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IMPROVED DIAMOND STONE SAW.

It is only necessary to recall the fact, that of all the trades, that of the stone cutter was practically the most lacking in labor-saving inventions, to appreciate the vast progress accomplished therein by the utilization of the diamond as a cutting tool. Days of slow grinding by the sand saw are giving place literally to minutes of swift penetration by the diamond blade. Numerous ingenious applications of the carbon to industrial uses have already appeared in these columns, and it is presumed that the reader is tolerably familiar with the effect of the diamond tool upon materials far more refractory than the metals. In proceeding to examine, therefore, another machine based upon a similar utilization, the questions of adaptation of the diamond to its work, so as to secure the best results, and that of the construction of apparatus to conduce to such an end, are the matters which present themselves most prominently to our investigation. So far as certain points of construction are concerned, to which reference will be made as we proceed, the invention we are about to describe is new; with regard to its essential features, however, the test of experience has been applied, and successful operation over some two years has well demonstrated their efficiency. The machine is a single blade stone saw. Its uses are to divide blocks into slabs, bed ashlar, edge coping, sills, and the like, square up blocks, and all but finish moldings, accomplishing all this with a remarkable rapidity of execution. Its essential feature is that the diamonds are made to act upon the stone in such a manner as to receive pressure or blow in one direction only. Without this provision, it is found by experience that no amount of ingenuity or care in the setting of the diamonds can prevent their being displaced from the sockets by the alternate reverse action of the blade.

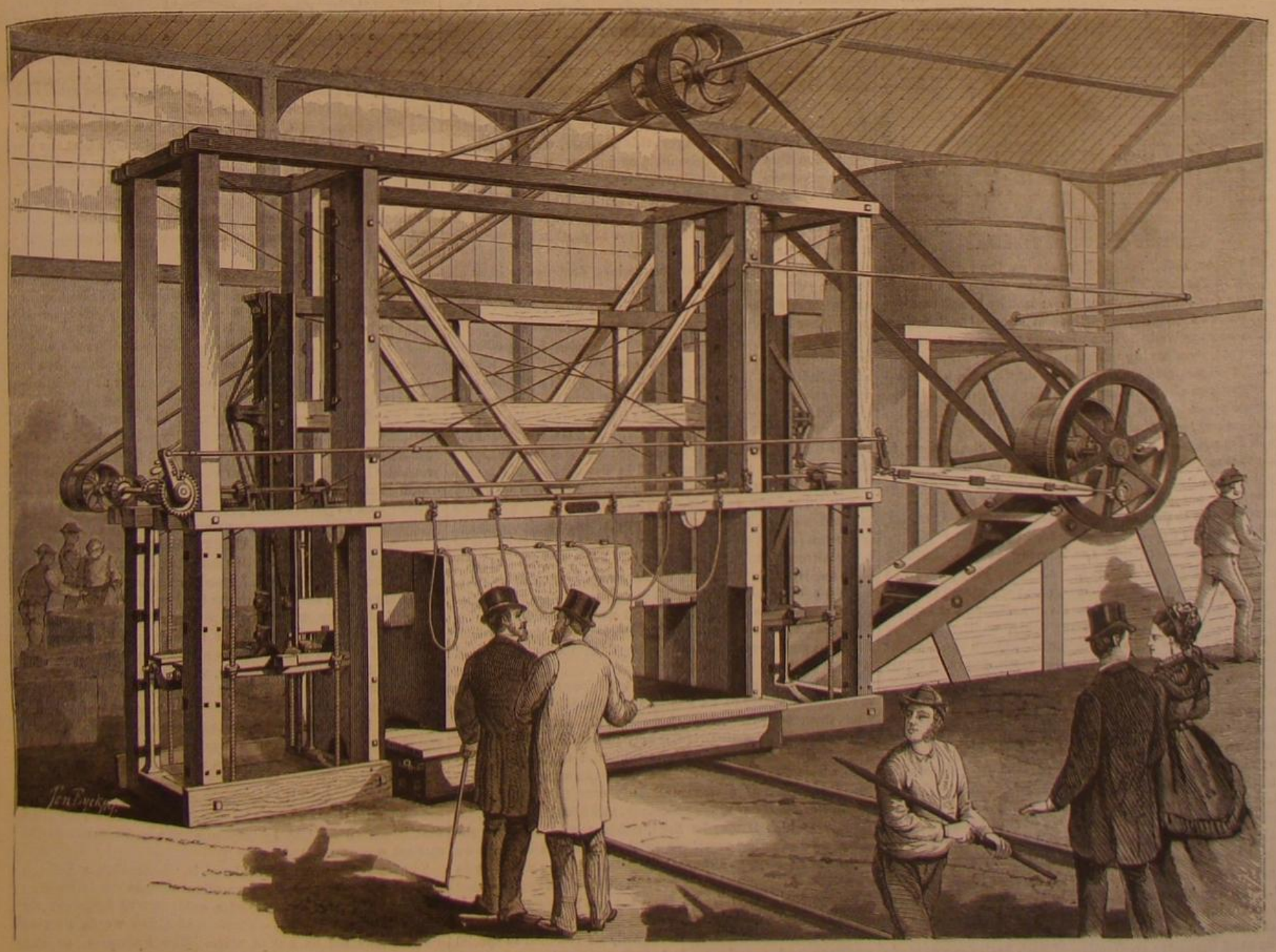
It is first necessary to glance at the mode of securing the carbons in the teeth, as the square bits of steel which are inserted in recesses in the blade, and there held by soft rivets, may be termed. At proper points along the lower edge of the teeth, indentations are made to receive the diamonds; these, inserted, are firmly bound in place with wire, and while thus temporarily secured are brazed-in in the usual way, the wire being afterwards removed. This operation, we are assured, fastens the borts or carbons in with certainty, so that no trouble is experienced through their working loose and falling out, so long as the saw is caused to cut, as above noted, in but one direction.

In the machine represented in the annexed engraving, there is a timber frame formed of eight posts, planted in a concrete foundation and strengthened with the necessary horizontal and transverse bracing. The sash frame is carried by horizontal slides between the posts, and supported on the nuts of eight screws, all of which screws are connected together by gearing to which motion is given by a separate pulley and belt. The effect of turning the screws in one direction is to lower the horizontal slides, and so feed the saw down to its work, the reverse action of course producing the opposite result. The gearing may all be moved, by hand or by belt, when it is desired to adjust the blade vertically; but when the mechanism is feeding, its operation is automatic through suitable arrangements whereby it is moved with the proper degree of rapidity. The horizontal slides above referred to are provided for the sash frame to travel upon; the blade, being mounted in the latter and tightly held by buckles, receives its reciprocating motion from the pitman connecting the crank with the sash.

We have stated that the blade cuts in one direction only. This important point is gained through depressing the saw when it begins its forward motion and then raising it on the return stroke. The mechanism for this purpose is extremely simple, and consists of an eccentric on the crank pin of the pitman, which, through a connecting rod extending along the latter, actuates certain levers and cams, the effect of which is to push the saw down against its own natural spring at the beginning of the stroke, and so to hold it at a given point of depression until the end. The resilience of the metal, of course, when the pressure is removed, carries the blade back to its normal position, and so lifts it clear of the bottom of the kerf, during the return stroke.

The above, though general as regards detail, is sufficient for the comprehension of the device, to the performances of which attention may next be directed. From those using the machines, we gather the following statement of its average downward feed per hour in various kinds of stone, the figures presented having, in many instances, been borne out by trials under our own examination: Connecticut brown stone, from 2 to 3 feet; Dorchester, N. B., stone, 2 feet 6 inches to 3 feet 6 inches; Amherst, O., 3 feet 6 inches to 4 feet 6 inches; Lockport limestone, 14 to 18 inches; Marblehead, O., limestone, 2 to 3 feet; Canaan, Conn., Westchester, N.Y., or Lee, Mass., marbles, 12 to 16 inches. In the harder kinds of slate, with quartz veins, the saw cuts from 2 feet 6 inches to 4 feet per hour, and so on in proportion to the hardness and impenetrability of the rock. Red Scotch granite we have seen cut at the rate of 3 inches per hour. The kerf made is from $\frac{5}{32}$ to $\frac{3}{16}$ of an inch, leaving a perfectly smooth surface. Slabs to almost any desired degree of thinness may be sawn. The work generally, it is claimed, is accomplished at a speed from ten to thirty times faster than the best apparatus hitherto employed. It is also asserted, by those using the saws, that the cost for the diamonds and setting is less than for the sand and iron required to do the same quantity of work by the old method. The machine is coming largely into use in this city and vicinity, and meeting, wherever employed, with the highest commendation.

Messrs. H. and J. S. Young were awarded, for it, the highest premium of the American Institute two years ago, and its progress and history since certainly show the propriety of that acknowledgment. Mr. Hugh Young, 546 East 117th street, New York, is the proprietor and manufacturer.



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ELECTRIC EARTH BATTERIES.

In the year 1838, Steinheil made, on the railroad from Nürnberg to Fürther, an experiment in using the rails as conductors for telegraph despatches; but he found that the current passed through the earth from one rail to the other, and then he conceived the idea of using the earth for the return current, thus saving half the wire. He found that it not only worked perfectly, but better than a wire for the return current, as the earth and one wire gave only half the resistance given by two wires, which were used before this great discovery, which was of the utmost practical importance to the progress of the telegraphic art. The manner in which this method of using the earth for the return current is applied is to bury, at each of the two terminal stations of the line, a copper plate in the moist earth, and connect it by means of a wire to the telegraph apparatus or battery. Gauss, in repeating this experiment, conceived the idea of leaving the battery out altogether, and burying at one station a large copper plate and at the other a large zinc plate; and he found that a powerful electric current then passed through the wire. This arrangement is evidently nothing but a single voltaic pair, constructed on a large scale, as the layer of moist earth of a few miles in thickness between the metallic plates replaced the layer of acidulated cloth, paper, or liquid in the cell.

Bain applied this arrangement to his telegraph, so as to obtain a current of long duration and constant quality. He buried a series of zinc and copper plates, opposite to one another in the moist earth, and connected them by insulated wire; and so obtained a current of sufficient strength to work his telegraph. According to the same principle, a variety of voltaic batteries or generators of electricity have been constructed, by means of which Bain, as well as Robert Weare, kept his electric clocks in constant and very regular motion. Such an earth battery remains in similar activity until in the course of time one of the metals has become entirely oxidized, which oxidation, according to experience, takes place only very slowly when large plates are buried deep in the moist ground.

The most extensive application of such batteries was made by Steinheil on the railroad from Munich to Nanhofen; the line was 22 miles long, and the earth battery was completely successful in performing not only the service required on the road itself, but also in serving for the sending of despatches for the public. The metal plate in Munich was of copper, of 120 square feet, while in Nanhofen a zinc plate of the same size was buried; both plates were sunk so deep as to reach the level of the subterranean well water of the locality, and connected with isolated wires to the air line. The current thus established was used to effect the deviation of a magnetized needle in a galvanometer, which Steinheil used as the basis of his system of signals, a system requiring only a very feeble electromotive force, a force entirely insufficient to move the electromagnets of the Morse system, or the hand of a dial telegraph.

The construction of such earth batteries, easy and simple as it appears to be, has never become a settled practice, for reason of the laborious digging required, it being much easier to plunge plates in cups and renew them after a while than to dig up the oxidized zinc plates in order to replace them by new ones. However, when a river or brook is at hand, the practice can be recommended; as in that case a zinc plate has only to be sunk at a convenient and safe spot. Then at any time, if the current becomes weak, the plate may be easily replaced by a fresh one; while in place of the copper, a quantity of coke may be buried in the moist earth. The great objection to this form of battery is, however, the unavoidable total lack of intensity; as the latter quality depends on the number of cups, and the earth or water acts as but one single cup, and thus the burial of several plates is equivalent only to the immersion of them in a single cup. If the plates are connected for quantity, that is, all the zincs together and all the coppers or cokes together, the series will act like a single pair of which the surface is equal to the sum of the individual plates, and thus as one pair of large surface; if, however, the plates are connected for intensity, that is, every alternate zinc to the next copper, only the two plates at the extremes of the series will be of use, because the several intermediate pairs discharge mutually all the electricity generated into the moist earth, through their metallic connections: which shows the fallacy of the advantage claimed for some earth batteries lately constructed and even patented.

Of all the batteries thus far constructed, the most constant appears to be that of Leclanché; it is to a certain extent an imitation of an earth battery. It consists of a large piece of coke surrounded by coarsely pulverized manganese and coke, all contained in a porous cell and surrounded by amalgamated zinc plunged in a solution of sal ammoniac. This battery has, during the last ten years, been more and more used in France; and according to the testimonies of the telegraph operators there, it far surpasses all others, for reliability and constancy.

TORPEDOES FOR HARBOR DEFENSE.

Approaching New York from the sea or the Sound, one can scarcely fail to observe, printed in very large letters on the faces of the forts which command the passage, the warning words: "TORPEDOES: DON'T ANCHOR."

We have heard the significance of the warning, frequently discussed by fellow passengers this summer, with a growing conviction that few implements of modern warfare are so little understood by peaceable people as the torpedo. "There's a lot of them stored in the fort, I suppose" (said one passenger to another the other day, in response to the question, "why not anchor?"), "and of course it wouldn't be safe for a vessel to lie alongside."

That torpedoes are submarine engines, designed to blow up invading vessels, is more commonly understood; but how they are made and placed, how exploded, and why vessels should not anchor in their vicinity, fewer seem to know.

It is natural that this should be the case. As an efficient weapon of defense, the torpedo is comparatively a new affair; indeed, it may almost be said that it is altogether an experimental affair; and though it is confidently predicted that, when the next great struggle between maritime nations comes off, it will be found that a revolution has been wrought by the torpedo in methods of conducting naval warfare, only the few who are actively engaged in developing this future decider of battles know very much about its character or capacity. This, too, is natural. The torpedo, like a mine or a masked battery, is valuable in proportion to the enemy's ignorance; and it would be simply foolishness on the part of any government to develop a torpedo system at great expense, then nullify their work and its advantages by spreading too minute a knowledge of it. Still, a general idea of torpedo operations can be gained from facts which are common property, without reference to any particular system of harbor defense; and a general idea is quite as much as the most of us care for in cases of this sort.

Distributed in a narrow passage, torpedoes are intended to arrest the progress of an enemy's vessels, either by compelling them to pause through fear of unseen danger—thus keeping them longer under fire of powerful land defenses—or by destroying them by direct explosion should they venture within the torpedo-defended area. In construction, the torpedo consists of a strong metallic case filled with gunpowder or other explosive substance, and fitted with an apparatus by which it may be fired, either mechanically by the shock of a colliding vessel or by the action of some one on shore. The first, or automatic exploder, is the simplest in construction and action, but has the great disadvantage that it cannot distinguish friend from foe. A passage defended by self acting mechanical torpedoes is therefore closed to all vessels, and their use must necessarily be confined to special positions and occasions. It is perhaps needless to observe that such a system of defense would not answer in channels thronged with peaceful shipping, like those which lead into our harbor. In cases of this sort, the thing needed is obviously something that will lie safely on the bottom or securely moored below the reach of passing vessels, completely under control by some one on land, and with no risk of untimely explosion.

