replace, at least in part, engraving by means of a revolving wheel, or even the well-known hydrofluoric acid method.

The apparatus used is very simple, and is shown in the accompanying cut, for which we are indebted to *La Nature.* Our French cotemporary, however, omits to mention the fact that this invention is the discovery of Mr. Benjamin C. Tilghman, of Philadelphia, Pa. Well dried sand, contained in the cylindrical vessel, A, is allowed to flow in a continuous manner through the tube, C, whose length and inclination can be altered at will, so as to regulate the fall of the sand. The tube conveying the current of air or steam terminates just above this spout, in a nozzle containing a series of fine holes. The sand, urged on by the jet, is thrown violently against the glass plate, E, or other body placed within its range, and thus exerts a corroding action. By varying the quantity of the sand, the volume and velocity of the current, as well as the diameter of the jet, more or less rapid effects are produced.



Bodies much harder than glass have been submitted to the action of sand thus thrown forcibly against their surface, and have been as rapidly worn away. In a series of experiments recently conducted in this city, a hole 3 centimeters in diameter was drilled through a block of corundum in twenty-five minutes, a pressure of 136 kilogrammes being used. With a pressure of 45 kilogrammes, a hole 3 centimeters in diameter and 8 millimeters in depth was formed in a steel file in three minutes. The weight of a diamond was sensibly diminished in a minute, and a topaz utterly destroyed.

In engraving on glass very little pressure is needed, the current from the bellows of an enameller's lamp being quite sufficient. In this way the divisions on graduated tubes, the labels on bottles, etc., can easily be engraved in laboratories with but little trouble.

The portions of the glass which are to remain clear are covered with paper, or with an elastic varnish, these substances being sufficiently exempt from the corroding action of the sand.

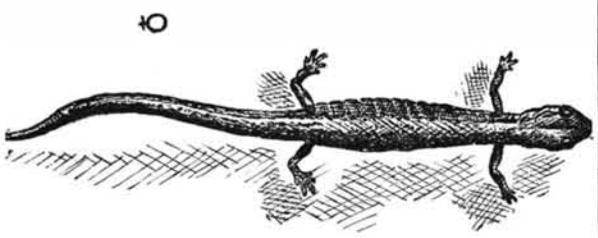
Belladonna in Asthma.

The Melbourne (Australia) *Medical Record* states that smoke from the leaves of the belladonna possesses much more power in cutting short an attack of asthma than that from stramonium; a long pipe being the best means of smoking them, the smoke to be drawn deep into the chest. Or if, when the attack is at its height, the patient has not the power of doing this, the leaves may be placed in a saucer containing lighted charcoal or wood ashes, which should be put on a chair in front of the patient, this chair, as well as his own, being covered with a large sheet, so as to confine the fumes, before the leaves are put on the hot charcoal. From two and a half to five grains of the leaves are sufficient when smoked, and from five to twenty grains when burned.

THE ASH-COLORED SALAMANDER.

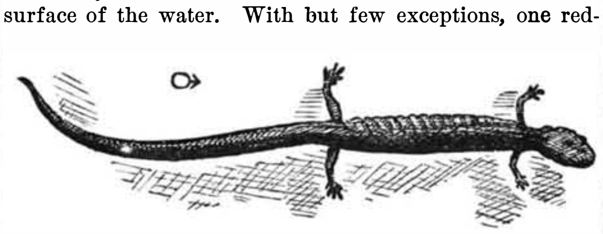
BY C. FEW SEISS.

This salamander was first described by Green in "The Journal of the Academy of Natural Sciences," Philadelphia



(vol. I, page 356), under the name of *Salamandra cinerea.* He in the same journal (same vol. and page) re-described it as the *s. erythronota.* Dr. Holbrook corrected this error, but lately Professor Cope has them once more divided into two sub-species, viz: *plethodon cinereus,* sub-species *cinereus,* and *plethodon cinereus,* sub-species *erythronotus.* I cannot now consider them sub-species or even varieties.

On March 24, 1877, my brother and myself captured, near Philadelphia, sixteen or eighteen of these salamanders. They were found beneath large flat stones where the soil was light and loamy, on the bank of a brook, about six feet from the surface of the water. With but few exceptions, one red-



backed (*erythronotus*), and one ash-colored (*cinereus*), were found together under the same stone. We have found in the same locality both red and ash-colored, from one inch to three and a half inches in length. We have specimens with a bright red longitudinal doreal band strongly defined, others with an obsolete dull reddish-brown band, and others completely grayish-brown above. On dissection, I have found ova in the red-backed animal, but thus far not in the ash-colored. So far as my observations have gone, I am of the opinion the ash-colored is the male, and the red the female, of the *plethodon cinereus* (Green).

This is one of our most inert salamanders, and it rarely, I think, quits its retreat in the day-time, unless during or after a rain. It is not an aquatic species, but is only found near the water during the breeding season, when it seeks to deposit spawn. With the exception of the *desmognothus fusca,* it is the most common salamander in the vicinity of Philadelphia.

In captivity its habits have been uninteresting, as it is continually hiding beneath the stones of the vivarium. I rather think small earth-worms are its common food when in its native haunts. I was surprised at the length of time some of them lived after having been dropped alive into a jar of alcohol. Many salamanders die almost immediately after an alcoholic immersion, giving only two or three convulsive jerks of the head; but many of these crawled about the bottom of the jar among their dead relations for nearly five minutes before expiring. You cannot censure me with cruelty to animals, for their life's finale must have been one of oblivious intoxication.

Photography in Disease.

We have in photography an excellent means of determining the condition of the blood. According to its quality, the blood deposits more or less impure material in all the cellular tissues. Such deposits occur also in the sebaceous glands of the skin, which secrete a natural fat and deposit it in the mucus layer between the true skin and epidermis. Although the color of the mucus layer is visible through the epidermis, its finer shades are not seen in this manner, yet they appear in the photographic negative with such sharpness that the slightest impurities are here apparent as dark specks.

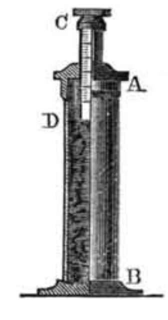
This phenomena is due to what may be called the photography of the invisible—that is, to that remarkable property of light by virtue of which the chemical action of color rays falling upon the plate varies with the rapidity of their transmission to it. It is interesting to observe the accuracy with which the condition of the skin is thus shown, varying as the shade upon the plate does, from the utmost delicacy and purity to a peculiar sieve-like character—that is, appearing as if punctured with innumerable little holes; these in the worst cases being irregularly united, so as to present a more or less ragged and unsightly appearance. After a person has taken fat, beer, tobacco, and other like injurious substances into the system, even for a little time, the negative exhibits this punctured appearance; while in the case of those whose manner of life is wholly corrupt, these defects are often magnified into such blotches as are seen upon the face itself in skin diseases.—*From Schlickeysen's "Fruit and Bread," translated by Dr. Holbrook.*

THE ALEUROMETER—GLUTEN TESTER.

This instrument has for its object the economic testing of the value of flour, so far as it relates to the quality and *elasticity* of gluten, one of its most important constituents. It is a very common remark that a particular description of wheat is far richer in gluten than another, but it by no means follows that *quantity* represents quality, when used for the purpose of making bread. For example, wheat adapted for the manufacture of maccaroni is unquestionably rich in gluten, but the grain specially sought after for this purpose is that which contains gluten distinguished for its *ductility,* rather than its elasticity, and it may be doubtful whether any judicious blending of this kind of wheat with other sorts would produce a first quality of flour.

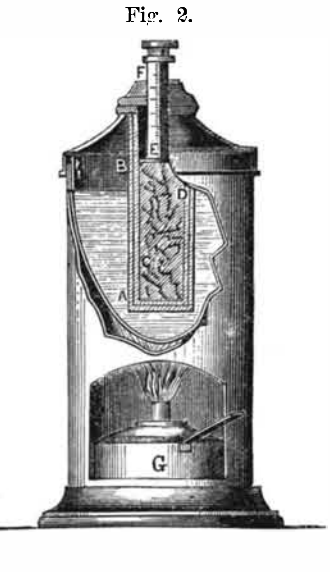
The ordinary methods of testing the quality of gluten are hardly conclusive. The rough and ready way of wetting a sample of flour and working it by the fingers, and other methods well known to buyers, doubtless, are excellent, but not altogether reliable. The aleurometer is designed to measure the *elasticity* of the gluten. The apparatus, Fig. 1, shown partly in section, with gluten expanded in the tube, consists of a brass tube, D, slightly over an inch in diameter and about five inches long. To its lower end a movable cap, B, is fitted; the top of the tube consists of an adjustable cap, A. Through the latter runs a graduated stem, C, to which is attached a *piston* that accurately fits the inside of the tube. The whole length of the tube represents 50 divisions. The stem of the piston is marked to a scale of 25 to 50, the piston itself being only capable of descending half way down the tube. This simple contrivance constitutes the aleurometer proper, and is designed for the use of bakers in their ovens.