The earliest torpedoes to be operated from the shore were arranged to be fired by a friction tube attached to a cord communicating with the land: a plan partially successful where the channel was narrow and the period of the firing line's exposure comparatively brief, but quite unsuited for permanent defenses and long ranges. During the Crimean war, the Russians first employed electricity as a means of exploding torpedoes, and the same method was adopted in some instances in the South during our "late unpleasantness." Since then the electrical system, both automatic and volitional, has been developed by numerous experiments in various countries, a very interesting series of them being just now in progress at Portsmouth, England, in connection with an experimental ironclad called the Oberon, the design being not merely to ascertain the destructive effect of torpedo explosions, but various other important questions touching the working of torpedoes arranged on what is known as the network system. By this plan any number of torpedoes may be placed in electrical communication with a firing station on land, so that the condition of each and all can be determined at a glance and any one of them exploded at will, without affecting the others. The connecting cable contains strands of copper wire insulated by gutta percha and covered by a protecting envelope of hemp and coiled iron wire. The copper wires lead from a galvanic battery on shore to the signalling and firing arrangements within the torpedoes, the one indicating to the operator the presence of a vessel within the destructive area of a torpedo, the other enabling him to explode the sunken mine by touching a key. In other cases the firing circuit is so arranged that it can be closed mechanically by the action of the signalling apparatus, thus making the torpedo automatic. The firing is effected by an electric fuse, commonly that known as the platinum wire fuse, in which a strand of platinum wire is made red hot by the electric current on the completion of the circuit. It is evident, as a writer in the London *Times* observes, in justification of the expensive experiments going on at Portsmouth, that a complete system of torpedo defense, embracing more complicated details, cannot be brought to perfection without extensive and exhaustive trials. "There are a multitude of problems connected with the subject which can only be solved by experiment. The action of the circuit closers may or may not be influenced by the rate of the tide in particular positions; the presence of sharp rocks may render electrical torpedoes impossible; the laying and raising of the cables and other parts require constant practice under various conditions to insure efficiency; lastly, it is absolutely necessary to know the range or distance at which a given torpedo ceases to be effective when exploded. This latter question is the more important, because upon its solution may depend, in a great measure, the quantity of the explosive agent to be used, and the relative positions of a group of torpedoes. The disruption of a number of other submarine mines by the explosion of a torpedo in their vicinity would seriously affect the defensive arrangements, and would probably lead to a complete gap in the line. It is therefore advisable that the amount of the explosive agent in a torpedo should be regulated so as to insure the maximum destructive effect upon a hostile vessel with the minimum disruptive effect upon the adjacent torpedoes."

The experiments carried out on the Oberon are said to show that comparatively large charges cannot be exploded without compromising other mines within the effective area. It remains to be decided which is best: to use large torpedoes far apart, and thus diminish the area of danger to hostile ships, or to use a smaller charge and moor the torpedo so that its explosion will occur in contact with or as near as possible to the vessel to be destroyed.

It is scarcely necessary to recur to the warning: "Don't Anchor." What the arrangement of torpedoes may be in the forbidden areas, it is not needful to know; a dragging anchor would be likely to disturb the nice arrangement of electric communication, and might possibly prove disastrous to private as well as government property.

SOMETHING ABOUT BALLOONS.

A reference to our files will show that we have endeavored to keep our readers fully informed in regard to the progress of aerial motors; for although the final success of the problem is far from being assured, the earnest labors of scientists augur well for the future. We have received so many inquiries, of late, in regard to the elementary principles to be observed in designing balloons, that it seems advisable to devote some little space to their consideration. Information of the kind sought for, simple as it may seem, can scarcely be found in any of the published literature of the subject; and the general solution of the question given in this article appears now for the first time in print, so far as our knowledge extends.

The general formula for the proportions of a balloon is somewhat intricate, and we have endeavored to simplify it so that it can be applied by any one who understands arithmetical operations.

The first point to be considered is what makes a balloon rise. We receive numerous questions such as the following: "What is the lifting force of a cubic foot of hydrogen, in pounds?" from which we infer that a few words on this subject may not be out of place. The hydrogen, or any other gas, however light it may be, has no lifting force

On the contrary, if it possesses the least weight, this weight is a force which would cause it to fall, unless it were buoyed up by something else. If it is sufficiently light, however, its tendency to descend is counteracted by the buoyant force of the air, and it ascends. Placed in a vacuum, it would immediately fall. Some illustrations may be introduced, to render this point plain. Suppose that a cubic foot of some substance, weighing in the air 400 pounds, is wholly immersed in water, which weighs 62 pounds per cubic foot. By the immersion, a cubic foot of water is displaced to make way for the substance, and, by its effort to return, presses upward against the substance, with a force of 62 pounds; so that the body, if weighed during immersion, will be found to have its original weight diminished by 62 pounds, and will balance the scale at 338 pounds, instead of the 400 required when weighed in the air. Now if, in place of this heavy body, we immerse a cubic foot of some other substance, which weighs only 40 pounds, the water, as before, will press up with a force of 62 pounds; and as the body only exerts a downward pressure of 40 pounds, it will rise, under the influence of the unbalanced upward pressure of 22 pounds. The action of the air on all bodies immersed in it is precisely similar to that of the water, except that most bodies are so much heavier than equal bulks of air that the effects are not ordinarily noticed. For instance, a cubic foot of air of ordinary pressure and temperature weighs about $\frac{1\,5\,3}{2\,0\,0\,0}$ of a pound; so that a substance, one cubic foot in capacity, which weighs 400 pounds in the air, will weigh $399\frac{8\,4\,7}{2\,0\,0\,0}$, or practically the same, in a vacuum. It is obvious, however, that there is some difference in the weights as estimated in the air and in a vacuum; and since the weight of the air varies somewhat at different times, the absolute weight of a body is its weight in vacuum. Of course, the weight of a body in the air is ordinarily sufficiently accurate, and it is only in delicate scientific researches that the method of weighing in vacuum is employed.

From the foregoing considerations, we are led to conclude:

1st. If a body is wholly immersed in any fluid, it will be pressed upward by a force equal to the weight of a volume of the fluid equal to the volume of the body.

2nd. If the upward pressure is less than the weight of the body, the latter will have a tendency to fall, under the action of a force equal to the difference between the body's weight and the weight of an equal volume of the fluid.

3d. If the upward pressure is equal to the weight of the body, the body will have no tendency either to fall or rise.

4th. If the upward pressure is greater than the body's weight, the body will have a tendency to rise, due to a force equal to the difference between the weight of a volume of fluid, equal to the volume of the body, and the weight of the body. These principles are a concise statement of the theory of a balloon's action. If we have a body whose weight per cubic foot is less than the weight of a cubic foot of air, the body will rise with a force equal to the difference between the body's weight and the weight of an equal volume of air. For instance, if a balloon is filled with hydrogen, the air will exert a lifting force of about $\frac{7}{1\,0\,0}$ of a pound for each cubic foot in the volume of the balloon, so that, if the weight of the balloon and car is less than this lifting force, the balloon will ascend. If common illuminating gas is used in the balloon, the lifting force will be about $\frac{1}{2\,5}$ of a pound for each cubic foot of the balloon's volume. The weight of the material in a balloon varies greatly, of course, according to the construction, some balloons only weighing, with the net work, about $\frac{1}{2\,0}$ of a pound per square foot of surface, or even less, and others weighing as much as $\frac{1}{5}$ of a pound per square foot of surface. The ordinary shape of a balloon approximates closely to that of a sphere, which it is commonly assumed to be in making calculations. An example is appended to illustrate the application of the preceding statements:

A balloon has a diameter of 40 feet, the weight of the material and netting is $\frac{1}{4}$ of a pound per square foot of surface, the weight of the car and contents is 600 pounds, and the gas which distends the balloon is subject to an upward pressure of $\frac{1}{2\,5}$ of a pound per cubic foot.

The volume of the balloon is 33,510 cubic feet, so that the upward pressure due to the air is about 1,340 pounds. The surface of the balloon is 5,026·5 pounds, so that the weight of material and netting is about 628 pounds, to which must be added the weight of the car, making a downward pressure of 1,228 pounds; hence the unbalanced upward pressure, which causes the balloon to ascend, is about 112 pounds. It will now be evident, we think, that the lifting force of a balloon is entirely due to the air, and is impeded, instead of being assisted, by the gas; so that it would be better, if it were practicable, to make a balloon with a vacuum in the interior.

It must be remembered that, as a balloon ascends above the earth's surface, the air in which it is immersed grows continually less dense, so that the lifting force becomes less and less, unless the volume of the balloon is increased. Thus at about 18,000 feet elevation, the air is only about half as dense as at the sea level; at 36,000 feet elevation, $\frac{1}{4}$ as dense, and so on. Hence balloons are rarely filled at the surface, as we have explained in former descriptive articles. We have also detailed the methods of manufacture, varnishes employed, etc., so that it only remains to explain the manner of calculating the size of a balloon required to fulfil given conditions.

In making the estimate for a balloon, one can generally ascertain the weight of the car and contents, the difference of weight of a cubic foot of air and of the gas to be employed (which may be called the buoyant effort), and the weight of the balloon with its ropes and network per square foot of surface. It is then required to find the diameter of a balloon which will have a tendency to rise with a given force. The calculation by which this is determined is somewhat complex, but it will be found explained at length below, an example being added for the purpose of further illustration. The following quantities must first be ascertained:

1. The buoyant effort, or difference between the weight of a cubic foot of air and of gas.

2. The weight, which includes the weight of everything except the material of the balloon and the netting, together with the lifting force.

3. The superficial weight, or weight of the material and netting, per square foot of the balloon's surface.

The operations for finding the required diameter are as follows

(*a*). Divide twice the superficial weight by the buoyant effort.

(*b*). Divide 8 times the cube of the superficial weight by the cube of the buoyant effort.

(*c*). Divide 0·95493 times the weight by the buoyant effort.

(*d*). Multiply 15·27888 times the cube of the superficial weight by the weight, and divide the product by the fourth power of the buoyant effort.

(*e*). Divide 0·91188 times the square of the weight by the buoyant effort.

(*f*). Add together the quantities obtained by rules (*d*) and (*e*), and take the square root of the sum.

(*g*). Add together the quantities obtained by rules (*b*), (*c*), and (*f*), and take the cube root of the sum.

(*h*). Add together the quantities obtained by rules (*b*) and (*c*), subtract the quantity obtained by rule (*f*), and take the cube root of the difference.

(*i*). Add together the quantities obtained by rules (*a*), (*g*), and (*h*). The sum will be the diameter required.

Example: It is required to find the necessary diameter of a balloon, the following data being given:

The weight of the car and contents is 475 pounds, of the valve 25 pounds, and the air is to exert a lifting force of 100 pounds. The gas in the balloon is to be such that the difference between its weight and that of a cubic foot of air shall be 0·04 pound. The weight of the material and netting is to be 0·12 pound per square foot of balloon surface.

Pursuing the same steps as indicated in the preceding rules, we find:

1. The buoyant effort = 0·04 pound.
2. The weight = 475 + 25 + 100 = 600 pounds.
3. The superficial weight = 0·12 pound.

(*a*). $2 \times 0{\cdot}12 \div 0{\cdot}04 = 6$.
(*b*). $8 \times 0{\cdot}001728 \div 0{\cdot}000064 = 216$.
(*c*). $0{\cdot}95493 \times 600 \div 0{\cdot}04 = 14{,}324$.
(*d*). $15{\cdot}27888 \times 0{\cdot}001728 \div 0{\cdot}00000256 = 6{,}187{,}946$
(*e*). $0{\cdot}91188 \times 360{,}000 \div 0{\cdot}0016 = 205{,}173{,}000$.
(*f*). $\sqrt{(205{,}173{,}000 + 6{,}187{,}946)} = 14{,}538$
(*g*). $\sqrt[3]{(216 + 14{,}324 + 14{,}538)} = 30{\cdot}75$.
(*h*). $\sqrt[3]{(216 + 14{,}324 - 14{,}538)} = 1{\cdot}26$.
(*i*). $6 + 30{\cdot}75 + 1{\cdot}26 = 38{\cdot}01$ feet, required diameter.

This explanation will doubtless render the method plain to all who are sufficiently interested to devote a little attention to the matter; and such readers would do well to work out other examples from assumed data.

As there are many who like to know the reasons for a result, we have added the method by which the rules are obtained, which can readily be verified by those who are familiar with algebra. Let

b = buoyant effort, W = weight, and a = superficial weight.

The balloon is to have sufficient volume that the upward pressure of the air, which is the volume of the balloon multiplied by the buoyant effort, shall be equal to the weight, increased by the product of the superficial weight and the surface of the balloon. Assuming that the balloon is in the form of a sphere, this condition is expressed by the following equation, calling x the diameter of the balloon:

$$0{\cdot}5236 \times b \times x^3 = \mathrm{W} + 3{\cdot}1416 \times a \times x^2$$

From which we deduce:

$$x = \frac{2a}{b} + \left[\frac{8a^3}{b^3} + \frac{0{\cdot}95493\,\mathrm{W}}{b} + \left(\frac{15{\cdot}27888a^3\mathrm{W}}{b^4} + \frac{0{\cdot}91188\mathrm{W}^2}{b^3}\right)^{\frac{1}{2}}\right]^{\frac{1}{3}}$$

$$+ \left[\frac{8a^3}{b^3} + \frac{0{\cdot}95493\mathrm{W}}{b} - \left(\frac{15{\cdot}27888a^3\,\mathrm{W}}{b^4} + \frac{0{\cdot}91188\mathrm{W}^2}{b^3}\right)^{\frac{1}{2}}\right]^{\frac{1}{3}}$$

the same value as was given in the foregoing rules.

It will be evident, by inspecting the equation of condition, that the same method can be applied to any form of balloon whose volume and surface can be expressed algebraically.

SENATE CONFIRMATIONS.

We are informed that the nominations of Captain J. M. Thacher as Commissioner of Patents, and General Ellis Spear as Assistant Commissioner, have been confirmed by the Senate, and also that of Major Marcus S. Hopkins as a member of the Appeal Board

It is gratifying to be able to say that they are all gentlemen of the highest personal character, possessed of ability and experience. The duties committed to their charge are of great importance, and will, we trust, be discharged with unswerving fidelity. They have before them a splendid opportunity, by an honest and liberal-minded administration of the Patent Laws, to secure the public confidence, and win for themselves individually, an honorable and widely extended fame.

We are requested to state that the case of the rotary blower, illustrated and described in our last issue, is formed of cast iron, bored out true, and bolted firmly to the heads of the machine. The mention of "light boiler iron, formed up very truly and inserted into the heads of the machine," is an error.

SCIENTIFIC AND PRACTICAL INFORMATION.

A NEW VARNISH FOR METAL WORK.

A late Italian patent contains the following recipe for a varnish for protecting metal work: A paste is made of finely pulverized quartz, carbonate of potash, or oxide of lead and water according to the color required. A thin coat of this is applied with a brush to the object, which is then placed in a muffle, and heated to 1,495° Fah. The articles emerge covered with a sort of polished glass, which resists blows and which does not split nor scale off, while it serves perfectly to protect the metal against oxidation.

RUSSIAN RAILWAYS IN PERSIA.

Since the revoking of the concessions obtained by Baron Reuter from the Shah of Persia, for the construction of the railways in that country, Russia has been negotiating for the privilege, and the success of her diplomacy is now announced.

Russian capitalists will furnish the funds, and the line to be built will connect the Caspian and Black seas through Tiflis and the port of Peti. The Shah guarantees 6 per cent of the cost of such portions of the road as enter his dominions.

ELECTROPLATING ON CHINA.

M. Hansen has recently patented in France the following process for electroplating on a non-conducting material: Sulphur is dissolved in the oil of *Lavendula spica* to a sirupy consistence. Sesquichloride of gold or sesquichloride of platinum is then dissolved in sulphuric ether, and the two solutions are mingled under a gentle heat. The compound is next evaporated until of the thickness of ordinary paint, when it is applied with the brush to such portions of the china, glass, etc., as are desired to be covered with the electro-metallic deposit. The objects are baked in the usual way before immersion in the bath.

IMITATION GOLD.

An alloy having a very fine and malleable grain, susceptible to a high polish and impervious to rust (which, while closely resembling gold, may advantageously replace that metal in a variety of cases), is made of 100 parts pure copper, 17 parts tin, 6 parts magnesia, 3·6 parts sal ammoniac, 1·8 parts quick lime, and 9 parts bitratrate of potassa. The copper is melted first, and the magnesia, ammonia, lime, and tartrate are successively added in small quantities. The tin in small pieces is then placed in the crucible, and the whole brought to fusion for 35 minutes, after which the alloy is allowed to cool.

EFFECT OF FLAME ON AN ELECTRIC SPARK.

Mr. S. J. Mixter notices a curious effect of a gas flame on the current of a Holtz machine. The jet consisted of a glass tube drawn out to a point, and the flame had a length of about an inch and a diameter of only an eighth of an inch. Inserting this between the two terminals of the machine, the length of spark obtainable was at once increased from less than ten inches to over twelve, the full distance to which the balls could be separated. The same increase was not obtained on simply inserting a conductor between the two terminals, a ball an inch in diameter only lengthening the spark about an inch.

A NEW GALVANIC BATTERY.

A new battery is manufactured by Messrs. C. & F. Fein, of Stuttgart, which is said to be remarkably cheap and to have a constant current, with high electromotive power. It consists of a three-necked jar, similar to a Woolff bottle. In one of the side orifices is inserted a charcoal plate, and in the other a strip of amalgamated zinc, the last covered with cotton. By means of the center tube, pieces of coke and pre-oxide of manganese are inserted until the bottle is about two thirds full. The remaining space receives a concentrated solution of sal ammoniac. The center tube terminates above in an inverted flask, the neck of which is extended down to the level of the liquid. The flask is also filled with the sal ammoniac solution, and, by affording a continual supply, provides against loss by evaporation. The contact between the charcoal and the copper conducting wire is made by platinum plates. The battery remains constant for a year, and is said to be easily cleaned and renewed.

HIPPOPHAGY IN FRANCE.

During the fall of 1874, Paris ate 1,555 horses, asses, and mules. A horse, which, for his skin, hoofs, etc., alone, is worth but about five dollars, brings as food, in the markets of the French capital, five times that sum.

Gas from Crude Petroleum.

In a reply recently given to one of our correspondents in respect to this subject, he was informed that many attempts had been made to employ crude petroleum for the manufacture of illuminating gas, some of which are in progress, and that, as yet, the various inventors have not succeeded in perfectly overcoming the practical difficulties.

The Ashtabula *News*, Ohio, objects to this reply, because, it says, Ashtabula is now and has been for more than a year lighted by gas made from crude petroleum by a process invented by Dr. Wren of Brooklyn; that the process is entirely successful and very economical; and that among other places which are now using this gas we may name Shelbyville, Indiana, and San José, California.

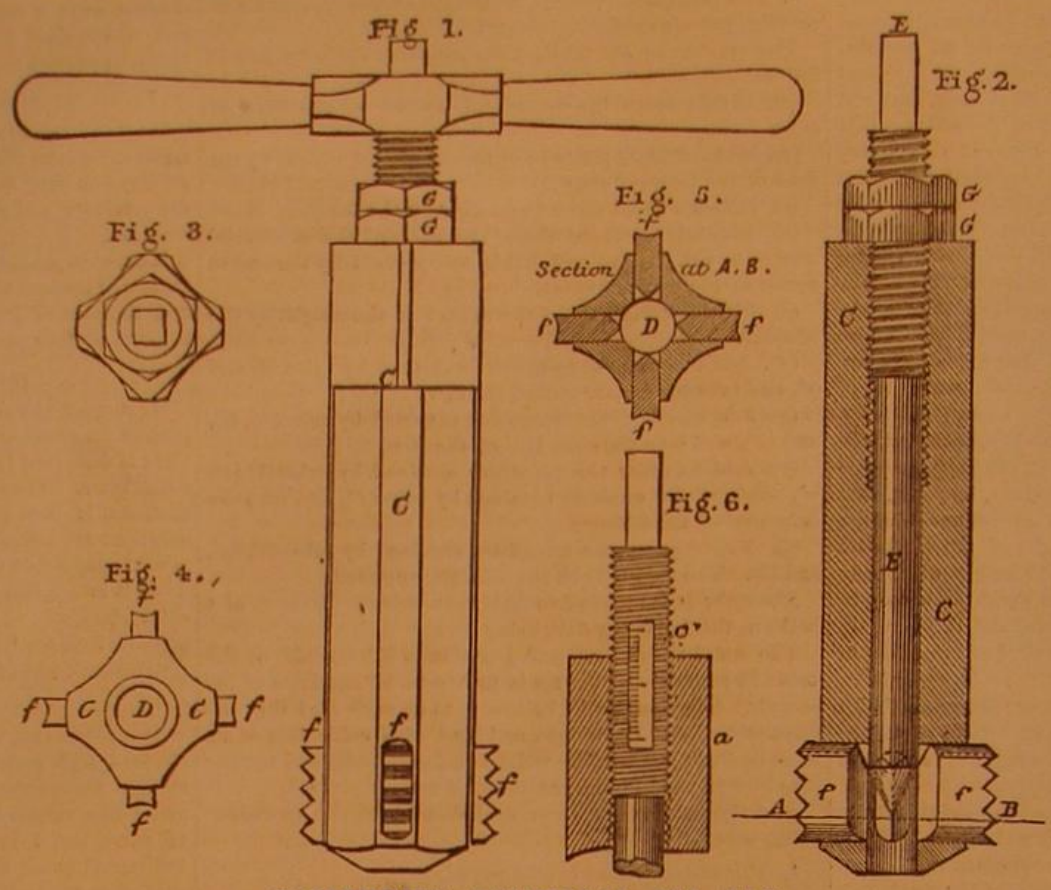
We are glad to record these evidences of successful progress in the use of crude petroleum, and we hope that gas engineers in all parts of the country will send us reports of what they are doing in that line. Crude petroleum is a very cheap, abundant, and valuable natural product. Its successful, economical use for gas illumination will be of great advantage to the country.

IMPROVED DIE TAP.

This is a new form of tap for screw cutting, the arrangement of which is clearly shown in our engraving. It will be seen that the main body tap, C, remains much the same as in the old standard, minus the thread, but that it is pierced through its centre with a round hole, tapped for a part of its depth; and that into this hole is screwed a pointed spindle, E. At the lower end of the tap, it will be observed, are four screw-cutting dies, *f f f f*, fitting into a corresponding number of slots radiating from the center of the tool. These dies have knife edges on the inside, their upper corners being chamfered for the reception of the point of the adjustable screw or spindle referred to.

In the engraving the dies are shown to have been forced out by the adjustable screw to their largest working diameter. To draw them back it is necessary to elevate the screw, E, and gently tap back the dies until they are flush with the turned part of the tap. In this position they close the central hole, leaving only a small pointed indenture at the top formed by the chamfered corners already mentioned. The dies, it will be seen, are concave on their cutting faces. By setting the check nuts, G G, Figs. 1 and 2, on the spindle, E, a large number of holes can be tapped to the same size. A graduated scale can also, if desired, be added for facilitating the adjustment, as shown in Fig. 6. The dies being adjustable, the diameter of the screwed hole can be regulated to $\frac{1}{100}$ inch, and even less. Further only one tap is necessary to cut a full thread, as compared with two and sometimes three used in the ordinary way. Again, the dies, being removable, can be easily re-sharpened, or they may be replaced by others of a different thread. This tap has been found to be specially useful in the cutting of threads in steel tyres of locomotive and carriage wheels (where the tapped bolt fastening is used), also for tapping gas pipes, and in renovating stripped or worn threads.

Mr. John McFethrie, of Kovroff, Russia, is the inventor.



McFETHRIES' UNIVERSAL DIE TAP.

FILTRATION UNDER PRESSURE.

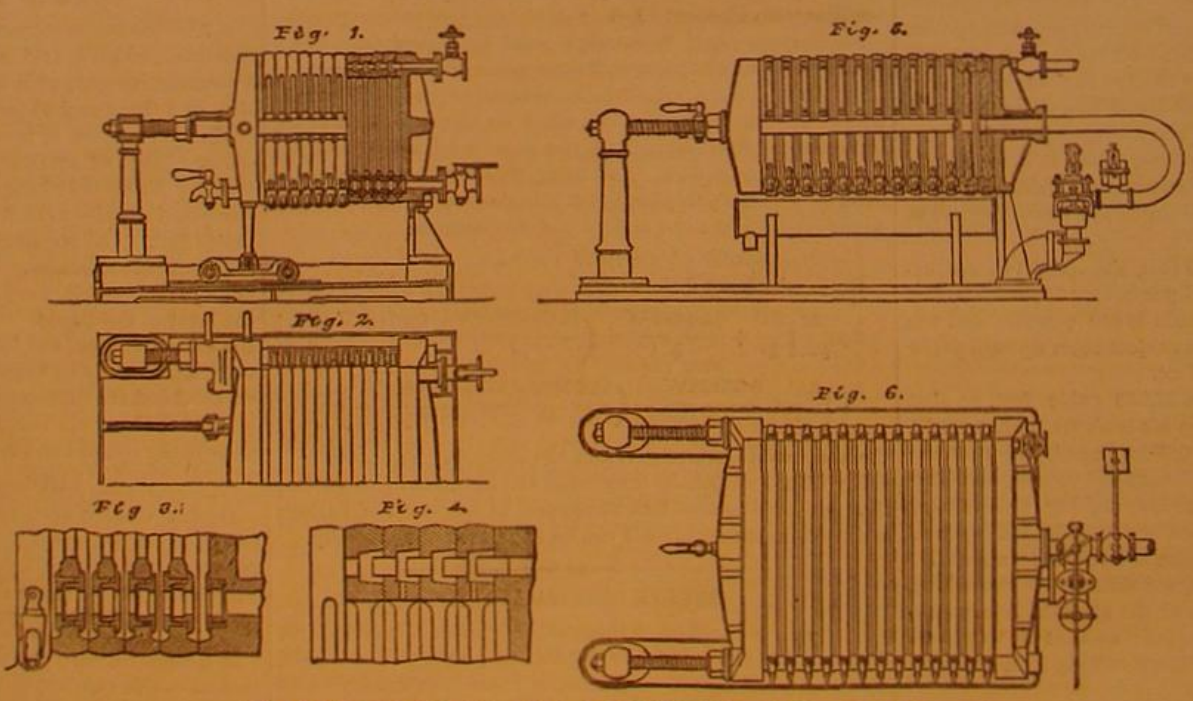
A very important economy is effected, in paper making, sugar refining, and other processes wherein matters are held in suspension in liquid, by forcing the fluid through a filter by pressure, thus recovering valuable material from waste and washings that would not pass through any filtering substance by the mere action of gravity. Mr. A. L. G. Dehne, of Halle, Germany, has introduced several inventions for this purpose, two of which (especially adapted for sugar refineries and chemical works) we illustrate herewith.

The first of these presses, shown in Figs. 1, 2, 3, 4, has a horizontal central admission for the material to be filtered, and is called by the manufacturers a refining press for the claying of sugar, and is used for the filtration of the sirup, as a substitute for the sack or bag filter, the preliminary filtration through bone black and the further filtration of the residue of blood coagulation and juice being omitted.

This press consists of the customary chambers of iron, but no special pump is required for forcing in the matter, as in most cases the pressure of a certain hight is sufficient. An apparatus of this kind used at Halle does the mechanical filtration of a thick solution, of about 55 per cent, of about from 800 cwt. to 900 cwt. of raw sugar in 24 hours, in the most satisfactory manner, without the use of any pump, but through the pressure from a reservoir placed about 7 feet above the press.

The residue in the chambers does not form cakes, but exists only in the form of slime, which is easily removed after the filtration has been completed by opening the cock in the front plate. The filter cloths may be changed every 24 hours, and this operation, together with the edulcoration, does not require more than half an hour's time, while no attendance is required by the press during the time of filtration. The general construction of the press will be easily understood from the engraving, the details of the chamber being shown in a larger scale in Figs. 3 and 4. The very handy arrangement has been adopted of carrying the front cast iron plate on rollers, whence the taking out of the chambers, and of the filtering cloths; becomes a matter of the greatest ease and simplicity. The method of fastening together of the chambers and plates is obvious in the engravings.

The second press is represented by Figs. 5 and 6, and has also a horizontal central admission. It has lately been much adopted in works where a quick separation of mud, slime, or chemical precipitates from fluids has to be made. This apparatus consists of a system of chambers made of wood, or occasionally of brass castings, with sheets of drill cloth placed between them. The fluid to be filtered is forced into the chambers by means of a pressure pump, a separation of the fluid from the mud, slime, etc.; then taking place. The fluid is tapped off perfectly clear, and with a continued forcing in of fluid, the filtration goes on until the residue in the chambers become solid. The emptying of the apparatus is very simple: the cakes, having formed in the chambers, are easily removed, or fall out when the apparatus is unscrewed. The general construction and fastening of the plates is the same as in the press described above.



FILTER PRESSES FOR CHEMICALS AND SUGAR.

Useful Recipes for the Shop, the Household, and the Farm.

Three bushels of clean sand, mingled with half a bushel of good lime and half a bushel of cement, makes an excellent mortar which is not liable to be dislodged by storms.

Dark purple and green slates are the best for roofing; others are liable to fade unequally and produce a disagreeable appearance.

If hammering continually is done in an upper story to such an extent as to be annoying on the floors below, the sound may be deadened by sheet india rubber cushions placed under the benches or anvils.

It is very dangerous to allow acid substances, used as food, to stand for any length of time in copper vessels. Preserves, when made in pots of that metal, should be emptied out as soon as possible after cooking.

Do not bring lights near empty whisky, alcohol, benzine, or coal oil barrels. The vapor of the fluid, mingled with the air within, is a dangerous explosive mixture.

Lamp chimneys may be, in a measure, prevented from sudden cracking by immersion in cold water in a suitable vessel, the last being set on the stove until the water boils. The chimney is then removed and allowed to cool slowly.

In painting, do not apply a succeeding coat before the previous one is dry. Do not use a lighter color over a darker one, nor add dryers long before using. Use as little dryers as will do the work.

Gall soap, excellent for washing silks or ribbons, may be made by heating one pound of cocoanut oil to 60° Fah., into which half a pound of caustic soda is gradually stirred. To this half a pound of Venice turpentine, previously warmed in another vessel, is added. The kettle is allowed to stand for four hours, subject to a gentle heat, after which the fire is increased until the contents are perfectly clear. One pound of ox gall, followed by two pounds of Castile soap, is then mixed in, and the whole allowed to cool, when it may be cut into cakes.

Never try to extinguish a kerosene fire with water. Smother the flames with blankets or rugs.

Benzole magnesia, a simple paste made of calcined magnesia and benzole, will take grease spots out of almost everything, however delicate. A paste of soda and quicklime is good to take oil stains from wood floors.

To detect adulteration in tea, burn the ashes. Pure tea, of any grade, will not leave over five per cent of ash, while the adulterated article will yield as high as 45 per cent.

Chloride of calcium or glycerin, added to shoe blacking, will prevent the latter's drying in the box.

It is said that half an ounce of a mixture of 100 parts logwood ground with 1 part of bichromate of potash, will make, with water, a pint of good ink.

Painters estimate that about 1 pound of paint per square yard is required for filling new work, and nearly half a pound for the second coat. The proportion is about half white lead and half oil of turpentine for the filling coat.

A good white cement for marble is made of 8 parts resin and 1 part wax, to which, when well melted together, 4 parts plaster of Paris are added. Use while hot.

Cements in general are comparatively brittle, therefore use as little as possible, so that dependence may be made upon its adhesion to the surfaces, and not upon the cohesion of the cement alone.

In using the flat drill, the cutting point should be made thin, so as to penetrate easily, and its form should be such as exactly to fit the inner angle of the try square, which is 90°.

A wash of lime, salt, and white sand is said to afford protection to shingle roofs against accidental conflagration from sparks, etc.

The following are two recently patented recipes for welding copper. The first, by Messrs. C. L. Schurr and W. G. Rehbein, consists in heating borax until all moisture is expelled. The dry residuum is pulverized and applied between the surfaces of the copper, which are formed in a lap joint. The metal is hammered together cold, then heated and dipped first in fine salt, and then in human feces, for the purpose of excluding the air. Welding may then be easily accomplished. In the second plan, the ends of copper to be welded are hammered out to form the lap. The pieces are then heated, dipped in powdered borax to clean the surfaces, and heated a second time. After the second heat the pieces are dipped in powdered cryolite (or any other anhydrous fluoride or similar salt, which, when heated, will form a liquid flux), and then hammered together on the anvil. The latter is the invention of Mr. E. Renaud, of Washington, D. C.

If a defect on a steam cylinder cannot be reached for plugging or melting-in a composition, stop the hole with 2 parts sal ammoniac and 8 parts fine iron filings. No sulphur need be used.

RATS EXPELLED.—A gentleman in Burlington, Vt., of an investigating turn of mind, a week or two ago determined to try it again with the rats which infested his house. He purchased a supply of coal tar at the gas works, and placed small quantities of it in the rat holes in his cellar and elsewhere in their runways. The rats, bedaubing themselves, became disgusted with the manner of their entertainment, and speedily left the premises, and have not been seen or heard from since.

The best way to use up scrap brass is to melt it in with new brass, putting it in with the zinc after the copper is melted.

THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER VIII.

Continued from page 4.