Fig. 1.



Special additions have been made to the instrument, in order to meet the requirements of merchants and extensive dealers in flour. For this purpose a small stove is provided (see Fig. 2) and a copper bath, A, filled with oil. The bath is covered by a cap, and to the latter is soldered a tube, B, which extends nearly to the bottom of the oil bath. On the lamp being lighted a thermometer is placed in the hollow tube and allowed to remain until 150° C. (318° Fah.) is reached. From the flour required to be tested 30 grammes (about an ounce) are taken, and made into a paste by the addition of 15 grammes of water. After kneading it the mass is carefully washed by a stream of water, which carries off the starch, leaving the crude gluten — which should be compressed so as to strain off the water —which will then contain about 0·66 of water. A sample of the crude gluten is then weighed, about 7 grammes (¼ ounce), and is rolled in starch or fecula forming a roll of gluten. The inside of the gluten tube, D, is greased; the roll of gluten is then inserted, and the tube closed up.

Fig. 2.



The gluten tube, or aleurometer, is placed into the hollow tube, B, and heated to 150° C. (318° Fah.). The lamp is allowed to burn ten minutes, and then extinguished. The gluten should remain undisturbed for about ten minutes longer, during which time, under the influence of the water, which is converted into vapor or steam, it expands and forces the piston upwards. The graduated scale, F, on the stem, E, marks the degree of *elasticity* of the gluten, C. The roll of gluten is then removed, and should the expansion not have forced the piston upwards the flour is considered too weak and unfit for bread making. The gluten of the best flour has never indicated more than 50 per cent.

Good flour furnishes a gluten which augments to four or five times its original bulk; but bad flour gives a gluten which does not swell, becomes viscous and nearly fluid, adhering to the sides of the tube and giving off occasionally a disagreeable odor, whilst that of good flour merely suggests the smell of hot bread.—*The Miller.*

THE Metropolitan Railway (the longest underground line) carried at the rate of 154,137 passengers daily during the first half of 1877, the average receipt from each being about 4⅓ cents. The net earnings were sufficient to justify a dividend of 2¼ per cent for the half year. The traffic was greater than for any corresponding period in previous years. It was sufficient to fill 2,770 large American cars every day.

Bricks perforated with three holes, that the mortar may get a good hold, are being used in the construction of some buildings in Minneapolis, Minn.

THE WATCH—ITS INVENTION AND HISTORY.

Having given in previous numbers a history of the invention and introduction of watches, we propose to add a little information on the subject of their manufacture, which we think will interest our readers.

In the earlier stages of their history watches were commenced and finished by the same man, who took upon himself the making of each piece of the watch, from the case to the smallest screw or pin, by which system each watch is said to have taken about a year to complete, and cost something like $1,500; but in the course of time the manufacture became more systematized, and regular factories for established. The watch business is said to have been started in Switzerland by the Protestants who were driven out of France into that country, and notably by Charles Cusin, of Autun, in Burgundy, from which beginning it has spread until it is said that as many as 40,000 men and women out of the 250,000 souls that form the population of the cantons Neufchatel and Geneva, and of the French-speaking part of the canton of Berne, are engaged in the industry, and turn out about 40 watches each on the average per year, making in all about 16,000,000 watches annually, of which, previously and up to 1873, an average of over 300,000 were exported to this country. Since that time, however, the importation has gradually decreased, until it is estimated that only 75,000 were imported last year. A part of this decrease is no doubt owing to the depression of business, but more is due to the increased demand for the home made article, the manufacture of which is constantly increasing.

Although the Swiss make the largest number of watches, it is said that the English were the first successful *manufacturers*, and watches of their make have a first-class reputation, but the numbers made by them are comparatively small. Many watches bearing English names are made in Switzerland, and others have most of their parts made there on account of the cheapness of labor. So disastrous has been the competition of the Swiss to the English workmen that it is stated in their trade journal that three fourths of their tools are now in pawn.

The French are also large manufacturers of watches, making some 500,000 per year, the most of which are for home consumption, although some of them are exported. Most of the French watches are made at Besançon, where the manufacture was started by a colony of Swiss from Neufchatel. Many watches supposed to be French are really Swiss.

The successful manufacture of watches in this country is comparatively of recent date, although sporadic attempts were made as far back as 1812, but all failed; and it was not until the Boston Watch Company, with a capital of $100,000, was started by Messrs. Dennison & Howard in 1850, that anything like success was attained. These gentlemen erected a factory in Roxbury, which site being found unsuitable on account of the dust, their operations were transferred to Waltham in 1854, but after overcoming many difficulties the company failed in 1856. The factory, machines, etc., were bought by Mr. Robbins, who in 1857 started the American Watch Company with a capital of $200,000, which was increased to $300,000 shortly after. As their trade increased their capital and facilities were increased, until they now wield a capital of $1,500,000, have 800 employees—half of either sex—and produce about 400 movements and 200 cases per day of ten hours.

Previous to the organization of the American Watch Company all watches were made by hand with the ordinary watchmaker's lathes, wheel cutters, etc.; but this company introduced the system of making every part by machinery especially constructed for the purpose, which imparts to every piece an accuracy far beyond that attainable by the most skillful hand labor, nothing being left to the eye or hand of the artizan. After the manufacture each piece is separately and repeatedly gauged by instruments, some of which can measure the seventeenth thousandth part of an inch. Each piece is thus capable of replacing the corresponding part of any other similar watch without fitting, or it may be replaced by another similar piece direct from the workman's hand with the surety that it will fit and work correctly; and a perfect watch may be formed by simply taking up the proper pieces at hap-hazard from the stock and "assembling" them together. To make a complete watch on this principle, it is said that over a thousand processes are required, and that the escape wheel alone requires 84 operations to form its teeth. As an instance of the extreme accuracy of the machinery employed, we may state that the cutters used in making the wheels are all shaped by separate machines, which *must* make the cutters of the proper shape required for the wheel they are intended to operate on.

To simplify the watch as much as possible the American Watch Company resolved to abolish the use of the chain and fusee, thus decreasing the number of pieces in a watch about 640, so that their watches have only about 160 pieces instead of 800, as have most of the English watches. As the chain and fusee, since the introduction of the hair spring and improved escapement, have been of little or no real use, being retained simply by the conservative habits of watchmakers, this change was not only no detriment to the watch as a timekeeper, but it lessened its cost considerably and correspondingly reduced the liability of derangement. By this innovation in the construction of the watch and their system of manufacturing, they not only produce a comparatively cheap watch, but also make an accurate one. Mr. Favre Perret, a Swiss member of the jury on watches at the Centennial Exhibition, took at random from the company's safe one their watches of the fifth grade, and exhibited it to one of the first "adjusters" in Switzerland, who after thoroughly examining it, declared "one would not find one such in fifty thousand of our (the Swiss) manufacture." Such is the perfection of their manufacture that their watches are now being exported in large numbers to Europe, some 20,000 per year being sent to England alone.

The American Watch Company, however, are not alone in the manufacture of watches in this country, as our readers are probably aware, there being an offshoot from this company at Elgin, Ill., which started in 1864, and after many enlargements of their establishment to keep pace with the demands of the trade, find themselves with a corps of employees numbering over 700, all of which are employed on movements alone, and yet are unable to supply the demand for their goods, notwithstanding the hard times and that they are working twelve hours per day. They are said to be so far behind their orders at the present time that their English and Russian agencies are idle for want of materials to supply their customers. This success has been attained, let it be remembered, in a section of the country that most people would consider as good ground for raising corn or pork, but without the right class of population for making fine machinery, to say nothing of such delicate articles as watches; so that the company had not only to build their machinery for their factory but to educate their employees to their business also.

In addition to the above companies, there are several others who manufacture watches in different parts of the country, at Boston, Philadelphia, Springfield, Mass., and Springfield, Ill.—in all about twelve, we believe. There is another one stated to be starting somewhere in New England, which will make a new style of watch, containing fewer works than the ordinary one; and these are set around the center and driven by a mainspring beneath them. By means of a toothed rim around the inside of the case, all the works are made to perform a complete rotation around the center of the watch—aside from their own proper motions—completing the performance once in every two hours. Any irregularity due from the difference of weight of any of its parts is said to be thus wholly compensated, no matter what may be the position in which the watch is carried, since in any and all positions the center of gravity of the movement for any two hours as a whole will be uniform. There is also a large factory at Marion, N. J., but we believe it is not now in operation, the company owning it having failed some time since.

A patent has recently been granted for a watch with its works so arranged in the case that, no matter whether it is hung up so as to have the pendant in a vertical position or set inclined in the vest pocket, the movement will always occupy the same vertical position, by which it is hoped that there will be less liability to variation in its going; but we have heard nothing of its being manufactured to any extent.

Pyroxyline for Photographic and Medicinal Purposes.

For the preparation of soluble gun cotton, or pyroxyline, for making collodion, very many recipes have already been published. According to Godeffroy the following has been recommended as the best of these: Nitrate of potash (saltpeter) 560 parts, sulphuric acid 420 parts, fuming sulphuric acid 420 parts, and cotton free from grease 70 parts.

I have, says Godeffroy, used these proportions repeatedly, and obtained as the result a collodion cotton which was for the greater part soluble in ether, although with a turbidity, which was caused by small particles of unnitrated cotton suspended in the solution, and the collodion was totally unfit for photographic purposes, and could only be employed in surgery after standing a long time to settle. I sought for the cause of this unsatisfactory result in the moisture contained in the saltpeter, hence I dried this in a large mortar, and when cold made the mixture again with no better results. One day when I was in a great hurry I neglected to to remove the dish and its contents from the sandbath, and after pouring in the mixed acids, at once threw in the clean cotton. This time I obtained a cotton which dissolved perfectly clear in ether.

My supposition, that warming the dish and the mixture to a certain temperature was essential to obtain satisfactory results, proved to be correct, and from that time on I have always got a perfectly soluble cotton, even when I omitted the fuming sulphuric acid and replaced it by ordinary English sulphuric acid.

I found by experiment that the best temperature for the dish is 56° C. (133° Fah.) and that the acid should act upon the cotton for just seven minutes.

The proportions which I use are 700 parts and 350 parts of nitrate of potash to 35 parts of cotton.

The cotton was freed from grease, as usual, by warming it with a solution of soda (the carbonate) and boiling a short time in water to which had been added a little caustic potash, then thoroughly washed, finally with distilled water. The cotton thus purified and dried again, then well pulled in pieces, is put into the dish and kneaded with a pestle so that it may come into perfect contact with the acid, left there seven minutes, then quickly transferred to a large vessel of hot water, then washed in a stream of cold water until the last trace of the acid reaction had disappeared, and finally washed in distilled water. The cotton is heavily pressed, picked apart, and either dissolved at once or transported wet. If the acid acts longer than the time stated, the quality of the cotton is not injured, but its coherence is destroyed, which causes loss in washing.

PROFESSOR WOOD'S specimens of lower jaws removed for phosphorous disease, and which were recently sent to the Surgical Congress at Berlin, have attracted a good deal of attention, and have reflected credit upon American surgery.

Recent American and Foreign Patents.

Notice to Patentees.

Inventors who are desirous of disposing of their patents would find it greatly to their advantage to have them illustrated in the SCIENTIFIC AMERICAN. We are prepared to get up first-class WOOD ENGRAVINGS of inventions of merit, and publish them in the SCIENTIFIC AMERICAN on very reasonable terms.

We shall be pleased to make estimates as to cost of engravings on receipt of photographs, sketches, or copies of patents. After publication, the cuts become the property of the person ordering them, and will be found of value for circulars and for publication in other papers.

NEW MECHANICAL AND ENGINEERING INVENTIONS.

IMPROVED BAND SAWMILL.

Jacob R. Hoffman, Fort Wayne, Ind.—The object of this invention is to improve the construction of band sawmills, that the strain of the saw is accomplished, in place of applying a greater weight, by employing the upper saw pulley for the purpose of driving the feed or any other mechanism, giving thereby the saw a higher tension or strain, and rendering the same less liable to "dodge" in going through the log. The friction on the bearings of the upper pulley shaft is thereby reduced, and either the front or back edge of the saw strained at will for forward or backward motion. The feed motion is also improved especially with a view to facilitate the "gigging" back of the log carriage. The straining of the saw by employing the upper saw pulley for that purpose and employing means to strain at will the front or back edge of the saw is an important improvement.

IMPROVED OIL BOX FOR LOCOMOTIVE ENGINE CYLINDERS.

William F. Foster, Fitchburg, Mass.—The object of this invention is to furnish an improved device for oiling the cylinders of locomotive engines, which shall be so constructed as to apply the same amount of oil at each oiling, and which may be operated from the cab of the engine. The invention consists in the combination of a tubular shaft, provided with a crank, tubular arms, and buckets, with the oil box divided into three compartments by two partitions. Oiling the cylinder from the cab of the engine and applying equal amount of oil at each time is an important feature.

IMPROVED ENGRAVING MACHINE.

Augustus E. Ellinwood, Garrettsville, assignor to himself and Robert Irwin, of same place, and W. W. Harris, Cleveland, O.—This invention relates to that class of engraving machines used by jewelers for engraving silverware, rings, coffin plates, etc., in which the combination of levers known as the pantograph is used to direct the graver, the tracing point being guided by patterns, forms, or templets. A further device for cutting inscriptions on a curved line, while the tracer works on a straight line, is one of the combinations of this machine.

IMPROVED SAW TOOTH ADJUSTER.

John F. Damon, Rockland, Mass.—This invention has relation to devices for truing the ends of circular saw teeth which are swaged; and the nature of this invention consists in a hand tool constructed with a gage for determining the trueness of the cutting edges of the teeth. The frame of the tool is constructed with a straight edge, with rests on either side thereof, and an adjusting screw combined. By the employment of a tool of this character, and keeping the cutting edges of the teeth true and even, more work will be accomplished with less power.

IMPROVED HYDRAULIC ENGINE.

John Coates, Erie, Pa.—This invention relates to that class of piston engines that employ water under pressure as a motive power; and it consists of a valve of peculiar construction, and in the arrangement of passages in the cylinder for the ingress and egress of water. The advantages claimed are that the water is discharged by its own gravity, and therefore requires no force to eject the water after it is utilized. The construction of the valve is such that its friction and wear are reduced to a minimum, and the full power of the water realized.

IMPROVED GRAIN-REDUCING APPARATUS.

James L. Wilson, Woodstock, Ontario, Canada, assignor to John Forrest.—This is an improved machine for converting the hulled kernels of oats or other grain into a coarse meal. This is accomplished by means of a rapidly revolving cylinder divided into several sections, the faces of which have numerous parallel grooves from the hollow interior space to the circumference, which cause the grain to pass along the grooves, and to be presented endwise to reciprocating knives, the grain being retained for their action by guards in the holes or openings. The grain is fed to the interior of the cylinder in suitable manner, and from the same to the exit grooves and openings, the exit passages having laterally moving agitators to prevent the clogging of the grain in the grooves. The objection to the ordinary methods of crushing by means of or grinding by means of millstones is that a large percentage of the grain is reduced to a fine flour, which is of much less value than the coarse meal.

IMPROVED PUMP ROD ADJUSTER.

N. C. Martin Gifford and Pratt Abell, Barnhart's Mills, Pa.—This invention relates to an improved device for clamping the "polish rods" of oil-pumping apparatus; and it consists in the combination, with a crossbar that is connected with the walking beam of a pumping apparatus by rods, and through which the polish rod passes, of a gib that extends through the crossbar, a bolt that extends from the end of the bar to the gib, and an eccentric for forcing the gib into contact with the polish rod. By turning the eccentric by means of its rod, the polish rod may be instantaneously released or clamped at the pleasure of the operator.

IMPROVED HYDRAULIC JACK.

Daniel L. Weaver and George Noble, Hunnewell, Ky.—The object of this invention is to provide a jack for testing bridge bolts, and for adjusting them to the proper degree of tension, so that the strain upon the several bolts in a bridge may be evenly distributed. An important feature of the apparatus is an index attached to a pressure gauge, which stands at a number representing the bolt under strain.

IMPROVED MACHINE FOR TREATING FLAX, HEMP, AND OTHER SIMILAR PLANTS.

Norbert D. Landtsheer, Paris, France, assignor to Charles Couture, of same place.—This invention mainly consists in cleaning, softening and separating the fibers by the processes of breaking, scutching, and hackling, the several operations being performed by a machine working automatically. This improved machine is calculated to give increased impetus to the culture of flax which will lead to cheapness of the raw material, with increased profit, not only to the grower but the manufacturer, as the cost of breaking and scutching on this improved system will be about one third less than ordinary.

IMPROVED LAGGING FOR COVERING STEAM PIPES.

George B. Wiestling, Mount Alto, Pa.—This invention relates to lagging or covering to be applied to pipes and boilers to prevent the radiation of heat; and it consists of an envelope of one or two thicknesses of ordinary straw board separated from the surface of the boiler or pipe. Cheapness of material, which may be straw board or even straw rope, and the ease of obtaining, are some of the recommendations of this invention.

IMPROVED METALLIC COUNTER FOR BOOTS AND SHOES.