At the north side of 98th street commences the stone viaduct, which extends to a point midway between 115th and 116th streets, forming the third division of the work; it was constructed under the supervision of Mr. George S. Baxter, C.E. This viaduct is built across the marshes known as the Harlem flats, and is, in all respects, a remarkably substantial work. Its total length is 4,563 feet, its greatest hight above street grade, which occurs at 104th street, 31 feet 1 inch, and its width in the clear, at railroad grade, 48 feet. The grade of the road across the viaduct, as will be seen by a glance at the profile (page 308, Vol. XXXI.) is by no means level. Between the south and north ends there is one continual fall of 40 feet per mile, the south end being 41 feet 3 inches higher than the north end. The work consists of an earth embankment contained between two retaining walls of first class rubble masonry, laid in cement mortar, with vertical and horizontal joints, and battered on the outer face one inch to the foot. The hight, breadth, and depth of foundation vary. Thus, at 100th street the dimensions are: Hight 9 feet, breadth of wall at foundation 6 feet, breadth of parapet 4 feet; at 102d street, 21 feetx11 feetx4 feet; at 103d street, 25 feetx11 feetx4 feet; at 104th street, 29x13x6 feet, and at 115th 2x4x3 feet.

In laying the foundation of such a massive structure in such soft ground, considerable difficulty was encountered. By far the greater part was laid either in concrete or on piles, the latter being used very generally under the piers and abutments of the bridges at the street crossings.

The piles (of which 198,900 linear feet were driven) were of white oak and spruce, from twelve to fifteen feet in length and twelve inches diameter at the butt, and were driven two feet six inches from center to center till they reached hard bottom, or till a ram of 1500 lbs., falling 30 feet, did not settle them more than half an inch. The tops were then sawn off level, at the proper hight, and capped with two courses of white oak timber laid crosswise and treenailed to the piles; and on these was laid the foundation. Wherever concrete was employed, it was quickly mixed and deposited in layers of from four to nine inches, and settled by slightly ramming, sufficient to flush the mortar to the surface. The viaduct is carried over the cross streets on arches, the first series of which is at 102d street.

Fig. 19 shows a portion of the viaduct in perspective, and also the passenger station, which is built in part within the viaduct. Fig. 20 shows an end elevation of the viaduct. Fig. 21 is a side elevation in part section, showing the character of the arches at the street crossings.

The foundations of these arches are first class gneiss rubble masonry, and project one foot beyond the line of the superstructure of the piers and abutments. On these foundations is placed a bridge of three arches, two of them semicircular arches, of 10 feet span and 5 feet rise, and 20 inches thick, which span the sidewalks, and one elliptical arch, 30 feet span and 17 feet rise, and 24 inches thick, placed between the two small arches and spanning the roadway. The piers are 8 feet by 5 feet by 56 feet, and the abutments 8 feet by 6 feet by 56 feet. The faces of the abutments, spandrels, wing walls, piers, and arches, are built of freestone well dressed, and (with the exception of the arch stones, which are cut to long ⅝ inch joints) are all cut to lay half inch joint. The backing of the walls, abutments, and hearting of the piers is first class gneiss rubble masonry, well tied to the face with face headers. The abutments are carried up five feet above the springing line of the arches on the outside; and from the top of this backing to the crown of the main arch, the spandrels are filled with concrete, plastered with half an inch of cement. The bridge at 103d street does not differ from the one just described, except that its rise is but 15 feet. The foundations for the bridge and walls at this point are from 10 to 12 feet deep, good bottom being found without going below the water level. From this north to 106th street, the foundations were laid dry. At 106th street, a wide street, there are four arches, one over each sidewalk, twenty inches thick, 15 feet span and 7½ feet rise, and two 24 inches thick, 26 feet span, and 13 feet rise. The two outside piers are 5 feet 6 inches by 9 feet by 56 feet, and the middle pier and two abutments 7 feet by 9 feet by 56 feet. Like all the bridges, it is built of freestone, the material in this case being obtained from the old bridge, which was carefully taken down, and the stones cleaned and, where necessary, re-dressed. The north pier and abutment foundations were put down about 9 feet below high water to a good sand and gravel bottom.

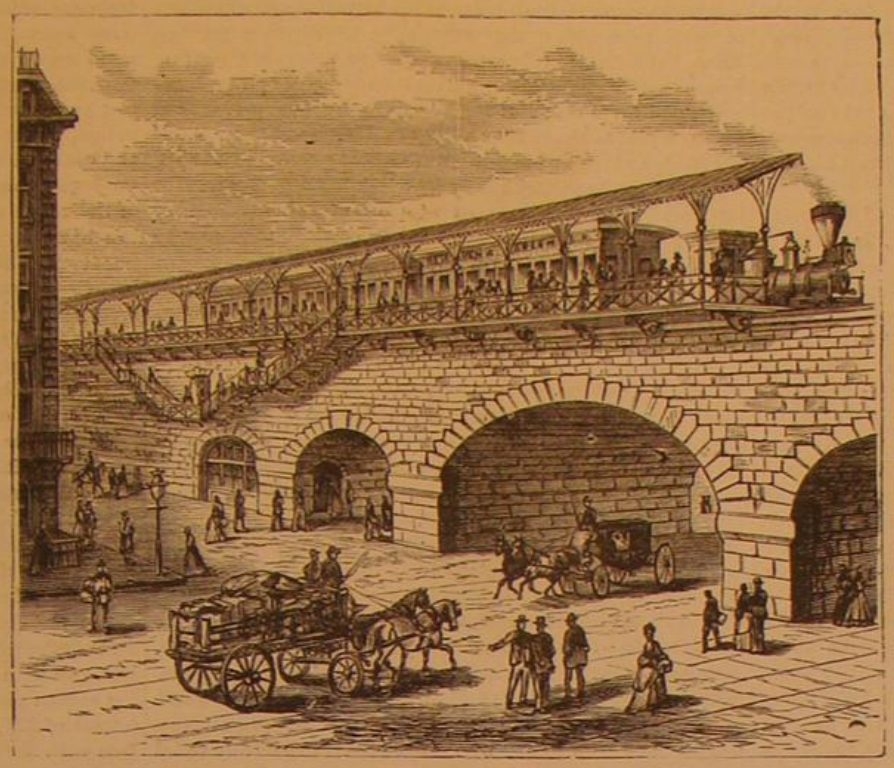


Fig. 19.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—THE VIADUCT AND PASSENGER STATION AT 110th STREET.

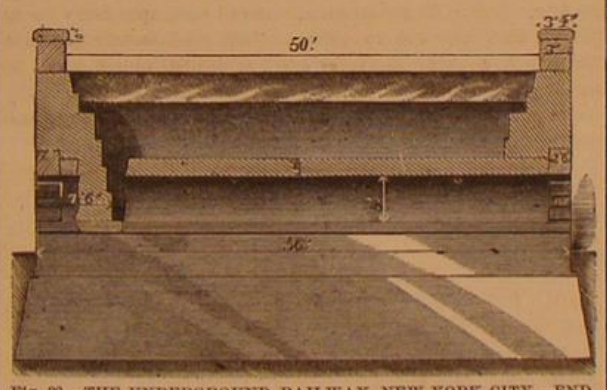


Fig. 20.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—END ELEVATION OF THE VIADUCT.

In the block between 106th and 107th street, the foundation of the retaining walls was put down to a depth of some 12 feet below high water, thus giving the foundation at this point a hight of 23 feet. The excavation was made through six to eight feet of black mud and about four feet of a black clay-like material, which was very probably the mud in a compressed state. The earth was taken for a distance of four feet outside of the foundation lines, and the excavation sheet piled and braced with heavy timbers. For the west wall, guide piles were driven on the water side to hold the sheet piling in place, and outside of these an earth dam was thrown up. On the east side the place of the dam was supplied by the embankment of an old road. The excavation, into which the water ran slowly, was easily kept dry by a steam pump, except on one or two occasions during the full moon tides.

It will be observed on the profile (page 308, Vol. XXXI.) that at 112th and 113th streets the grade of the railway approaches so near to that of the avenue that sufficient headway could not be obtained for stone arches. Their places are therefore supplied by double wrought iron Post truss bridges, capable of supporting 3,000 lbs. per linear foot of track, independent of their own weight, their factor of safety being 5. In the bridge at 112th street, the trusses are 8 feet high, 52 feet in the clear between the outside trusses, and 63 feet span. It is supported on stone abutments 7 feet thick at street grade, 4 feet at top, and 15 feet high by 58 feet long. These abutments are returned on each side to the retaining wall. The bridge at 113th street is the last in the viaduct.

The retaining walls from 98th street to 115th street are surmounted by a parapet wall (rock faced on the outside) 2 feet 6 inches in hight, 2 feet at bottom by 18 inches at top. Upon this is placed the coping of pene-hammered granite, 10 inches by 3 feet four inches. The coping and parapet are anchored to the retaining walls by wrought iron galvanized rods, 1¼ inches in diameter and 6 feet long, with a head and washer on the bottom and a nut and cast iron washer on top.

At 110th street is one of the way stations, built in part within the viaduct, as shown in exterior view in Fig. 19. It consists of a waiting room built in the north abutment of the 110th street bridge, and two iron stairways which rise, on the outside of the east and west retaining walls of the viaduct, from the waiting rooms to two covered landings on top of the viaduct. The waiting room is on a level with the street grade, and consists of a vaulted room 10 feet broad, 3 feet 6 inches long, and 12 feet 7 inches from floor to the crown of the roof, and running parallel to the axis of the north archway of the bridge, into which it opens through a groined archway of freestone, 12 feet broad by 5 feet

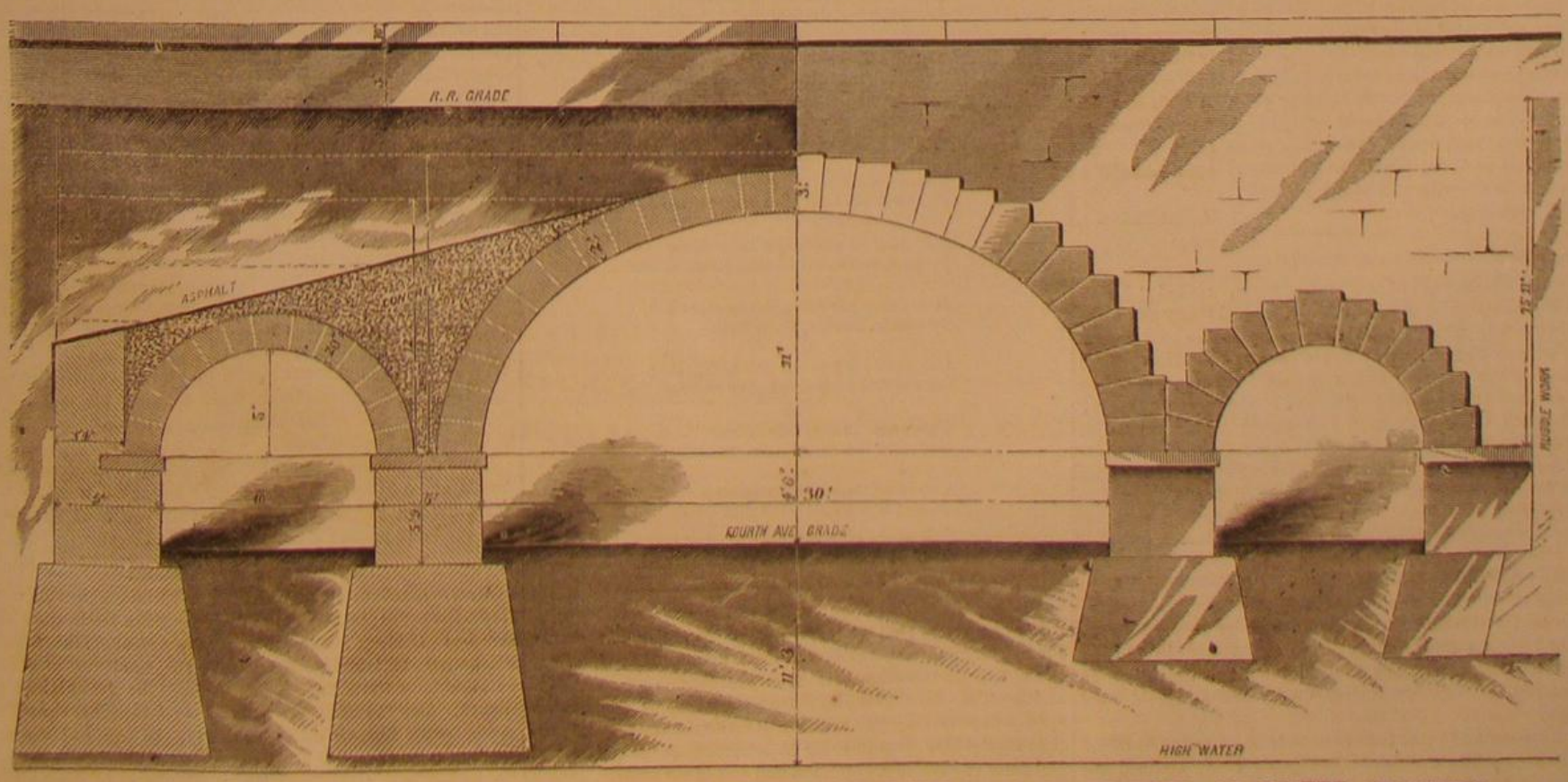


Fig. 21.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—SIDE ELEVATION OF VIADUCT AT STREET CROSSINGS.

thick, and placed 22 feet from the outside of either retaining wall.

The arch is semi-circular, and of brick, 20 inches thick. This room is lined with brick and plastered, and closed at the east end by a large semicircular arched window (see Fig. 19.) Two flights of steps rise from this room through two brick-lined segmental arched ways, 6 feet broad by 8 feet high, to points on the outsides of the retaining walls 17 feet above street grade, from which iron stairways lead to the covered platform on top of the viaduct. Of these passage ways, the one leading to the west side of the viaduct passes out from the west end of the waiting room and forms almost a continuation of it. That leading to the east side of the viaduct is placed to the north of the waiting room, and parallel to it, but separated from it by a masonry wall 4 feet 6 inches in thickness.

At the outside of the retaining walls, at each of the openings of the arched stairways, just mentioned, is placed a wooden platform, 3 feet by 6 feet, from which are two flights of iron steps, one to the north and one to the south. These steps are 3 feet wide, with yellow pine steps, cast iron risers and string, supported by 9 inch heavy H beams built into the solid masonry of the retaining wall. They lead the covered landing beside the track. These landings consist of wooden platforms resting upon six rows of longitudinal wooden beams, supported, in turn, by iron beams, 8 feet long, placed transversely on the parapet walls, 7 feet 3 inches apart, and anchored by iron rods extending 6 feet downward through the masonry. The platforms are 130 feet 6 inches long and 8 feet 3 inches broad, thus projecting 2 feet 3 inches beyond the parapet wall on the inside and 3 feet on the outside. The covering railing is of design shown in Fig. 19.

The amount of masonry used in the construction of the retaining walls, foundations, bridges, abutments, wing walls, spandrels, parapets, etc., of the viaduct was 60,047 cubic yards; 2,458 cubic yards of concrete was laid; 198,900 linear feet of piling was driven; and of timber and plank used in platform, grillage, etc., 352,000 feet, B. M., was used, and of iron anchors, 51,000 lbs.

Correspondence.

Crystallization of Carbon.

To the Editor of the Scientific American:

While contemplating the great economy in all departments of Nature, in the utilization of many substances which casual thinkers might think noxious or waste materials, the thought occurred to me that, if Nature were to enter largely upon the manufacture of diamonds, a bed of charcoal would not be melted down for the purpose so long as carbonic acid gas is everywhere escaping and going to waste, from the decomposition of the rock formations. Further, if experiments were to be instituted in this direction, they could best be conducted in connection with the manufacture of stone lime. For example: Let the gas (which always escapes in large quantities from a burning lime kiln) be collected and turned into a retort; or, if found necessary, a series of three or four retorts might be employed, and the gas carried through a refining process, so that nothing but pure carbon should reach the last retort in the series. Should heat or pressure be found necessary, still another retort could be prepared for that purpose; but it is a question as to whether carbon will not readily crystalize as soon as set perfectly free from all other substances.

St. Albans, Vt. CHARLES THOMPSON.

Animal Suicides.

To the Editor of the Scientific American:

In your issue of January 9, you mention a suicidal scorpion. Allow an old reader to say that the scorpion becomes greatly enraged on very slight occasions; and bending its tail in the form of part of a circle, over its back, lashes it furiously from side to side, the sting barely missing its own body at each pass. When it strikes itself, which is not unfrequently, the verdict should read: "Deceased, while carelessly brandishing his weapon, accidentally inflicted upon himself a wound, from the effects of which he died."