Ira O. Mann and George R. Rankin, Lake City, Col.—This invention is an improved metallic outside boot counter that prevents the crushing down or running over of the heel, protects the back of the boot against wear, protects the eye seam, keeps the boot in proper shape, and the inner counter dry, gives support to the ankle of the wearer, and adds to the symmetry of the boot instead of detracting from the same. This invention is intended to furnish a boot to miners, lumbermen, farmers, etc., that will sustain severe wear and tear, and at the same time preserve its shape and perform its office until the boots should be otherwise worn out.

IMPROVED PNEUMATIC TUBE FOR DREDGING.

William P. Lewis, Oroville, Cal.—This invention is designed for the purpose of hoisting dirt, débris, etc., from river beds, by creating a vacuum in the tube used for the purpose; and it consists of a tube having an inclined valve and side door, both being fitted in air-tight manner, and closed by steam admitted before sinking the tube, which, by condensation, creates a vacuum and draws in the sand, etc., that is finally discharged through the hinged side door on raising the tube. Simplicity of apparatus is the recommendation of this invention.

IMPROVED VALVE GEAR.

Albert M. Scott and Joseph J. Roth, Edwardsville, Ill.—Valve casings are attached to the head of the cylinder, and provided with ports in which a plug or cylinder valves are placed. These valves are cut away to afford a passage for steam through the casings. The space in the valve is of sufficient width to include two of the ports. Levers are attached to the lower end of the valves, and are connected by a rod, from the center of which an arm projects horizontally at right angles. A cam lever is placed under the piston rod whose shaft is at the center of the stroke of the cross head. The arms of the lever are curved upward, so as to engage with the cross head at each end of its stroke. The valves at the ends of the cylinder are oppositely arranged, so that when they are moved by the lever one of them admits steam to the cylinder, while the other permits it to escape through the exhaust port. The advantages claimed for this improvement are that the engine may be readily reversed, is simple and therefore easily constructed, and is not liable to get out of repair.

IMPROVED FRICTION CLUTCH.

William H. Clark, Chicago, Ill.—This clutch consists in a combination of cups and a friction ball mounted on spindles which have their bearings in a jointed frame. This clutch is applicable to sewing machines and all light machinery, wherein it is desired to have a variable motion and to stop the motion of the shaft at pleasure.

IMPROVED RICE CLEANING MACHINE.

Jesse Carter, Lake City, Fla.—The main object of this rice cleaner is to combine in one machine means for both hulling and pounding or mortaring the rice, while it also hulls the small rice that fails to get hulled in the ordinary huller. This is accomplished by a screw that projects down to the stone, working the rice from one end of the cylinder to the other, over one stone and against another. The screw forces the grain by a gentle and gradually increasing pressure against the stones and effectually rubs off the skin as well as the hull. The screw cylinder is adjustably attached to its shaft so as to allow the screw to be brought closer to or further from the stone, according to the quality of the grain. The object of the invention is to furnish an improved machine for hulling rice and other grains that shall be simple in construction, effective in operation, doing its work quicker and with less expenditure of power than the machines heretofore used for the purpose.

IMPROVED DRAIN.

George C. Mesler, Dunellen, N. J.—This invention relates to an improved draining device for freeing cellars and other low places from water; and it consists of a tube having a pyramidal point and a series of perforations at its lower end, and containing a smaller tube also perforated at its lower end and screwed into the pyramidal point, and extending a short distance above the upper end of the larger tube. The manner of using this tube is as follows: The lower part of the surface to be drained is selected, and the tube is driven down through its first stratum of earth and through the first water course, through the second stratum of earth and into the second water course. The upper end of the tube should be just even with the surface to be drained. The water flows down through the tube, into the lower underground current, and whatever air may exist in the water course escapes through the tube, permitting the water to flow freely down the outer tube.

IMPROVED PEGGING-AWL HANDLE.

Alexander U. McDonald, New York city.—This handle is so constructed as to withdraw the awl from the leather automatically by means of a spiral spring before the handle is raised, so that the operation of withdrawing the awl will not pull up the leather from its place. The awl is driven into the leather by a blow with a hammer, and is returned to its place in the cavity of the handle by the action of a spiral spring.

IMPROVED GRIPING AND PROPELLING ATTACHMENT FOR CAR TRUCKS AND LOCOMOTIVES.

James J. Thomas, Cahto, and William J. Anderfuren, San Francisco, Cal.—This invention provides for locomotives and car trucks an improved griping, safety, and brake attachment. It is intended to be used with advantage for ascending and descending steep gradients in railroads, being operated by hydraulic, pneumatic, or mechanical pressure, so as to facilitate the ascent and accomplish the descent with perfect safety, also to prevent derailment at any point. Grooved wheels bind on a center coil and serve, on applying steam or other power to the same, to assist the pulling of the train up hill, while down hill the wheels are pressed firmly without power to the rail, acting thus as a brake.

IMPROVED MACHINE FOR SHEARING BOILER PLATES.

John W. Johnston and Robert Johnston, Ferrysburg, Mich.—The object of this invention is to furnish an improved boiler plate shears, operated by hand or other power, and which may be so changed as to expeditiously give any desired bevel upon different thicknesses of plate. The lower blade is held against outward pressure by a wedge driven between its outer edge and a flange formed upon the outer edge of the bed plate. The movable blade is bolted to the holder, which works in a guide socket bolted to the standard. The guide socket turns upon a pivot at its lower end, and may be adjusted to the lower blade by means of a bolt, or to give any desired bevel to the plate to be cut. The object of this invention is to furnish improved boiler plate shears, which shall be solid, less liable to get out of order, and may be expeditiously changed to give any desired bevel upon different thicknesses of plate.

IMPROVED MILLSTONE BALANCING DEVICE.

Luther Read, Henderson, N. Y.—This invention consists in horizontal cups formed in the middle and upper parts, either or both, of each quarter of a millstone beneath the band, and provided with a hole leading into the upper part of the cups through the band, and closed with a screw. The cups are filled with shot to balance the stone. In case of old stones, the lower cups may be formed in the stone through holes cut in the band, which holes are afterward covered by patches secured to the band by screws. The upper cups may be formed by removing a part of the plaster, putting in the shot and replacing the plaster.

NEW MISCELLANEOUS INVENTIONS.

IMPROVED SCALE PAN.

Edward M. Whyler, Hays City, Kan.—The outer part or scoop of the pan is made in the general form of a section of a hollow cone, and the other part is made in the general form of a hollow cone, with a part of one side cut away. To the apex of the part cut away, and in the opening thus formed, is secured a short tube which serves as a funnel for pouring substances weighed into bags and boxes. For pouring substances into bottles, cans, and other narrow-mouthed vessels, a detachable funnel is fitted to the tube.

IMPROVED BATHING APPARATUS.

William J. Hill, Matteson, Ill.—The object of this invention is to provide a convenient portable bathing apparatus, which may be used in localities where water is not distributed throughout dwellings in pipes as in the larger cities and towns. A reservoir made of any suitable material is adjusted to any convenient height and is filled with water, when it is raised by means of a cord. The bather enters the tub and closes a movable port that permitted him to enter. By drawing a cord, a valve is opened and the water in the reservoir escapes through a sprinkler, the quantity being controlled by opening the valve more or less.

IMPROVED METHOD OF ORNAMENTING METALLIC SURFACES FOR JEWELRY.

Edward Huguenin, Philadelphia, Pa.—The object of this invention is to provide an improved method of ornamenting gold and other jewelry in highly artistic, durable, and multicolored designs, in perfect manner and without the old processes of cutting out and soldering on the ornaments, or of coloring by means of salts; and the invention consists in applying to a bottom plate of greater thickness, by soldering or rolling, a number of superimposed thinner plates of variously colored gold, silver, platinum, or other metal, and finishing the article made therefrom by hand or machine work, producing a large variety of effects, by cutting down to the differently colored plates. The advantages of this method over the old style consists in producing the color by very thin plates, but in larger or smaller surfaces, as required, and in flat, round, or other shape, the engraver getting readily to the colors required by cutting through to the required layer or color, and enabling him to work continually on a solid plate, without the uncertainties of the old soldered process, in which every ornament had to be cut out and soldered on, and which was liable, as well as the chemically produced colors, to work off by use.

IMPROVED MOP.

Edmund S. Ellis, Lynn, Mass.—This invention consists in the combination of a ratchet and pawl and a lever handle with a cylindrical rotating mop, for the purpose of squeezing the water out of the latter. The cylinder is perforated and has thrums or tufts of yarn fixed to it. A wringer roll is held in contact with the cylinder by means of a bow spring. By working the handle, the cylinder is rotated and by contact with the roll the water is squeezed out.

IMPROVED BAR FOR JAILS, PRISONS, ETC.

Thomas J. Tolan, Fort Wayne, Ind.—The object of this invention is to furnish bars, rods, and plates for jail and prison purposes, which shall be hard upon the outside, so that they cannot be filed or sawn, and at the same time tough so that they cannot be broken. The iron, in the shape of bars, rods, and plates of the required size and form, is carbonized by any of the well known processes upon its outer surface, while the interior is left in its natural state.

IMPROVED BAGGAGE CHECK.

Ray F. Livermore, Port Henry, N. Y.—It consists of two pivoted metal plates, that are connected by a lip of one plate binding on the other plate, and by the leather strap attached to a loop of one plate and passed through slots near the connecting lip of both plates. Notched station-indicating disks are set, by a center and circumferential pin, between the metal covering plates to the required points, which are read off by corresponding recesses of the metal plates. This invention facilitates the system of checking baggage from and to local and main stations over different roads. The trouble of exchanging checks is avoided, and the number of checks required for a station is lessened.

IMPROVED BASKET.

Charles H. Ball, New York city.—The object of this invention is to provide an improved basket of strong and durable construction that may be conveniently folded up after use into narrow compass, and instantly extended when desired; and the invention consists of a basket made of a flexible body, solid bottom, and top band, and with a swinging bail pivoted to the top band or hoop, and binding by curved spring extensions reaching the solid bottom, to retain the basket in expanded state. As the basket takes up a small space when folded, it is conveniently shipped and stored. As a lunch, market, and travelling basket, it combines cheapness, strength and durability.

IMPROVED FIREMAN'S SUIT.

John W. Oestberg, Stockholm, Sweden.—This invention consists in an air and water proof suit that covers the entire body, and is continually flooded with water, which is introduced by pipe connection with the hood, covering the headgear or helmet of the dress. The helmet is tightly applied to the body-covering dress, and the dress strapped to the body, air being supplied to the inside to keep out the smoke by an air supply pipe and pump. The helmet is provided with a hollow valve mask, through which the water is continually flowing, passing by a connecting tube to the hood that is fitted on the face mask and extended over the dress to shed the water over the same. The object of this suit is to protect the whole body against the influence of fire, smoke, and water, so that firemen may not only approach fire but pass through or into the same without being exposed to injury by fire or smoke.

IMPROVED PANTOGRAPH.

Elijah Ware, Omaha, Neb.—This is a pantograph for enlarging and reducing drawings. The device consists of a bent lever capable of universal motion, and carrying a tracing point and a pencil, both of which are arranged in the same axial line and work upon separate tables placed one above the other. The relative size of the copy and tracing may be varied by moving the table. Moving it up makes the tracing larger, and moving it down, smaller.

NEW AGRICULTURAL INVENTIONS.

IMPROVED GRAIN SEPARATOR.

William J. McCulla, Estherville, Iowa.—In this invention the separator is provided with two carrier belts, the primary one adjustably inclined with respect to the secondary one, and in the combination of a thrashing machinery made with a carrier having its upper end adjustable to and from the top of the casing of the machine. The shifting of the first carrier to a higher or lower position either retards or accelerates the motion of the straw, and adapts thereby the machine to the threshing and separating of the different kinds and conditions of the grain.

IMPROVED ANIMAL STOCK.

John Bowman and Samuel C. Irving, Greenbush, Ill.—This invention consists in making an animal stock with independent foot rests to permit the feet of the animal to be operated upon at the same times by different persons. The shoes are applied to the feet when the animal is in hoisted position, and the nails clinched and the shoeing finished, or the animal may be lowered and the finishing operation completed when the same is in natural position. The apparatus is readily handled and the animal brought thereby fully within control without danger or trouble.

IMPROVED OX-BOW FASTENER.

Prescott Webb, Greenleaf, Minn.—A base plate is attached to the top of the yoke, and extends by a circular part around the hole provided for the passage of the bow end, and guides in a socket a sliding bolt that is moved by a stud and retained in locked position by an L-shaped slot. The bolt passes through a lateral hole of the bow and into a socket at a point diametrically opposite to socket. The bolt may be made spring-acted, if desired. This is a simple and reliable device for fastening ox bows to the yoke, so as to readily admit putting on of the bows to and taking off of the frame from the yoke and the necks of the oxen.

IMPROVED STRAW CUTTER.

George H. Keller, Shotwell, Mo.—This invention consists in the combination of connecting rods and a pivoted lever, a three armed lever, and pawls with ratchet wheels attached to the journals of the feed rollers and with the driving gearing of the machine. The lower feed roller is pivoted to the lower stationary part of the forward end of the feed box, and the upper feed roller is pivoted to the movable part of said end so that it may adjust itself to the varying thickness of the material. The feed rollers may be provided with teeth to prevent slipping on the material.

IMPROVED HARROW.

Frank Barnes, Fairmount, Neb.—This invention consists in the combination of two pairs of rods with the forward inclined bars of the two parts of the harrow frame; in the combination of the tongue with the two pairs of rods and two parts of the harrow frame; in the combination of the seat, the slotted seat board, the standards, and their braces, with the two parts of the harrow frame. The object of this invention is to furnish an improved harrow, simple in construction, convenient in use, effective in operation, harrowing the ground thoroughly with once passing over it.

IMPROVED GARDEN PLOW.

Thomas E. Smoot, Florence, Ala.—This invention consists in the combination with a garden plow having a front wheel, a shortened beam, and the usual handles; of a reversible push bar having breast piece and forked lower end pivoted directly to the axle of the same, the arrangement permitting the push bar to be reversed and used as a draft bar to equal advantage.

IMPROVED CORN PLANTER.

Frederick A. Hartnagel and John W. Hartnagel, St. Louis, Mo.—This invention is designed to furnish an improved corn planter, simple in construction, convenient in use, and reliable in operation, dropping the seed at regular intervals, and so constructed that when the dropping device is thrown out of gear the said device will continue to move on until just ready to drop the seed for another hill, so as to drop the seed as soon as it is again in gear.

IMPROVED WHEEL PLOW.

Ammon A. Amonett, Wrightsborough, Texas, assignor to himself and James E. Wells.—The object of this invention is to furnish an improved wheel or riding plow, which shall be simple in construction, convenient in use, easily guided and controlled, of light draft, and at the same time strong and durable. Trash may be cut by a circular or ring cutter attached to the near wheel in such a way that its edge projects two inches, more or less, beyond the rim of the wheel.

IMPROVED GATE LATCH.

Cyrus B. Austin and Milton S. Austin, Cuba, O.—This invention consists of an arc-shaped bolt attached to a pivoted arm, and provided with ratchet teeth, and operated by means of a lever carrying a pawl, which is capable of engaging either of the ratchet teeth of the bolt, as occasion may require; the object being to provide a simple latch for gates and doors that will automatically adjust itself to the distance between the gate and post or between the door and jamb.

IMPROVED HOG TRAP.

Charles R. Rutledge and John W. Rutledge, Shannondale, Ind.—This invention is designed to furnish an improved trap for catching hogs and holding them while being ringed. It consists in a slotted head block, a pivoted bottom board, cords, lever, and hook in combination with each other and with a box; and in the lever having its forward part bent into U shape, and provided with a cord, in combination with the slotted head block.

IMPROVED STRAW CUTTER.

Samuel Mepham, Fayette, O.—The standards that support the box for containing the straw or other feed to be cut also supports the journal boxes of the shaft. This shaft is arranged parallel to the side of box, and upon it, at the front end of the box, the wheel is secured, having knives, with edges that are convex in the direction of their length, attached, by means of bolts, to two opposite arms of the said wheel, and adjusted by set screws so as to lightly touch the lower side of the mouth of the box as the wheel is revolved.

NEW WOODWORKING AND HOUSE AND CARRIAGE BUILDING INVENTIONS.

IMPROVED MORTISING CHISEL.

George Buttler, New Brunswick, N. J.—This invention consists in a mortising chisel concaved upon its back and edge. The object of the invention is to furnish an improved chisel, which shall be so constructed as to work easier, and do better work than chisels constructed in the common way.

IMPROVED THILL COUPLING.

Julius T. Pomeroy, Edgerton, Wis.—The object of this invention is to provide a simple, effective, and safe thill coupling, by which the thills may be readily attached to and removed from a vehicle. The side pieces of the socket are connected by a rivet and have ribbed flanges in combination with a plate that is fastened to the thills upon which a sector-shaped bevel is formed. The thills are removed from the vehicle by raising them into a vertical position, when the head may be lifted from the socket.

IMPROVED THILL COUPLING.

Charles B. Post, New London, O.—This invention consists in the combination of a bolt or pin provided with a stop, a U.shaped recessed fastener, and a rubber block, with hooks formed upon the forward arm of the clip, and with the forwardly projecting end of the yoke. The object of this invention is to furnish a coupling that cannot become unfastened when the thills or pole are in a working position and so constructed as to be easily and quickly attached, and which shall be anti-rattling.

IMPROVED VEHICLE BRAKE.