New York city. T. B. TOMPKINS.

To the Editor of the Scientific American:

Your article on page 21, current volume, headed "A Suicidal Scorpion," calls to mind a story, related many years ago by my mother, of a suicidal rattlesnake She said that a party of men were removing an old barn in New Hampshire; and among the rubbish, they captured a rattlesnake, which they secured with a forked stick, and commenced tantalizing it. It soon became enraged and would frequently lay its head over on its body and remove it again. Finding its tormentors persistent, it at last threw its head back, thrust its fangs into its body, and soon after died. W. D. CLARK.

Springfield, Ill.

[For the Scientific American.]

THE CRESCENT STEEL WORKS AT PITTSBURGH, PA.

These works, belonging to Messrs. Miller, Barr, and Parkin, are located at Pittsburgh, on the Allegheny river, between 49th and 50th streets. They were established in 1865 by the present firm, with the avowed intention of rivaling, in the quality of their product, the very best Sheffield steel makers.

The methods of manufacture used in the famous Sheffield houses are exactly followed here, merit being claimed for careful and exact working rather than for any quick or patent processes. In order to insure uniformity in stock, the firm have their arrangements for their fine Swedish irons so made that they import direct from the makers, and have secured to themselves an entire brand of Dannemora iron, equal to any ever made, so that in certainty of supply and quality of stock they are not second to the best houses in England. With abundant experience, skilled workmen, the best of material, and machinery in every respect up to the highest standard of the latest practice, the growth and reputation of the concern have been continuous. Established nine years ago, with twelve melting holes, three hammers, and a capacity of three tuns a day, they now have twenty-four melting holes, four Siemens furnaces (equal to ninety-six melting holes) capable of producing thirty tuns a day, six steam hammers, and three trains of rolls. They are thus prepared to make twenty to thirty tuns a day of all sizes and varieties of bar steel, and are making constant improvements in their appliances for a beautiful and exact finish to their work. Not the least of these is the rapid adoption of gas furnaces for heating, making it very difficult for a careless workman to overheat their steel. Having steadily pursued the policy of buying the best stock to be had, and having made its careful working a constant study, their success has corresponded with their efforts. For several years, they have supplied regularly some of the very best ax and edge tool makers in the country, and many of the largest machine works, nail factories, screw cutters, and others where steel has to do the hardest and finest work. They have driven the German rolls and the English die steel out of the United States mint, so that American specie is now rolled and coined on American steel. We are informed that, on account of the especial demand for their steel in Pennsylvania and the West, they had not solicited New England trade to any considerable extent prior to the panic. During the past 18 months, however, through their eastern agents, Messrs. Ely & Williams, No. 1,232 Market street, Philadelphia, and No. 20 Platt street, New York, they have secured the patronage of many prominent steel consumers in the East, and their steel is now sold by the leading dealers in principal cities throughout New England and New York, who pronounce it to be fully equal to the imported brands heretofore controlling the market. In conclusion, we must not forget to say that this firm use largely of the best American charcoal hammered irons, and are engaged in careful tests of new brands, some of which promise so well that they express a confident hope of soon putting into the market an exclusively American tool steel, which shall not be excelled by the combined product of Sweden and Sheffield; in the meantime their abundant supply of the best Swedish irons insures to their customers uniform and good results. Being all young men, none of them yet forty years of age, they propose to continue their studies and practice until such a thing as preference for English steel shall be no longer known. They make tool, machine, roller, spindle, hammer, file, frog, fork, hoe, rake, shovel, cutlery, and cast spring steel. * *

Grammar in Rhyme.

The annexed effusion does not come under the head of new inventions and recent discoveries, in fact we believe it has been published from time to time during the past twenty years. But, as the *Commercial Advertiser* (where it appeared last) says: "The name of the author should not have been allowed to sink into oblivion. On the contrary, he deserves immortality, and the gratitude of generations yet unborn, for we have never met with so complete a grammar of the English language in so small a space. Old, as well as young, should commit these lines to memory, for by their aid it will be difficult, if not impossible, for them to fall into errors concerning parts of speech:"

I.
Three little words you often see
Are articles, a, an, and the.

II.
A noun's the name of anything,
As school or garden, hoop or swing.

III.
Adjectives show the kind of noun,
As great, small, pretty, white, or brown.

IV.
Instead of nouns the pronouns stand,
Her head, his face, your arm, my hand.

V.
Verbs tell us something to be done,
To read, count, laugh, sing, jump, or run.

VI.
How things are done, the adverbs tell,
As slowly, quickly, ill, or well.

VII.
Conjunctions join the words together,
As men and women, wind or weather.

VIII.
The preposition stands before
A noun, as in, or through, the door.

IX.
The interjection shows surprise,
As oh! how pretty—ah! how wise.

The whole are called nine parts of speech.
Which reading, writing, speaking, teach.

The Fog Gun.

For some time past endeavors have been made to secure for coast signal purposes something more suited to the duty than the 18-pounder cast iron gun now used. Major Maitland, R. A., of the Royal Gun Factory, has designed a species of revolving gun which will no doubt answer the purpose admirably. But in order to determine the best material and form of muzzle for the new fog gun, four models, each 2 feet long and capable of containing a cartridge consisting of from four to five ounces of powder, were, says the *Engineer*, constructed upon the following different plans, to be tested from the summit of the proof butts in the Plumstead marshes, at various respective distances: A cast iron gun with a plain muzzle; a cast iron gun with a conical mouth; a cast iron gun with a parabolic mouth; and a bronze gun with a parabolic mouth.

The object of trying both conical and parabolic mouths was to arrive at a decision in regard to the question, which has always been pending among manufacturers of speaking trumpets, as to which is the best shape for transmitting sound. Some assert, that the form of the instrument should be a truncated cone; others, that it should be a truncated parabolic conoid, the mouthpiece occupying the focus. Either form would, in a greater or less degree, confine the undulations of sound (which would otherwise disperse themselves in all directions and cause them to take a direction parallel to the axis. Hence the application of one or the other of them. On the occasion of the recent experiments, the four models were placed in a row upon the summit of the butts, with their muzzles pointing towards Shooter's hill. The weather was cold and clear The observers stationed themselves at various distances in front of the row of guns, from 100 yards to 3,000 yards, moving forwards to a greater distance each time that the whole series of four guns was fired. They were ignorant of the order in which the guns were fired, that being purposely left in the hands of the proof master, so it was impossible for their opinions to be prejudiced. It was decided that the volume of sound emitted by each discharge should be represented as nearly as possible in figures, No. 1 being the highest figure of merit, and No. 5 the lowest. The following results were obtained: Adding together the respective figures of merit of each gun at eight several distances, from 100 to 3,000 yards, it was found that the cast iron gun with the conical mouth gave a total of 10, or, in other words, took the first place as regards the volume of sound produced at all ranges; the cast iron gun with the parabolic mouth a total of 21, thus taking the second place; the bronze gun with the parabolic mouth a total of 22½, or taking the third place; while the cast iron gun with the plain or straight mouth gave 26½, the lowest value of all four. At a distance of 1,000 yards only, the bronze gun with the parabolic mouth took the second place. This was probably due to the superior ringing qualities of the metal, which would be observed at such a short range. Further experiments were then made by observers stationed about two miles off upon Shooter's hill. The figures of merit under these circumstances for the several guns were as follows: Out of six observations, 6 for the cast iron cone, 12½ for the cast iron parabola, 19 for the bronze parabola, and 22½ for the cast iron plain mouth. Thus we see that the great increase of distance is very unfavorable to the bronze model, and that the plain muzzled one is out of the field altogether.

During the above mentioned experiments, trials were made with gun cotton, in order to see whether the sound of its report on explosion would reach to any great distance. Masses consisting of about ten ounces were detonated in the open air upon the butts. The noise made considerably exceeded that of the guns. It must be remembered, at the same time, that the proportion of powder in the gun cartridges bore no analogy to the quantity of gun cotton detonated. The result of the trials was, however, considered so satisfactory that a parabolic reflector is being constructed, in which it is intended to explode pieces of gun cotton.

Evergreens in Orchards.

A correspondent says that the theory of planting evergreens among fruit trees, for protection, mentioned in our Special Edition, recently issued, is wrong.

They impoverish the ground, occupy space, and shade the fruit trees. Fruit from shaded trees is always inferior in quality. To produce a fruit bud, the sun must thicken the sap to a glutinous liquid. Without the rays of the sun, buds will form only to produce leaves. The most perfect fruit is found on the outside of a tree; and therefore, to give light, the pomologist trims and thins out the branches. This explains why wall trees produce such uniformly large and excellent fruit.

A belt of evergreens around an orchard may be beneficial, not because of the heat that is supposed to emanate from them, but because they break the winds and still the air as sweeping winds often dry up the vital sap of both evergreen and deciduous trees.

Alternate heating and freezing are destructive to vegetable as well as to animal life; because the heat starts the sap, and the frost freezes it. The freezing swells the sap, and lifts the bark from the wood, the channels of circulation are strained and destroyed, and the part so affected dies. Well matured wood is not apt to suffer from cold. To save tender trees, let them finish their season's growth before cold weather; and to hasten maturity, give a dry bottom and light and air in abundance.

Some evergreens supposed to be tender (the rhododendron, for instance) will survive the winter better on the north side of a building, unprotected, than on the south of the same protected and sheltered from the rays of the sun.

A Cure For Diphtheria.

A correspondent says: "Take a flat iron and heat it a little on the stove; on this apply a very little pitch (not gas) tar; have the iron hot enough to make a good smoke. Then let the patient take into his mouth the small end of a funnel, and have the smoke blown through the funnel into his mouth. Let the smoke be inhaled well into the throat for few minutes five or six times a day. In very bad cases, it might be well to use it oftener. After this, let the patient lie on his back then break up small pieces of ice and put them into his mouth, and let them go as far down to the roots of the tongue as possible. When they have dissolved, put in some more; this will keep down the inflammation."

PRACTICAL MECHANISM.

NUMBER XVI.

BY JOSHUA ROSE.

MOVEMENTS OF PISTON AND CRANK.

Let us now see how the steam in the front end, whose admission in the cylinder is shown in table No. 1, is exhausted. We find in that table that, at 11¾ inches of the stroke, the expansion ends, and the valve, ceasing to be a steam port, becomes an exhaust port.

TABLE NO. 4..

Piston moved inches	Exhaust port open inch
11 7-8	1-16
12	3-8
Piston returned 1-4	11-16
1-2	full
8 1-4	full
9	11-16
9 3-4	9-16
11	1-4
11 5-8	exhaust port closed
12	port again taking steam

The exhaust for the other end of the cylinder, that is, for the back end (the admission of steam to which is shown in table No. 2), is as follows:

TABLE NO. 5.—BACK END.

Piston moved inches	Exhaust port open inch
11 7-8	1-8
12	3-8
Piston returned 1-4	5-8
3-4	full
9 1-4	full
9 3-4	3-4
11	7-16
11 5-8	1-8
11 3-4	port closes
12	port again taking steam

Here we find that the average area of exhaust port opening (allowing the full opening of the port for the eight inches or so of movement, during which the port was fully open, and which are therefore omitted, for brevity's sake, from the tables) is about $\frac{5}{8}$ of an inch for the front and about $\frac{1}{1}\frac{0}{6}\frac{8}{0}$ for the back end of the cylinder. Referring again to the admission of steam to the cylinder, and comparing it to the exhaust, we find that the front end had the least opening of steam port, and the back stroke the most, so that the exhaust is the most at the end where it is required to be the least, and *vice versa*.

In order that the value of a small increase in the valve travel may be fully appreciated, we will now take the same engine and alter its eccentric sufficiently to increase the valve travel from 2½ inches to $2\frac{1}{1}\frac{3}{6}$, first noting that the travel of a valve necessary to open both the steam ports full (and allowing that the valve movement were true) is twice the width of each steam port and its lap, or, in other words, the width of each steam port and the lap on each side of the valve added together.

TABLE NO. 6.—FRONT STROKE.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	5-8	8	3 4 full
2	13-16	9	5-8
3	7-8	10	7-16
4	7-8	11	1-8
5	7-8	11 1-4	closed and expansion begins
6	7-8	11 13-16	expansion ends
7	7-8	12	exhaust open ¼ inch

TABLE NO. 7.—BACK STROKE.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	13-16	8	3-4
2	7-8	9	1-2
3	7-8	10	1-4
4	7-8	10 7-8	closed and expansion begins
5	7-8	11 3-4	expansion ends
6	7-8	12	exhaust open ⅛ inch
7	7-8 bare		

Adding up the area of port opening at each inch of piston movement, and dividing the sum total by the number of inches in the stroke, which will give us in each case the average port area for the whole stroke, we shall find the average for the front end of the lesser valve travel to be $\frac{3}{8}$ of an inch, and for the same end of the greater travel to be $\frac{4}{8}$ of an inch, the average for the back stroke of the lesser travel to be $\frac{9}{1}\frac{4}{6}\frac{4}{0}$, and for the greater to be $\frac{5}{8}$.

A glance at the respective tables will also show the admission of steam to be much greater during the early part of the stroke, in the case of the increased valve travel, which is of great advantage The quarter movements under the increased valve travel will be

TABLE NO. 8.

Movement of crank	Piston movement	Average port opening
1st quarter	6 3-4 inches	$\frac{1}{1}\frac{3}{6}\frac{8}{0}$
2d "	5 1-4 "	$\frac{9}{16}$
3d "	5 1-4 "	$\frac{1}{1}\frac{3}{6}\frac{4}{0}$
4th "	6 3-4 "	$\frac{8}{1}\frac{7}{6}\frac{7}{0}$

From the above table we find that the increase of valve travel has been more serviceable to the fourth quarter movement than any other, leaving its opening still less than the other, it is true, but still largely increased: which is very important, because it is so much more proportionate to quarter movement No. 2, during which the piston is (as in movement No. 4) moving from full power to a dead center, and further because it is especially desirable that the average area of the port opening should be as large as possible for and during the quarters having the longest piston movement. We also find that the average port opening for quarter movement No. 3 has not been affected by the increase of valve travel; this again is decidedly beneficial, for it was, under the short valve travel, the greatest of all independent of its proportion to the piston movement, and the most disproportionate of all when considered in relation to the piston movement; but under the increased valve travel, it is not only not the greatest, but it is less (as is also its piston movement) than is the average port opening of quarter movement No. 1, the crank (during each quarter movement) having moved from a dead center into full power. These considerations convince us that not only has the increase of valve travel given us a better steam supply, but it has given us one more regular and proportionate to the piston and crank movements.

Now let us examine to what extent and in what way our increase of valve travel has influenced the ports as exhaust ports. Commencing, then, with the front stroke, that is, the port at the front end of the cylinder, which exhausts the steam admitted through the area treated of in table No. 1, we find as follows:

TABLE NO. 9.—FRONT STROKE EXHAUST.

Piston moved inches	Exhaust port opened inch
11 7-8	1-16
12	3-8
Piston returned 1-4	11-16
1-2	full
9 1-4	full
9 3-4	3-4
10	5-8
11	5-16
11 13-16	exhaust port closed
12	port again taking steam

TABLE NO. 10.—BACK STROKE EXHAUST.

Piston moved inches	Exhaust port opened inch
11 7-8	1-8
12	3-8
Piston returned 1-4	11-16
9-16	full
9 7-8	full
10 1-2	11-16
11	1-2
11 1-2	1-4
11 13-16	exhaust port closed
12	port again taking steam

Comparing the exhaust opening for the front stroke of both valve travels, we see that the increased travel has given us as free an exhaust in the early part of the exhaust, kept the exhaust port full open during 1 more inch of piston travel, given us a much more free exhaust during the latter part, and finally increased the average of exhaust opening from $\frac{3}{8}$ to $\frac{1}{1}\frac{1}{6}\frac{4}{0}$. Comparing the exhaust opening for the back stroke of both valve travels, we find also that the greater travel has given us a greater exhaust opening in the early part of the exhaust, has kept the exhaust port full open during about 1¼ inches more of piston movement, and increased the average of exhaust opening from $\frac{1}{1}\frac{0}{6}\frac{8}{0}$ (which it was under the lesser valve travel) to $\frac{1}{1}\frac{1}{6}\frac{2}{0}$ under the increased travel. Hence our increased travel has been highly advantageous to the opening and keeping open of the ports, both as steam ports and as exhaust ports.

It is here proper to explain how it occurs that the increase of valve travel gives a greater proportionate increase of steam port opening for the early part of the front stroke than it does for the early part of the back stroke, and also a greater proportionate exhaust area during the latter part of the back stroke than during the latter part of the front stroke, the reason for which is that the increase in the travel of the valve (and hence in the throw of the eccentric) increases the lead of the valve; and the altering of the position of the eccentric to take away this increase of lead brings the eccentric into such a position that a line drawn from the center of its bore to the most distant part of its circumference, representing the throw of the eccentric, would be nearly true (if it were circular instead of straight) with the circumference of a circle described from the center of the bolt at the opposite end of the eccentric rod, as shown in Fig. 53, A being

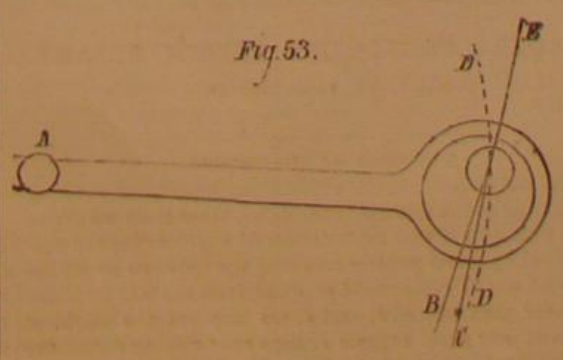


Fig. 53.

the joint of the slide valve spindle and eccentric rod end, B, the line representing the throw of the eccentric, and showing the position in which the eccentric requires to be set in the case of the lesser valve travel, C, a line representing the throw line of the eccentric as it is when the eccentric is made to suit the increased valve travel, and the dotted line, D, a circle struck from the center of A

It is apparent that the nearer the line representing the throw of the eccentric (that is, the line, B in Fig. 53) approaches in its main course to a line struck from the center of the eccentric rod end (D D, in Fig. 53), the less effect will an increase or decrease in the throw of the eccentric have in altering the position of the slide valve spindle (and hence of the valve) either backward or forward, at the time when the eccentric is in the position shown in Fig. 53. And, as the greater the increase in the throw of the eccentric the nearer will the throw line of the eccentric, when the latter is set, approach the line, D D, it follows that the less will the difference in the position of the spindle and rod joint (and hence of the valve) be when the eccentric is in the particular position shown. When, however, the crank has made one half of a revolution, and the throw line of the eccentric stands in the position denoted by the line, E, in Fig. 53, the least alteration in the length of the throw of the eccentric will have a great effect in altering the position of the joint, A, and hence of the slide valve, the effect being to bring the joint, A, nearer to the crank shaft in proportion to the increase, and to throw it farther back from the crank shaft in proportion to any decrease in the throw of the eccentric; which shows why an increase in the throw of the eccentric (or, in other words, of the travel of the valve) makes the difference in the port opening before referred to.

Preparation of Thallium from Soot of Sulphuric Acid Works.

BY FRANZ STOLBA.

In repeatedly working up the soot of two sulphuric acid works in Germany, where pyrites from Meggen were employed, a method was employed for separating the thallium, which depended upon a formation of a thallium alum. The soot is first passed through a coarse sieve to remove the pieces of brick, mortar, and clay mixed with it, and then boiled in water acidified with sulphuric acid. It is next placed on a suitable filter and stirred while carefully washed with hot water until all the acid is removed. The wash-water, after acidifying, can be used for boiling a second portion in, and so on. The first filtrate, which is tolerably concentrated, is evaporated in very shallow dishes to such a degree as to crystalize. Beautiful large reddish crystals of thallium-alumina-iron alum are formed as it cools. To the mother liquor was added some sulphate of alumina, and again evaporated, when a small quantity of mixed alums separated. The last mother liquor, as well as the rinsings from the crystals, when precipitated with crude hydro chloric acid, yielded a surprisingly small quantity of chloride of thallium.

The crystals of thallium-alum were recrystalized twice from water containing sulphuric acid. The alum thus obtained was so pure that it yielded pure thallium when acted upon by pure zinc and pure sulphuric acid, and with pure hydrochloric acid, pure chloride of thallium was precipitated.

The crude chloride of thallium may be prepared in the usual manner, and next converted into sulphate by means of sulphuric acid, and finally, by means of sulphate of alumina, into thallium alum, which can be purified by recrystalization. The first method is, however, more convenient, because it does not involve the troublesome decomposition of the chloride by means of sulphuric acid. As the thallium alum is considerably more soluble in hot than in cold water, the conversion of the much less soluble sulphate into the more soluble alum offers the great advantage that the latter can be recrystalized from a much smaller quantity of water, which is more convenient and requires less time. Beside this, the alum is a compound easily converted into the chloride or iodide, from which the metal is easily obtained.

Horse Car Bell Punches.

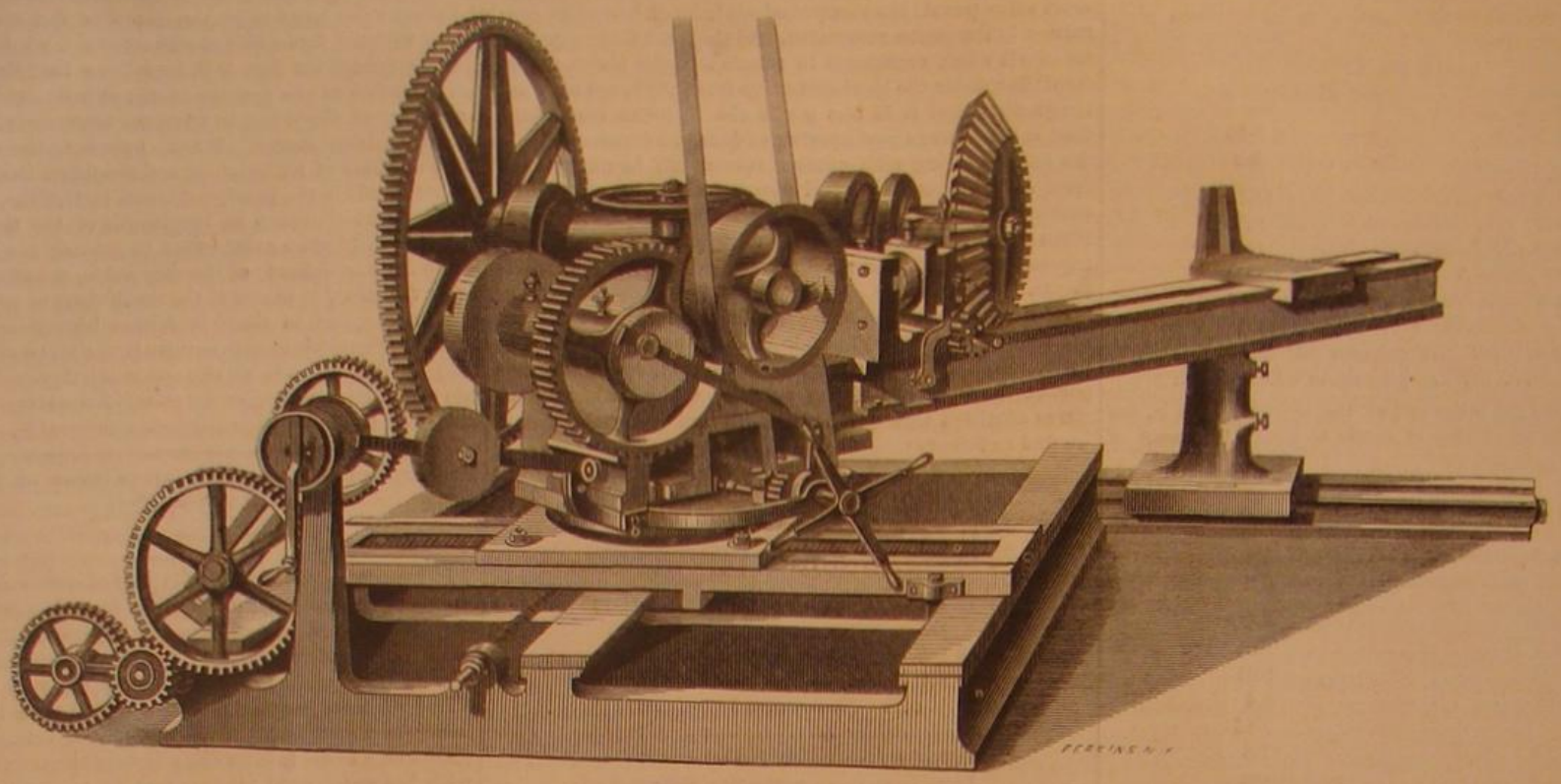
The Hartford *Post* states that the patent bell punches manufactured at Colt's armory are now very extensively used on horse car lines, especially in the large cities. There are about 1,500 in use in New York, 1,600 in Philadelphia, 400 in Boston, 200 in Chicago, 150 in Buffalo, 100 in Providence, 150 in Albany, and 200 in Troy. In London there are 1,600 in use, 1,200 in Dublin, and 150 in Liverpool. These punches are not sold to the companies, but are loaned to them at a fixed rate, and there are two punches for each car. The punch which is used to-day is turned into the office to be reset for tomorrow, and in the meantime the conductor employs the spare instrument. A general rule is that every conductor is compelled to deposit $100 with the company for the safe keeping and fair usage of the punches.

Cruelties of the Seal Fisheries.

Attention has been called at different times to the barbarous practices identified with seal fishing. At the breeding season, the unfortunate animals are swooped down upon in their ice-bound retreats, and both young and old indiscriminately slaughtered. The young seals yield but little oil, and their skins are comparatively valueless; and it is, therefore, from a commercial point of view, inexpedient to kill them, leaving sentiment altogether out of the question. We are glad to observe that there is a probability of an arrangement being ratified which will ensure for the seals a close time, and save them from the extermination which now threatens. The British Board of Trade is moving in the matter, and the opinions of those connected with the trade are being ascertained with a view to ultimate action. It is probable, says the *British Trade Journal*, that an international law, binding on the British, Norwegian, and Swedish Governments, will eventually be agreed on, which will prevent the subjects of those governments from fishing for a specified period of the year

CUTTING GEAR WHEELS.

The Chemnitz firm exhibited at the Vienna Exposition a gear wheel cutter, of which we herewith present an engraving, which clearly shows the construction. The cutting tool is moved on a bed placed diagonally, and supported at the end by a movable rest. As the cut can be varied to any angle, wheels of any dimensions or bevel can be made by this machine; and an ordinary planing tool can be used, turning out gear work of the highest finish and accuracy. The machine is simple in construction; and it seems to be a useful tool, capable of many applications which shop practice will, from time to time, suggest.



GEAR WHEEL CUTTING MACHINE.

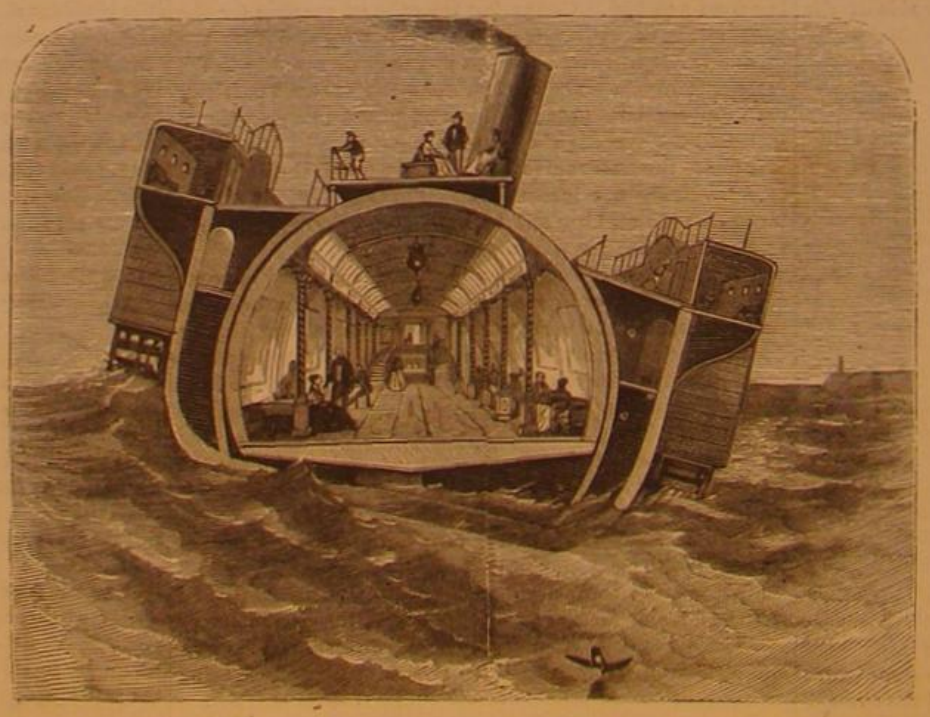
THE BESSEMER SALOON STEAMSHIP.

We illustrate herewith the interior of the steamer designed by Mr. Henry Bessemer, to defeat seasickness and give comfortable transit to persons in delicate health. Among her peculiarities are two pairs of paddle wheels and her freeboard of only 3 feet for 48 feet from each end. A sort of hurricane deck, 254 feet long, extends from bulwark to bulwark, 8 feet above the main deck. Her engines, nominally 750 horse, can work up to 4,600 horse power, which, it is calculated, will propel her at 18 or 20 miles an hour. The two paddle wheel shafts are 106 feet apart, and the swinging saloon, 70 feet long, is placed amidships between them.

Mr. Bessemer designed the apparatus for keeping the saloon perpendicular, an arrangement which possesses several original and ingenious features, which are fully described and illustrated on page 50 of our last issue. The new steamer is built from the designs of Mr. E. J. Reed, formerly Chief Constructor to the British navy.

If the inventor's hopes are realized, a very great stride in steamship accommodation will have been taken. As will be seen from our engraving, which represents a cross section of the vessel, the saloon is very commodiously and elegantly fitted up, and its great size will enable a large number of people to occupy it without suffering from the indescribable stuffiness and nausea inseparable from steamer cabins even of the largest usual dimensions; while for the great number of people to whom a sea breeze is the most enjoyable part of a voyage, the upper deck over the saloon will afford an agreeable promenade, as well protected from the effects of a rolling sea as the elegant apartment below.

The Bessemer started on a trial trip December 21, last. The day was foggy, and the trial was not completed; but the attempt was not altogether unsatisfactory, as it was found that, with a pressure of only 19 lbs., the engine making but 20 revolutions, a speed of over 16 miles an hour was made against a strong head wind. As it is intended to run her with 30 lbs. steam at 30 revolutions, a very good ultimate result may be expected. She answered her helm very readily, turning in a very small circle for a vessel of her length. Mr. Reed was well satisfied with her behavior, her fore deck being seldom covered with waves, in spite of her low freeboard. Another point was satisfactorily solved, namely the manner in which her two sets of paddlewheels worked together. The broken water from the forward pair of wheels was so slight in its action on the after pair that the two never varied more than one or two revolutions per minute from each other, thus showing a very small percentage of slip for the after pair of wheels. The vessel was constructed by Earle's Shipbuilding Company, of Hull, England; and further trial of her engines was in contemplation when our last advices left England.



BESSEMER'S OSCILLATING SALOON STEAMER.

A Scientific Inter-Collegiate Contest.

A college contest in oratory recently took place in this city, in which representative students of six institutions of learning participated. The exercises have excited much interest, and the successful competitors have been awarded substantial prizes. There is no question but that the public regards favorably these trials of intellectual strength among our students, and the effect of the same is naturally to awaken a broader taste for education, and desire for its advancement throughout the country. Why, however, should these competitors be confined to the classical and literary departments of the colleges? Let us have a scientific inter-collegiate contest also. There is the Sheffield school, the Worcester Institute, the Columbia School of Mines, the Stevens Institute, the scientific departments of Union, Cornell, Lehigh University, and of a multitude of other colleges, all of which could furnish contestants. Cannot Professor Draper, or Henry, or any of our foremost scientists, suggest subjects for essays, and will not some of our wealthy citizens who are directly interested in scientific progress join in offering prizes for the best original investigation to be made by any student in any department of science? The essays could be read and passed upon by a competent board of judges, and the researches could be described and fully illustrated or repeated, if possible, by apparatus in presence of the audience.