William P. Pickard, Columbia, Tenn.—The object of this invention is to furnish an improved brake for wagons, drays, carts, and other vehicles, which shall be so constructed that the forward pressure of the vehicle against the horses may apply the brake, which will enable the draft of the forward horses of a four horse team to assist in applying the brake, and which will enable the brake to be applied by hand, when desired.

IMPROVED WAGON BED.

Wharton J. Kinsey, Denver, Col.—The sills of the wagon bed rest on transverse timbers that are fitted to the bolsters of the wagon, and are stayed by braces secured to the sills by bolts. The bed is made concave, which tends to hold the load centrally. The load is supported above the wheels, so that it may be loaded and unloaded with facility. The object of the invention is to provide a strong and convenient wagon bed for farm purposes and for hauling and transferring freight.

Business and Personal.

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

Notes & Queries

J. R. will find a recipe for stove blacking on p. 41, No. 3.—For information on rubber stamps, A. A. R., D. R., and others may consult No. 6, p. 91 (33). —A. B. C., G. H. J., J. B. B. and others are referred to No. 7, p. 100, for information on curving a base ball.—W. S. P. will find information concerning the preservation of flowers on p. 98, vol. 35.—J. M. will find directions for making the American flag on p. 12 (29).—R. L. asks how to prepare sumach leaves for insect powder. The leaves must be thoroughly dried, ground very fine, sifted, and kept dry.—W. B. S. must see reply to W. T. for instructions for etching metals with acids.—T. C. is informed that wood is a conductor of electricity. Glass is a non-conductor.

(1) L. R. asks: How is nitro-glycerin made? A. Nitro-glycerin is produced by treating ordinary glycerin with a mixture of equal parts strongest nitric and sulphuric acids, and then washing the heavy, oil-like product with plenty of cold water. See p. 407, vol. 35, also vol. 34 of the SCIENTIFIC AMERICAN. Nitro-glycerin, when pure, is free from acids. It is a compound in which part of the hydrogen of the glycerin is replaced by nitric acid.

(2) F. W. S. says: I want something that in quantity of only about an inch square will burn with a small flame for about 10 hours? A. We know of no substance a cubic inch of which would be capable of maintaining a notable flame during 10 hours, excepting, perhaps, a quantity of heavy oil controlled in a diminutive lamp.

(3) J. C. D. asks: What kind of mineral do the stone piers of the East River bridge rest on for a foundation? One person claims they stand on clay, or what is called a hard pan, while I claim they stand on solid rock or stone. Is either of us right, if so, which one? A. The piers rest on solid rock in some places, and on gravel or boulders in others.

(4) J. A. says: Would you reproduce the description of the magneto-electric machine given on p. 195, vol. 34? A. No.

(5) J. A.—For the information of C. R. B., in reference to the fluid contained in a storm glass, says: "The mixture is made as follows: Place in a long narrow bottle or test tube, camphor gum 2½ dhm, spirits of wine 11 dhm. When the camphor is dissolved add the following mixture: Water 9 dhm, saltpeter 38 grains, sal ammoniac 38 grains. Dissolve these salts in 9 drachms of water before mixing with the camphorated spirits, then shake the whole together. Cork up tight, and seal with wax, then make a small hole through the cork with a red hot needle, so as to have a small clean hole. Heavy atmosphere will cause the salts to rise; a light atmosphere to fall. Cost of mixture, 10 or 15 cents.

(6) H. M. N. asks for the best method for cooling water without the use of ice, being situated in a place where ice cannot be obtained. A. See "A self-cooling goblet," p. 72, No. 5. We shall soon publish another method of cooling water and liquids.

(7) P. R. asks how the ends of the single wires are joined together to form the strand for the East River bridge cables? A. Short thimbles are made with a right hand thread cut in one end and a left hand thread in the other. Corresponding threads are cut in the ends of the wires to be joined, which are received in the thimbles.

(8) O. B. says: Suppose I suspend two weights from line 50 feet long, say 200 feet apart at the point of suspension. Now it seems to me that, by carefully measuring, the distance from weights would not be quite 200 feet, as both tend to the center of the earth. I think therefore that in this way I might be able to find the radius of the earth by simply measuring the distances between the weights, make calculations where they would finally meet. Am I right or wrong? A. The theory is correct. You may find it difficult to apply under the circumstances.

(9) S. J. S. asks: 1. Would not steam power be more economical or take less steam and wood to pump in air with the steam? A. There would probably be some economy in the arrangement. 2. Are the petroleum engines a success? A. There are some forms that are favorably spoken of. 3. What does the crude oil cost? A. The price is variable, about 9 cents a gallon at present. 4. Does water in boilers protect no thicker iron than ⅜ all over burn out or away? A. It is not usual to make fire surfaces thicker than this. 5. If cast iron boilers are covered with sheet iron, does that do away with the objection to them or make them as safe as wrought iron boilers? A. We think not. Your other questions would require quite a treatise for their proper consideration, and if you will consult the back files of our paper, you will find that they have all been referred to. 6. How much cheaper is water power than steam, say for the length of time that an engine or boiler would last, or in the long run? A. Experiment can alone decide.

(10) A. B. asks how to make sizing for walls? A. Size to make paper stick to walls is made by adding 8 ozs. of dissolved glue to a pail full of hot water. Apply the preparation to the wall with a whitewash brush. Be particular to touch every part of the wall, especially the top and bottom. Allow the size to dry a little, and hang the paper with paste as usual.

(11) E. F. S. says: Will you tell me how to clean guns? A. Remove the barrels, wash with hot water to remove the residuum of the powder, wipe dry and oil lightly with oil that contains neither salt nor acid. Keep the locks dry and do not get water into them.

(12) F. M. Y. says: In procuring alkalies from barks by boiling in dilute muriatic acid, I find great difficulty in separating them from the tannic acid. How can I precipitate the alkaloids moderately pure? A. Heat the solution with a solution of lead acetate (Goulard's solution) as long as a precipitate forms, and then remove the excess of lead by cautious addition of ammonia or by hydrosulphuric acid (sulphuretted hydrogen). Evaporate and crystalize from the filtered solution.

(13) M. L. T. asks: What is the process and appliances used for extracting oils from herbs? A. The volatile oils are generally obtained by distilling in a deep narrow retort the articles along with an equal weight of water; but some substances that give out their oil with difficulty are first soaked for 24 hours in twice their weight of water, to each gallon of which 1 lb. of common salt has been added, by which its boiling point is raised, and consequently the oil comes over more readily. The distillate separates into two layers, the water being drawn off and returned to the retort, and this is repeated until distilled water ceases to come over mixed with oil. The rectification of the oil is performed without water, by the careful application of heat just sufficient to cause them to flow over pretty rapidly, so that they may be kept heated for as short a time as possible.

(14) J. G. S. asks how to clarify neats' foot oil? A. The oil is usually agitated by means of injected steam, first with solution of tannin (hot infusion of oak bark), next with water and chloride of lime, and then with dilute oil of vitriol. Solution of blue vitriol (copper sulphate) and salt is also sometimes used, and the oil filtered through dried and powdered fuller's earth or charcoal in large bags of Canton flannel.

(15) S. L. E. asks: What is the best method of making black and violet ink that will dry immediately? Also what will take such ink stains from hands and clothing? A. The purple ink made from aniline violet solution with a little gum is among the best of its kind. A purple or violet ink may also be made by triturating 6 parts of finest Prussian blue and 1 part of oxalic acid into a smooth paste with a little water, and, after standing 24 hours, diluting with sufficient quantity of water and enough extract of Brazil wood to strike the desired color. A little alum solution and an ounce of gum to the gallon should then be added. For other ink recipes and methods for removing ink stains see p. 76 (54) vol. 37, pp. 155 (30), and 315 (26), vol. 36, and pp. 101 and 297, vol. 35 of SCIENTIFIC AMERICAN.

(16) W. G. says: How can I save apple and pear trees attacked by the blight? A. A good lime wash is recommended, with the addition of a little soot or lampblack to neutralize the glare if this is objectionable. This wash destroys the eggs of insects and germs of fungi, and keeps the bark free to swell as the cells grow. Some farmers have used strong hot solutions of common soap applied with a swab, also linseed oil where the white scales abound.

How can I separate nickel from a solution of nickel coins dissolved in nitric acid (HNO_3)? A. Heat the solution gently, slightly acidified with dilute sulphuric acid, and pass a slow current of sulphuretted hydrogen through it until a filtered drop of the solution no longer gives the copper reaction when brought into contact with a drop of potassium ferrocyanide solution. Filter, cautiously add a little potassium chlorate, heat to boiling, and precipitate as oxalate (with oxalic acid). The dried oxalate heated in a closed crucible will yield pure nickel.