The End of the World.

If the body's death seems to teach the lesson that modesty is becoming to the scientific speculator, what shall we say as to the prospects of that material frame which is beyond ourselves—the general orderly frame of the universe as we see it around us? People would suppose, from the way in which you hear men talk now, that there was not the slightest chance of any great organic change ever coming across the outward world in which we live. No doubt God works by fixed laws. No doubt the world goes on morning and evening, and summer and winter; but what reason have you to suppose that it will so go on to infinity? Have no great catastrophes befallen the world before now? Does not physical science itself speak of these catastrophes? What is there to prevent other catastrophes, produced by the operation of laws of which at present we are very ignorant, coming athwart the globe on which we live, and a complete change taking place in the relations in which things even in the outward world stand at present, so that in the scriptural sense of the word there may be an end to the world, as there is certainly to be an end of our earthly life? To be sure, things have gone on for a long time in the same way, but is that any proof that they are to go on in the same way for ever? You arise morning after morning in good health and strength, and seem to say to yourself for a time that this will last for ever; but one morning something happens, you cannot explain what; the best physician in the world cannot tell you what; but something has happened that lays you on a bed of sickness, and in two days sends you off to your grave a corpse. Will the experience of the reality of the way in which everything has gone on since you were young, till you have attained maturity, save you from that great mischance? Again, men for centuries had ranged over the mountains in Campagna; they thought that all would go on there, herds and flocks feeding and vineyards growing as they had done for centuries; and suddenly there was a strange sound heard, and a volcano burst forth, and the greatest philosopher of the age came to look at it, and lost his life while he was looking. But neither he nor any of the men who had speculated with him ever expected that these great cities were to be swept to destruction, and their beautiful pastures to become for a time an arid wilderness. I do not say such instances explain or tell us distinctly that such catastrophes will befal the whole globe; but at all events, I think they ought to make us modest, seeing that the wisest know so very small a portion of the laws that regulate God's creation. Surely we may not dogmatically assume that such catastrophes are beyond the range of possible or probable events. It is true, I say, things have gone on for a long time, and men say: "Where is the promise of His coming, for all things continue as they were from the beginning of the world?" But still with Him, with whom one day is as a thousand years, and a thousand years as one day, there may be changes maturing which no philosopher of the present or of any previous age has ever dreamed of, which will bring this great catastrophe to the globe, which will answer, on the whole outward creation, to something as great as is our passage from life to death, and what is beyond it. I do not think there is anything fanciful in such an expectation. I believe that a man, of that modest mind which is the characteristic of true science, will hesitate before he pronounces with any assurance that such a change may not come over the world as has been distinctly predicted in the Scriptures.—*Dr. Tait, Archbishop of Canterbury*

Protective Power of Clothes.

Clothes protect the body, not by keeping out cold, but by keeping heat in, or more correctly, by allowing through their interstices such ventilation that the nervous system may not be sensible to extremes in changes of temperature. If the first mentioned effect were produced by garments, then the material which is the most impervious to air would be the warmest. A kid glove, for example, would keep the hands more comfortable than thick woolen mittens. Just the reverse, as is well known, is the case.

Dr. Pettenkofer states that equal surfaces of various materials are permeated by air as follows, flannel being taken as 100: Linen of medium fineness 58, silk 40, buckskin 58, tanned leather 1, chamois leather 51.

HIGHLAND AND LOWLAND CATTLE.

Two distinct varieties of neat cattle are indigenous to Scotland; and all breeders are familiar with the races, which, either pure bred or modified by cross-breeding, are to be found in all countries.

The lowland cattle are celebrated milkers, and the well known Ayrshire cow is probably a derivative from this stock. The beauty of this race, when thoroughly domesticated, is well known; and their value to the farmer and the dairyman is highly appreciated in this country, where also their graceful, sleek, good-conditioned appearance adds an ornament to our yards and pastures.

The mountain oxen (or kyloes, as called by the Scotch agriculturists) are generally black, red, or brindled in color; and from the earliest times they have been used to roaming the forests and the hills, holding no connection with tame cattle, and concealing their calves in fens and underwood. Their self-color (free from variegation, an infallible sign of domestication and servitude) still testifies to the purity and antiquity of the race. The animals are by no means large specimens of their genus, but their meat is excellent, and a large portion of the London supply is drawn from the neighborhood of Aberdeen, in Scotland.

We illustrate both these breeds of cattle, the drawings being from the pencil of Mr. Harrison Weir, an English artist and naturalist, whose vivid and accurate pictures of animals are widely celebrated.

Many interesting anecdotes of the sagacity and intelligence of cattle have been related, among which are the following (selected from *The Leisure Hour*, from which we extract the engravings)

A cow once had an aversion to a certain milkmaid in a dairy. If ever she dared to attend, Colly would stand patiently till the process was finished, and then turn round and kick over the full pail with a movement too agile, albeit premeditated, to be forestalled. Another cow held herself the queen of her herd, and would never leave the field unless she went first; so obstinate was she in this matter that, if any or all of the other cows left first, she would refuse to move unless the dairymaid drove the whole of them back again into the field, when, with a graceful bow of the head, she would condescendingly take precedence and march home, the other ladies of her kind meekly following.

There was one cow which was very much attached to a little lass of some eight summers. This cow grazed in a large field with many others. When the child entered, if at the farther side, the cow would at once perceive her, and run to meet her, lowering its head with its formidable horns, in a manner which would have been frightening to a stranger. The little girl would hold out her dimpled arms and run as eagerly to meet her old friend in a warm embrace. It was a pretty sight to see the child's arms round the cow's great neck, while she kissed its brindled coat, and the gentle animal licked with its rough tongue the bairn's golden curls.

On Saturday evening, just after a heavy rainstorm (in Manor Township, Pa.), little Henry Goff was saved from a grave by a cow which he was driving home. A number of cows were pasturing on the farm of Thomas Seachrist, in Manor Township, and had crossed a small run which passed through the premises. The boy, who is very young, was sent for the cows, and he had to cross the run, which was very much swollen, on a small foot bridge. Two of the cows proceeded along quietly and passed through the run, but the third would not cross it, notwithstanding the little boy urged her on determinedly. Seeing that she refused to go across, the boy thought he would cave her where she was, and drive the other cows to the barn. He stepped upon the frail bridge; and just as he was near the middle, the structure snapped asunder, and precipitated him into the swiftly flowing waters below. The cow seemed to comprehend that the boy was in danger of being drowned, for she instantly plunged into the stream below the bridge; and as the little chap floated up to her, she appeared to wait for him, an advantage he was not slow to take. He clasped her round the neck, and was drawn hastily to shore, terribly frightened, but not much the worse off bodily by his experience.

LOWLAND CATTLE.

HIGHLAND CATTLE

Anointing with Cocoa Butter for Scarlet Fever.

Upon the recommendation of Schneeman, the anointing of the body with fat has been extensively practiced in Germany during the past ten years, with the view of lowering the temperature and hastening the desquamation. Dr. Bayles suggests, in this connection, the employment of cocoa butter, as producing a more cooling and refreshing effect upon the patient, and emitting a more agreeable odor in the sick chamber. This agent, on account of its solid consistence, is more readily applied than either fat or oil, and is more easily absorbed by the skin. Furthermore, it is thought to afford the system a certain amount of nourishment.

In severe fevers, the entire surface of the body should be rubbed with this substance every hour, or at least once every four hours. Its application is also recommended in typhoid fever, in cases where the patients manifest a dread of water, or where the application of water is impossible: likewise in other inflammatory diseases, especially the severer forms of inflammatory rheumatism and tuberculosis.—*Herald of Health.*

[Some years ago an acquaintance of ours had several children very sick with scarlet fever. After their recovery he communicated his recipe, which was published at the time in this paper; he had kept his little patients well anointed with the rind of smoked hams. He believed his treatment to have saved his children; and we remember to have received at the time a number of letters from persons who had practised the method after our publication, commending the ham remedy as important to the community.—EDS.

The Bottom of the Sea.

Among scientific puzzles is one which has long perplexed geologists, namely, the existence of large areas of rock containing no sign of life, side by side with formations of the same period which are full of fossils—relics of primeval life. Why should one be so barren, and the other so prolific? There is now an answer to this important question, and readers who take interest in the exploring voyage of the Challenger will be glad to learn that the answer comes from that ship, in a paper written by Dr. Wyville Thomson, chief of the scientific staff on board. This paper was read last month at a meeting of the Royal Society. It contains the results of deep sea soundings which have revealed the existence of vast areas of barren clay at the bottom of the sea, in depths varying from two thousand two hundred to four thousand fathoms and more. In other parts, the bottom is composed of the so-called *globigerina*, which live near the surface, and sink to the bottom when dead. There they accumulate, building up chalk for ages to come, when land and sea shall once more change places. But it is remarkable that, at the depth of two thousand two hundred fathoms, the *globigerina* thin off and disappear, and the gray deposit merges into the barren clay above mentioned. The explanation is that, below two thousand fathoms, the tiny shells of the *globigerina* are dissolved by some action of the water, and that the minute quantity which they contain of alumina and iron goes to form the areas of barren clay. The extent of these areas is so great that it exceeds all others as yet known at the bottom of the sea, and it is the most devoid of life. In this respect, the red clay now forming resembles the schist which at present occupies so large a part of our earth's surface.

We are all more or less familiar with chalk and with rocks that show no sign of fossils; and to be thus, so to speak, made eye witnesses of the process by which chalk and rock were formed is unusually interesting. An eminent naturalist declares that this paper alone is worth all the cost of the Challenger expedition.—*Chambers' Journal*

(Translated from the Official Reports upon the Exposition.)

THE VEGETABLE FIBERS AT THE UNIVERSAL EXPOSITION VIENNA.

BY PROFESSOR DR. JULIUS WIESNER.

Number II.

In the English colonial exhibit, furthermore, there were displayed two East Indian fibers, up to the present time quite unknown to European commerce. We refer to the *yercum* fiber and the *jetee* fiber, which, so far as tenacity is concerned, throw all the vegetable textile fibers with which we are acquainted into the shade. The first is the fibrous bark of *calatropis gigantea*, and the latter that of *Marsdenia tenacissima*. A comparative estimate of strength is afforded by the following example: A jute cord of given size will support, say 140 lbs., while a cord of *jetee* fiber of the same diameter will support a weight of 248 lbs., the ratio of strength being very nearly as one to two. For the manufacture of ropes and cordage needing great tenacity, the above named fibers are therefore deserving of high recommendation.

The fiber *sunn*, finally, is worthy of some attention on the part of our hemp and coarse flax manufacturers. This is a very strong fibrous material obtained for many years in India from the *crotalaria juncea*, extensively cultivated in India, Java, and Borneo. Since its first introduction to European manufacturers, which occurred at the Paris Exposition in 1867, the *sunn* has been to some extent employed in England. The appearance of this material is not very prepossessing, the commercial product resembling tow more than anything else. This is, however, to be attributed to the method of its preparation. By the employment of a more complete mode of separation, the fiber could be much improved in fineness and homogeneity. Strength and great ability to withstand alternations of wet and dry are its chief characteristics.

In one qualification—namely, its want of hygroscopic properties—the *sunn* surpasses every known fiber; and whereas the last named raw materials are able to absorb from 16 to 22 per cent of moisture from the air (and some are known that take up as much as 40 to 50 per cent by weight of moisture when exposed to a damp atmosphere), the *sunn*, under ordinary circumstances, contains only 5 to 6 per cent of water, and can absorb, from an atmosphere charged with moisture, only 10 to 11 per cent. As these raw products are sold by weight, and no account is taken of the weight of moisture absorbed therein, this property of the *sunn* is worthy of consideration.

The colonial exhibits were likewise rich in their display of manilla hemp and cocoanut fiber; to these, however, it is unnecessary to do more than simply refer, inasmuch as our manufacturers are already sufficiently familiar with their qualities. The material called *pite*, the fiber of certain *agave*, has been introduced in Vienna within the past few years under the name of *fibris*, and so largely employed, in the manufacture of brushes and the like, that it may be of interest to name the countries that make exhibits of the raw material. These are: Martinique (*agave Mexicana*) Guadeloupe (*a. Americana* and *a. faltida*), Guiana, Brazil, Venezuela (the exhibit of this country, called *cocuisa* fiber is closely allied to the *pite*; it is the product of *Fourcroya gigantea*), India, Mauritius, Réunion, Algeria and others. Central and South America, however, are the chief producers of this fiber. The *piassava* of Brazil, with which we are already familiar, was likewise well represented at the Exposition.

Before passing over to the consideration of the vegetable silk and wool, and of the vegetable horsehair displayed at this exhibition, it will be well to enumerate some of those vegetable textile materials, thus far entirely unknown to commerce, but which are largely utilized in their native countries, and may in time play an important rolé in our textile industries. In this enumeration belongs the bark fiber of numerous species of hibiscus (*h. cannabinus, tiliaceus, sabdariffa*, etc., found and utilized chiefly in India); the genuine *aloes* and *ananas* fibers; and the *cacoa* or *cacoua*, consisting of the leaf fibers of the pandanus, and produced chiefly in Réunion, Mauritius, and the French colonies.

The so-called vegetable silk, the seed tufts of numerous *asclepiadaceæ* and *apocynaceæ*, were happily not so strongly represented as at the recent Paris Exposition. At that time the French colonies presented such a quantity and variety of these products that one was tempted to regard them as wares of much importance.

In spite, however, of the beauty and eminent luster of these silks of the vegetable world, their technical value is very small. The fiber is both weak and brittle, and therefore poorly adapted for woven fabrics. And unfortunately these are the varieties that might be placed in the market in unlimited quantities: the seed tufts, for example, of *asclepias gigantea* and *curassavica*, that are least valuable for industrial purposes. In this connection, the seed tufts of *Beaumontea* (East Indies) appear not to have received the attention that the material deserves, inasmuch as its comparatively greater strength would appear to render it more adaptable for utilization than those previously named.

The vegetable silk appears to be far better adapted for the manufacture of artificial flowers and similar artistic work—in which direction it has been considerably employed—than for textile uses. It has likewise been suggested as a substitute for down in filling bolsters, pillows, and the like; but for this use, the brittleness of the fiber will be likely to prove a serious objection. The samples of this product at the Exposition were almost exclusively from the French colonies; and in the published catalogue of their exhibits its merits were placed in the most flattering light.

More modest in its pretentions was the vegetable wool. It was nowhere exhibited save as an article shown in practice to be an excellent substitute for mattrass filling. This fine material consists of the seed tufts of several trees of the family *bombaceæ*. Of these raw materials we noticed the following varieties on exhibition: *paina limpa*, from Brazil (seed tufts of *bombax heptaphyllum* and *b. ceiba*); the *kabok*, from the Dutch colonies (obtained from *eriodendron anfratuosum*); the *Edrédon végétale*, from the West Indian French colonies, called also *patte de lièvre* (from *Ochronia lagopus*); Venezuela exhibited, under the name of *laine végétale*, the wool of both *O. lagapus* and *B. cumanensis*. The wool of *O. lagapus* is brown, while that of the several bombax species is white or only slightly colored. All of the vegetable wools above enumerated consist of a delicate, not brittle fiber, which forms when in bulk a soft, elastic mass, well adapted for the purpose to which it is applied (see above).

In Holland, the *kapok* is very largely introduced; and in Germany, likewise, the wooly product of *eriodendron anfractuosum*, under the name of vegetable down, has recently been introduced. The statement, occasionally met with in books, that these vegetable wools, either alone or in mixture with cotton, could be satisfactorily made into woven fabrics—upon which point, I have on a former occasion expressed my doubts on account of the weakness of the fibers—appears to be quite erroneous; at all events, no such goods were at the Exposition, nor were any of the exhibitors aware that this result had ever been accomplished; in addition to which, all the exhibits were entered as bedding materials.

In addition to the above, a number of coarse vegetable fibers, generally characterized as vegetable horsehair (*crin végétale*), are deserving of notice. The desirability of securing a cheap substitute for the expensive horsehair, which should possess similar properties, and resemble it closely enough to be mistaken for it on cursory observation, has long been felt in several important branches of industry. In Austria and Germany, the leaves of *carex brizoides*, brought into the market from Upper Austria and certain quarters of the Grand Duchy of Baden, is used in enormous quantities as a substitute for horsehair. The material in question is but slightly elastic and not very durable, and affords only an indifferently good substitute.