(17) W. E. S. asks: What is the quickest way to make vinegar? A. What is known as the German process is the most rapid method of making a good vinegar. In this, dilute alcoholic liquor to which $\frac{1}{1000}$th part of honey or extract of malt has been added is caused to trickle down through a mass of beechwood shavings previously steeped in vinegar and contained in a vessel called a vinegar generator (*essigbilder*). It may consist of a large oak hogshead or barrel furnished with a loose lid or cover, a few inches below which is fitted a perforated shelf, having a number of small holes loosely filled with packthread about 6 inches long, knotted at the upper end to prevent their falling through. Several small glass tubes long enough to project slightly above and below the shelf are also fitted in perforations in the shelf to serve as air vents. The vessel at the lower part is pierced with eight or ten holes equally distributed around the sides at about six inches above the bottom, to admit of the entrance of air. A small siphon tube, the upper curve of which is an inch below the air holes, serves to carry off the liquid as fast as it accumulates at the bottom. The alcoholic liquid at a temperature of 75°—83° Fah. is run in on the shelf, and slowly trickles down through the holes by means of the packthread, diffuses itself over the shavings, slowly collects at the bottom, and runs off by the siphon exit. The air enters by the lower holes, passes freely through the shavings, and escapes by the glass tubes. The temperature within the apparatus soon rises to about 100° Fah., and remains stationary at this point while the action goes on favorably. The liquid generally requires to be passed three or four times through the cask before its acetification is complete.

(18) C. says: I have used the following recipe for making hard soap: 7 lbs. common yellow soap, 4 lbs. sal soda, 1 oz. hartshorn, 2 oz. borax, ¼ lb. rosin, to be dissolved in 22 quarts water, and boiled about 20 minutes. It hardens sufficient on cooling to be cut in bars, but after a short time it becomes greasy, with particles of soda appearing in it. A. Use a larger proportion of sal soda and boil with the rosin and borax some time before adding the soap. It should be kept in a dry place for a time after cutting.

(19) H. R. says: I wish a preparation to coat paper moulds so that a mixture of glue and molasses will not adhere to the paper? A. Dip the moulds in melted paraffin, and when cold cover them uniformly with a thick oil.

(20) A. B., and others who ask how to make marine glue: Dissolve 1 lb. best caoutchouc (gum rubber) in 4 gallons of pure gas naphtha, with frequent agitation. After ten or twelve days add 2½ lbs. of shellac, in finest powder, and allow to stand for about a week in a well stoppered flask. The mixture must then be carefully heated in an iron vessel having a discharge pipe at the bottom, and, when the whole has become liquid, drawn out upon large metal slabs to cool. When required for use it should be heated to 258° Fah. (best in an oil bath), and applied with a brush. It forms, when properly prepared, one of the strongest and most insoluble cements known.

(21) T. J. S. asks: What ethers will mix with naphtha or gasoline of 62° without danger of explosion? A. As we understand you, most of the common ethers are miscible with the oils mentioned, and the vapors are explosive only when mixed with air and ignited.

(22) L. H. asks how to make ozone in large quantity? A. Ozone may be formed in large amount by electrifying air or oxygen. It is by this process that it is usually made when required in large amount and in very concentrated form. You should consult some standard work on inorganic chemistry.

(23) W. C. R. says: 1. I made some fulminate of mercury, and instead of exploding with a loud report, it only made a puffing noise and very bright blaze. A. The detonation of the fulminate in small quantities is not very violent unless it occurs in a confined place. 2. Will you tell me how to explode torpedoes made of chlorate of potassa and sulphur? A. The ingredients must be reduced separately to the finest powder and intimately mixed; the mixture explodes either by concussion or ignition.

(24) L. A. L. asks: What action will lager beer have on elastic rubber, when in constant contact with it? A. It will probably soften it considerably after a time.

(25) G. H. E. asks: 1. What is the difference between pot and pearl ashes, and how made? A. The crude carbonate of potash of commerce is obtained by lixiviating the ashes of plants with water, and boiling down the liquid to dryness in iron pots. The dark-colored residue is called potashes, and this when calcined in a furnace so as to burn off most of the coloring impurities, affords the impure carbonate known as pearlash. 2. Who use ashes, and for what purpose are they used? A. These find extensive use in technical operations, such as soap-making, glass making, dyeing, metallurgical and chemical operations, and are the source of nearly all the potassium preparations and salts in use.

(26) A. P. asks: How can I prevent souring and putrefaction of flour paste? A. A small quantity of solution of corrosive sublimate or chloride of zinc will prevent the souring and putrefaction of the composition. These antiseptics are poisonous when taken into the system.

(27) D. F. asks how to prepare chewing tobacco? A. Chewing tobacco is prepared by some unprincipled persons from the leaf by soaking in cheap rum and molasses, with the addition of ammonia and niter, and pressing; but it is, we believe, a common practice to first soak it in urine and then in molasses water, etc. See p. 68 present volume of the SCIENTIFIC AMERICAN. Common smoking tobacco is prepared from the wet pressed leaf, the waste of cigar making, and stems similarly treated, dried, and broken, or cut. It is usually thought proper to improve (?) it with various quantities of safflower, rhubarb, potato, cabbage, coltsfoot, dock-leaves, sawdust, malt combings, medicinals, and sand.

(28) E. D. asks how to construct a Leclanché battery? A. The Leclanché battery consists of a plate of zinc placed in a solution of ordinary commercial sal ammoniac (chloride of ammonium). The porous cup should hold a plate or prism of carbon surrounded with a dry mixture of manganese black oxide and pounded gas carbon. The contents of the cup is usually sealed at the top with a layer of asphaltum, through which the end of the carbon plate projects for connection. See (40), p. 60, present volume of SCIENTIFIC AMERICAN. 2. Is the Leclanché battery durable and strong by always leaving it together? I like to have a very strong and durable galvanic battery, preventing the use of acids and vitriols if it can be helped. A. On open circuit it lasts a long time, and, at the moment of closing circuit, has an electromotive force greater than the Daniell's or gravity form of battery, if in good order.

(29) J. H. C. asks for a simple way of purifying coal gas? A. Hydrated oxide of iron or coke dust saturated with a strong alkaline solution will answer; but for large quantities of gas, lime or lime water is the cheapest. Washing with water will not completely purify it.

(30) I. M. asks: Can scent of coal oil be removed without injuring its qualities? A. A great part of the disagreeable odor may be removed by treating the oil with milk of chloride of lime (bleaching powder) at a temperature of 138° Fah. for some time, decanting from the sediment, agitating with a few per cent of soda solution, and washing well with water.

(31) H. W. S. asks if there are any compounds or liquids that will explode or ignite when brought in contact with each other? A. Hydrogen phosphide ignites explosively on contact with air or oxygen. On contact of calcium phosphide with water, hydrogen phosphide is formed, and inflames immediately in contact with air. Iodine inflames phosphorus (vitreous) by contact. A mixture of potassium chlorate with fine sugar or ether is ignited by a drop of oil of vitriol. Pure hydrogen and chlorine (gases) combine explosively by contact in strong sunlight. The ozone liberated by the action of a little strong sulphuric acid on dry, powl dered potassium permanganate directly ignites coagas, cotton, oil, or other combustible substance brought in contact with the generating mixture. Other similar reactions might be cited.

(32) W. T. asks how to etch on steel? A. The clean plate must be covered with an even film of wax, either applied while the plate is uniformly heated, or dissolved in alcohol and flowed on the warm plate. The etching fluid may be made as follows: Pyroligneous acid 4 ozs., alcohol 1 oz., nitric acid 1 oz.; by measure, Or use iodine 1 oz., iron filings ½ drachm, water 4 ozs. The lines are cut through the wax with a fine steel point, so as to leave the metal surface bare under the lines. The etching fluid is then poured on, and removed as soon as the metal is sufficiently etched.

(33) F. H. asks how to obtain the color of the "liqueur absinthe"? A. The substances used by the French to color their liqueurs are, for blue, sulphate of indigo neutralized with chalk, or the juice of blueberries; fawn and brandy color, burnt sugar; green, spinage and parsley leaves digested in spirit, also by mixing blue and yellow; red, powdered cochineal, either alone or mixed with a little alum; violet, litmus; yellow, an aqueous infusion of safflowers or French berries, or a spirituous solution of turmeric.

(34) A. E. G. asks: 1. What solid substance is most sensitive to changes of temperature, or has the greatest coefficient of expansion? A. Zinc, we believe, suffers the greatest change. 2. What substance is most sensitive in lengthening and shortening for changes in humidity? A. Porous bodies, such as light wood, are most notably affected.

(35) C. E. F. asks for some liquid of a volatile nature that will reduce sawdust and scrap white paper to a pulp? A. Ammonio-cupric oxide and aluminous chloride dissolve and soften woody fiber and paper.

(36) J. D. S. asks how to make the putty used by carriage painters? A. Take dry white lead and mix with 1 part brown Japan and 1 part carriage rubbing varnish. A common wagon putty is made by using whitening in the place of dry white lead and adding a small quantity of white lead in oil, from the keg. This putty should be kept in water when not in use, to prevent drying.

(37) E. D. asks: 1. Can I leave a sulphate of copper battery together without the blue vitriol eating the copper? A. You can let the battery stand, but after a short time the copper solution will get to the zinc and coat it with copper. If the solution does not contain a free acid the copper will not be corroded to any extent. A little sulphate of zinc solution is better than salt water as the zinc fluid. 2. Is it unhealthy to leave the filled battery uncovered in a bedroom over night, where the windows are open? A. If the chemicals are pure, no. 3. Are the solutions very dangerous? A. They are only dangerous when taken into the system; they are not volatile.

(38) H. T. R. asks: What boat ever made the fastest time from New York to Albany? A. It is stated that the trip of the Chauncey Vibbard from New York to Albany in six hours and twenty minutes, April 18, 1876, is the fastest on record. If any of our readers possess records of faster time over this route, we would be glad to hear from them.

(39) R. J. K. asks: How fast will a 15 foot boat go with a screw propeller 12 inches in diameter and 18 inches pitch, a boiler 12 x 20 inches, cylinder $1\frac{1}{2}$ inches, bore 3 inches stroke. A. Probably between 3 and 4 miles an hour.

(40) R. S., Jr., asks: What size engine, boiler, and propeller would work to the best advantage in a small boat 15 feet long and 5 feet beam, and what speed may I expect to obtain in smooth water? A. Boiler 24 inches diameter, $3\frac{1}{2}$ feet high. Cylinder $2\frac{1}{2}$ by 3 inches. Propeller, 18 to 30 inches diameter, 30 inches pitch. Probable speed 5 to 6 miles an hour.

(41) J. W. W. asks: Can you send me a prescription for weak kidneys? A. You should consult a physician.

Is an improvement in link motion for steam engines patentable? Are any links on locomotives patented? A. Certainly it is. There have been many patents relating to link motion, and it would be well for you to study up the subject and become acquainted with the most advanced practice before attempting to effect improvements.

(42) E. H. R. asks: Is it safe to carry 120 lbs. steam on a boiler of the following description: Diameter 48 inches, length 26 feet, four 12 inch flues. Thickness of the boiler iron $\frac{5}{16}$ of an inch. A. We do not think that this figure allows a sufficient margin for faults of construction and deterioration by use.

(43) J. C. asks; Why do propeller shafts break? A. In such cases as have come to our notice, the cause was insufficient strength, either by reason of being too small, or on account of imperfections.

(44) A. A. McN. asks: What is the horse power of a 4 x 8 steam engine when worked up to its fullest capacity, also if the length of stroke is 7 and the cylinder 4, has it the same power as a 4 x 8? A. See p. 33, vol. 33.

(45) R. W. K. says: I have a steam boiler 30″ x 42″, 18 2″ tubes (party from whom I bought it said it was a 5 horse power boiler); how large an engine, screw, and boat could this run, and what speed? I have a small 2 cylinder oscillating engine, each cylinder is 2″ x 2″. How large a boiler should I use to run my boat (12 feet x $3\frac{1}{2}$ feet) with side wheels, for safety? A. See pp. 33 and 225, vol. 33.

(46) B. C. M. says: I think G. W. W., July 28 (31), would find the information he desires in Thomas Oxley's "Gem of the Astrial Sciences," in which the author treats at length on the construction of planispheres.

(47) Machinist says: Suppose a piece of inch iron was cut with two threads, one right and the other left handed, commenced opposite and of the same pitch, would the screw enter a nut cut with the same threads, the same pitch? A. Yes, but if the threads were fine and of small pitch, the thread in the nut would be nearly obliterated.

(48) T. E. asks: What is enamel made of, and how is it put on iron? A. Enamel is a species of vitreous varnish, colored with metallic oxides, applied in a thin stratum to metallic surfaces. In small articles it is fused on the surface by the flame of a blowpipe and in larger articles by means of the heat of a furnace. Ordinary enamel is common glass fused with oxide of lead. Hollow ware is enameled by a mixture of powdered glass, borax, and carbonate of soda, mixed, fused, cooled and ground. The ware is cleansed with acid, wetted with gum water, the powder dusted on, and then fused by heat carefully applied.

(49) L. D. asks for a good ink that has a pale color when first written, then turning to a deep black. A. For 1 quart of ink take Aleppo galls 4 ozs., soft water 1 quart; macerate in a clean corked bottle for ten or twelve days with frequent agitation; then add $1\frac{1}{4}$ oz. gum arabic dissolved in a wine glassful of water, $\frac{1}{2}$ oz. lump sugar. Afterward add $1\frac{1}{2}$ oz. sulphate of iron; agitate occasionally for two or three days, when the ink may be decanted for use, but it is better if the whole be left to digest together for two or three weeks. When time is an object, the whole ingredients may be put into the bottle at once and agitated daily until the ink is made, and boiling water may be used instead of cold.

(50) S. T. asks for the process of making an impression of a photograph on glass. A. In photographing on glass the clean plate is first coated with a thin, uniform film of collodion (gun cotton dissolved in ether and alcohol) containing a little ammonium iodide or bromide, and often similar salts of cadmium. While the film is still moist, the plate is immersed in the dark in a bath of silver nitrate dissolved in water. This causes the film of collodion to become filled with insoluble iodide and bromide of silver, and in a few minutes the plate is ready to be placed (wet) in the camera and exposed therein for half a minute, more or less. On removal from the camera it is treated in the dark room, first with a strong aqueous solution of ferrous sulphate (copperas), which developes the picture, and then, after washing, immersed in a fixing bath, which may be either a solution of sodium hyposulphite, or of potassium cyanide. The photograph is finished by washing with water, drying, and coating with a film of transparent varnish. In the Woodbury and similar processes for preparing glass photographic transparencies, the picture is printed with a fatty ink from the impression in a plate of zinc of a photographic gelatin bichromate film. Consult Vogel's "Chemistry of Light and Photography."

(51) J. L. & Co. ask: By what method can we temper the blades of our steam shears, so that they will stand to cut old saw blades or any thin tempered steel? A. Harden as for ordinary tempering and draw the temper to a bright straw color.

(52) J. C. says: I have an engine which requires lining up on the crosshead. Having no adjustable gibs I pour in Babbitt metal, which does not answer. I want some harder metal which can be poured and will not cut the guides. A. You can harden Babbitt metal by melting it and adding a quantity of antimony.

(53) G. L. L. says: What is the new process of coating old table knives so they look like silver? A man has been collecting knives and plating or coating them so they look like silver. He claims they will last for years and that it is neither silver or nickel but some kind of metal which is kept secret and that no battery is used. A. The coating may be of tin, or an alloy of this with some other metal, applied to the clean blades by simply dipping in a bath of the molten metal under suitable conditions. We cannot say positively, from your statements. Such a coating would not be very durable.

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

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

J. J. S.—The clay may be used for brick and tile making, etc. It is too impure for fine pottery.—C. W. G. —The clay is of a low quality and would not probably pay to mine for market. It might be used in the vicinity for the manufacture of bricks and some kinds of pottery. The other specimen is not logwood extract but asphalt.—S. L. P.—It consists principally of oxide of iron. The glimmering particles are magnetite. The specimen in bottle will be noticed subsequently.—G. G. —It is iron pyrites. See p. 7, vol. 36, SCIENTIFIC AMERICAN.—D. C. S.—It is magnetite—magnetic oxide of iron.—H. C.—It consists of lime carbonate and a little clay, sand, and oxide of iron. Properly calcined it might yield a good lime or cement, but it does not excel as a polishing powder.—D. L. P., Curaçao, South America.—The sample of cave earth much resembles bat manure, as the per cent of organic matter and ammonia is very small. It contains a large quantity of phosphates—principally calcium phosphate—together with some lime carbonate, a little iron and silicates—clay and sand. If treated with oil of vitriol so as to form the superphosphate it would be of some value as a fertilizer, alone or mixed with others. Its value could not be named even approximately, until a quantitative analysis determines its composition.

COMMUNICATIONS RECEIVED.

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

On a Puzzle of Ropes and Pulleys. By A Subscriber.
On Bacteria. By F. G. Fairfield.
On How to Draw an Octagon. By I. M.
On a Lightning Draughtsman.

Also inquiries and answers from the following:

A. A. R.—P. G. H.—W. C. C.—M. B. M.—T. D. S.—J. A. McC.—J. M.—E. M.—H. F.—J. W.—E. F.—O. C. —C. B. C.

HINTS TO CORRESPONDENTS.

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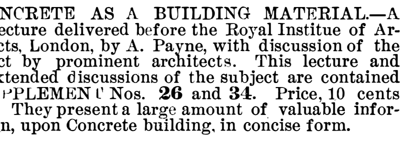

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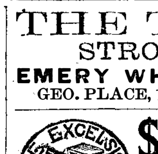

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