The *crin d'Afrique* (called also *crin Aversing*) of the French, the split leaves of the dwarf palm (*chamaerops humilis*), is a far superior article for this purpose, and it is now being imported into Europe from Algeria in large quantities. The same material has lately been brought into the Vienna market for bedding, and colored black (the natural color of the product is green); it is known by the name of Afrik, and is employed for a great variety of uses. The introduction of the *crin d'afrique* has unquestionably been of great utility to numerous industries. Despite its excellent qualities, however, the leaf of the dwarf palm is by no means the best substitute for horsehair with which we are acquainted. Of far greater value for this purpose, inasmuch as they possess the properties of horsehair to a much higher degree, are to be mentioned the three fibers *ejoo*, *pitool*, and *caragate*. The *ejoo* fiber, called also *gomuti* fiber, is the product of a very common sugar palm of India (*arenga saccharifera*), and occurs in the form of a black horsehair-like mass, growing on the stems where the leaves have been attached. This fiber remains behind when the leaves fall off. The black fiber *kitool* has a similar origin. It is derived from the palm species, *caryota mitis* (Réunion) and *c. urens* (India, Ceylon). The best substitute for horsehair, however, is without question the fiber *caragate*, called also tree hair. This fiber is a portion of the aerial roots of a parasitic plant (*bromelincea*) infesting certain trees, and occurring in Tropical America. It attains a length of 8 or 9 inches, and in appearance, elasticity and tenacity approaches so closely to the genuine horsehair that an ordinary observer will scarcely be able to distinguish the difference. By burning one of the fibers, however, its vegetable character may be readily established by the absence of the characteristic odor of burning horn, which accompanies the combustion of horsehair and similar animal matters. The following very essential difference between the two materials, which is observable upon close inspection, will serve to distinguish them apart quite readily: The horsehair consists of one single fiber throughout its length, while the *caragate* consists of a succession of branched fibers. At the present time Guiana is perhaps the most important producer of this valuable material, and the only objectionable feature incident to its introduction is found in the fact that dealers employing it cannot resist the temptation of representing their goods as being made of the genuine article.

The coarse fibers were represented at the Exposition by the *esparto* fiber, and another obtained from Spanish cane, by mechanical disintegration. Ropes, cords, etc., made from the last named material, were amongst the novelties of the Exposition, having been exhibited for the first time. Ropes, and the like of the *esparto* formed one of the features of the Paris Exposition of 1867, and their reappearance at Vienna demands no special notice in this report.

Permanence of Vital Power.

In clearing away the refuse from the ancient silver mines of Laurium, in Greece, a large number of seeds of a papaveracea of the *glaucium* genus were found, which must have been buried there for at least fifteen hundred years. Exposed to the beneficent influence of the sun's rays, they rapidly took root, flourished, budded, and blossomed, their yellow corollas being beautiful in the extreme. This interesting flower, unknown to modern science, is particularly and frequently described in the writings of Pliny and Dioscorides, and is thus again resuscitated, after having disappeared from the surface of the globe for more than fifteen centuries.

Nature of Nerve Force.

In one of Jean Paul Richter's novels—if our memory serves us rightly, in that one called *Der Comet*—the hero is said to have had, when a boy, a peculiar light visible around his head when in a darkened room, something like the aureole or nimbus with which the old painters used to represent divine or saintly personages. Richter, who in such matters faithfully followed the extraordinary in Nature, gives, as his wont is, various references to medical works wherein such a phenomenon is mentioned. There is indeed no question of the correctness of such observations. But the explanation of the phenomena has been insufficient.

Dr. Brown-Séquard, in a recent lecture, quotes an analogous phenomenon. He remarks that there are animals which are phosphorescent, and which are so under an act of their wills, so far as we can judge, and under the influence of the nervous system; so that light also can be evolved as a transformation of nervous force. There are cases of consumption in which light has come from the lungs. The fact has been pointed out by Sir Henry Marsh and other physicians. The light appears not only at the head of the patient, but it may be radiated in the room. It has been considered that the light was only a peculiar effect of the mucus that came from the lungs of the patient. Dr. Brown-Séquard continues: —"It is not likely that this is the case, because mucus in greater quantity is evolved, and all sorts of mucus, from the chests of the people, every day, without any such phenomenon. I have read the history of each individual case of the kind, so far as I have been able to get it, and in every one of the cases, the patient, I find, was in a terrible state of nervousness."

If this were shown beyond a peradventure, our theories of nerve force would undergo material alterations, as it would at once come into the category of the *forms of motion*, and be seen to be a correlate of light, heat, etc. To this investigation seems tending, but no one can aver that it has been proven.—*Medical and Surgical Reporter.*

DECISIONS OF THE COURTS.

United States Circuit Court.--Eastern District of Pennsylvania.

PATENT LOCOMOTIVE TRUCK.—THE LOCOMOTIVE ENGINE SAFETY TRUCK COMPANY *vs.* THE PENNSYLVANIA RAILROAD COMPANY.

The patent in suit (patent of Alba F. Smith, February 11, 1862) was for the pilot truck of a locomotive engine, resting on a bolster, and connected with it by a king bolt, on which it oscillated; the bolster being suspended from the truck frame by links diverging outwardly, so that when the engine moved laterally in passing a curve it was raised on that side, and its weight tended to bring it back to its normal position.

This arrangement was found to have been previously in use upon railroad cars; but in applying it to the pilot truck of an engine, the operation and effect of it were held to be essentially different and useful, and the patent was sustained.

It appeared that a pilot truck had been previously patented in which the engine rested upon, and was bolted to, a curved block, which moved on either side in a curved slot in the truck frame, so that the engine would oscillate around a point in rear of the truck, which was the center of the curves. Either the king bolt or the curved block might be made to rest on inclined planes, so that a lateral movement would raise the engine, and it would tend to settle back. Though these devices were regarded as the equivalents of those described in the plaintiff's patent, it was nevertheless held valid, because the previous patent made no provision for the oscillation of the engine on the king bolt.

Imperfect and crude descriptions of an invention imparted to others are no evidence of an intention to abandon it.

Neither is the use of an invention for the purposes of experiment, though made in public from necessity.

Neither does such use debar from a patent, although it takes place more than two years before the application.

In closing the case, Judge Strong says:

My conclusions, then, upon the whole case, are as follows:

1. The combination claimed by Alba F. Smith, and described in his specification, was a patentable invention.

2. The patent granted to him on the 11th day of February, 1862, is not void for want of novelty of the invention. The invention had not been anticipated.

3. There is no sufficient evidence that the patentee abandoned the invention.

4. The patent is not invalid because the invention was in public use, or on sale, with the allowance of the inventor, more than two years before his application for the patent.

The only question that remains is whether the defendants have been guilty of infringement. In regard to this there is no controversy. An infringe- is very clearly proved. I shall, therefore, order the injunction prayed for in the bill, and decree an account, etc.

Let a decree be prepared accordingly.

[*Charles M. Keller* and *Charles F. Blake*, for complainants. *J. H. B. Latrobe* and *Chapman Biddle*, for respondents.]

United States Circuit Court.---Southern District of Ohio.

[October Term, A. D. 1873.—Rehearing October Term, A. D. 1874.]

PATENT BAKING OVEN.—HOSEA BALL *vs.* GEORGE K. WITHINGTON AND O. M. LANGDON.—SAME *vs.* JOHN BAILIE.

EMMONS AND SWING, *J. J.*:

OPINION OF THE COURT.

EMMONS, *J.*:

The bills charge infringement of letters patent granted to complainant September 23, 1856, for an "Improvement in Ovens," reissued October 12, 1869, and, a second time, June 14, 1870, and extended for seven years from September 23, 1870.

By agreement of counsel, both cases were argued together, and the decision to be delivered governs both.

The reissued patent, upon which the bills are founded, contains three claims, but the first, which is as follows, is the only one in controversy:

1. One or more swinging bread holders, suspended from the arms or end plates of a rotating reel, in combination with a furnace so arranged and connected that the products of combustion will pass into or through the chamber within which the bread holders move.

We prefer to rest this judgment solely upon the ground that the original patent did not warrant that part of the claim, in the reissue, which includes the direct application of heat to the bread chamber. We say the direct application of heat, because we thus construe the words "products of combustion."

The only significance which we can give to that part of the claim is that the rays of heat from the fire must be radiated directly into the baking chamber.

The reissued patent, as we construe it, claims a device which will accomplish this result. The infringement is said to depend upon the fact that the defendants' apparatus applies the "products of combustion" directly to the baking chamber, and that, as the reissue claims this feature, there is an infringement. That it does so is entirely clear; all the "products of combustion" which ascend at all move upward and around the swinging breadholders.

There is no proof, nor is there any suggestion from counsel, that there is any "product of combustion," heat excepted, which is efficacious in the baking of bread. Conceding—which we much doubt—that there are what may be called two principles in a legal sense in the application of heat to the baking of bread, we can draw the line between them only as follows:

The one, that used by the defendants, and which we suppose complainant's reissued patent to claim, radiates the heat directly from the fire into the chamber, with no intervening wall or medium, the air excepted, between them. The other heats the baking chamber by heating its external walls, or by carrying heated currents of air into it, but excluding all the direct rays of heat from the fire. The former mode greatly economizes fuel. The fire is in close juxtaposition to the baking bread, which is rotated in the chamber above the directly ascending and, therefore, greatest possible amount of heat which can be economized from a given amount of combustion. This mode defendants' device employs to the full. Turning to that of the complainant it completely excludes the employment of the principle, if principle it be. Not a single direct ray, radiated from the furnace, can enter the chamber. Its bottom is solid, and completely shuts off the fire of the furnace. The flues by the side of the bread chamber are so far removed and so cut off from the fire of the furnace that nothing but heated currents of air can pass into the former, through the apertures in the side walls. There is not only not a word in the original patent calculated to hint at the leading idea or principle employed by the defendant, but the drawings and model suggest a mode of operation wholly different. They rely upon heated walls and heated currents of air to bake the bread, and must have been contrived at a time when fuel was used, whose unconsumed gases and smoke were noxious, and which, therefore, had to be conveyed away without contact with the dough. So far from suggesting the defendants' device, or the unwarranted claim made in the reissue, had a baker been about to adopt the device of the defendants and believing that that of the complainant embodied the best application o

heat, he would have abandoned his own in the belief that it was worthless. We do not think the case one where a beneficial idea has been appropriated by another in a different form.

The complainant delayed rather than hastened the direct application of heat employed by the defendants.

It may be said the claim necessarily uses the terms "product of combustion" in a sense other than that imputed to them by the court, as they were used in reference to a device in which the direct radiation of rays from the fire was impossible, necessarily they must have contemplated something else; what this something else is is not stated. The court is asked to presume there is some unknown "product of combustion" beside heat, which can be conveyed through the apertures in the side walls upon the bread.

It is argued, if the court will but imagine some such improved incident to combustion, then the original device embodied a mode in which it might be employed in baking, and thus it would lay the foundation for the claim made in the reissue. The answer is: We know of no such quality; all the product of combustive material in this process is the heat evolved, and, as the original patent provided no mode for its application, the subsequent claim for it is void.

Although our judgment goes upon another ground, and we have not, therefore, fully considered whether the patent for this combination is void because no invention is involved in making it, still such is our strong impression. We apprehend the new mode, which dispenses with smoke flues and separating walls surrounding the baking chamber, depends far more upon the modern use of fuel, which can, without injury, be consumed directly beneath the dough, than in any discovery on the part of the complainant or any one else in the application or law of a new principle of heat to baking. But, however this may be, previous patents had, in express terms, pointed out the mode and claimed as a benefit the direct application of heat to a baking chamber. The attention of those engaged in this department of industry had been directly challenged to this subject, and, what we deem somewhat material upon the mere question of invention, they had combined a furnace and chamber for the direct application of heat with an endless chain or apparatus for moving the bread over the fire. The reel is an old and familiar device. We should feel that we were carrying the doctrine which protects slight inventions to the last limit, if we were to hold the combination of the reel and furnace in this case involved invention. We have no disposition to deprive this species of property of its due protection. When a meritorious invention is presented, every disposition is felt to protect it from spoliation by the employment of other devices, where it is apparent the idea of the complainant has been employed. We decide this case against the complainant because convinced that not only had the patentee no notion whatever that he had included in his device what is claimed in the reissue, but because neither the patent, specification, nor model would have suggested it to any one else.

The bill will be dismissed with costs.

[*N. S. Fisher* and *John E. Hutch*, for complainant.
Edward Boyd, for defendants.]

NEW BOOKS AND PUBLICATIONS.

MANUAL OF DETERMINATIVE MINERALOGY, WITH AN INTRODUCTION ON BLOWPIPE ANALYSIS. By George J. Brush, Professor of Mineralogy in the Sheffield Scientific School. Price $3. New York city: John Wiley & Son, 15 Astor Place.

Professor Brush and Professor S. W. Johnson have for many years had control of one of the most important of our technical schools; and the Sheffield students are well grounded in the methods described in this volume, the greater part of which was compiled, some time ago, especially for their use. It is a work of the greatest practical value, and the classification is very exact and descriptive, and yet simple and clear. Although much has lately been written on the subject of blowpipe analysis, it is not probable that the branch of study is nearly exhausted; and Professor Brush's treatise carries it down to the latest date exemplifying the processes with well executed illustrations. We recommend this work to the attention of the scientific world.

A NEW TREATISE ON THE ELEMENTS OF MECHANICS, ESTABLISHING Strict Precision in the Meaning of Mechanical Terms. Accompanied with an Appendix on Duodenal Arithmetic and Metrology. By John W. Nystrom, C. E. Philadelphia: Porter and Coates, 822 Chestnut street.

Mr. Nystrom has published a work which is likely to be of value to engineers and students of mechanical physics. It contains numerous problems n statics and dynamics, many of which are new to Science, and are solved with clearness and originality. Most of the solutions are illustrated by diagrams. The treatise is exhaustive, and contains the author's researches into the statical condition of the heavenly bodies. The appendix contains some remarkable speculation as to the use of systems of numeration with other bases than 10, such as the duodenal (base 12) and the senidenal (base 16); but the disadvantage of making a change in a matter of such everyday usage is far greater than anything that can be gained by a more symmetrical method, especially when (as we recently showed in the case of the French meter) the supposed improvement is merely theoretical.

BOOK-KEEPING SIMPLIFIED: THE DOUBLE ENTRY SYSTEM BRIEFLY, Clearly, and Concisely Explained. By D. B. Waggener. Price $1 in cloth, 75 cents in boards. Philadelphia: D. B. Waggener & Co.

This is a neat and useful little work, written with clearness and illustrated with specimen pages of the various account books.

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From December 19 to December 24, 1874, inclusive.

BOILER FURNACE.—W. C. Ford, Brooklyn, N. Y.
CAN.—F. D. Brodhead, Boston, Mass.
LIFE PRESERVING BULWARK.—R. W. Newbery, New York city.
NEEDLE.—H. M. Jenkins *et al*, New York city.
PUMP CYLINDER, ETC.—G. F Blake, Boston, Mass.
SPRINGS.—R. Vose, New York city.
STEAM BOILER.—W. C. Ford, Brooklyn, N. Y.
SURGICAL NEEDLE.—H. M. Jenkins, New York city.
VAULT LIGHT COVER.—J. T. Foley *et al.*, New York city.

Recent American and Foreign Patents.

Improved Sulky Harrow.

David Saigeon, Wattsburg, Pa.—The harrow is made in three sections, each section being formed of three S-shaped parallel bars, connected by cross bars. The S-bars are secured to each other, at their points of intersection, by the shanks of the harrow teeth, which pass through holes in the said bars, and are secured in place by nuts screwed upon their upper ends. The nut of the central tooth of the next to the rear cross bars of each section is made with a loop, to which is secured a chain. The other ends of the three chains are so connected that all the sections may be controlled by a lever at the driver's seat. There are also devices whereby the point of draft attachment may be adjusted as required, and also whereby the sections are allowed to conform to irregularities in the ground.

Improved Range.

Edwin O. Brinckerhoff, New York city.—The invention consists in the combination of the circulation and exit flues in connection with an elevated boiler, to adapt it to be heated by the products of combustion as they pass from the range to the chimney; in the arrangement of the circulation and exit flues in connection with the elevated oven to adapt it to be heated by the products of combustion, as they pass from the range to the chimney; in the arrangement of the circulation and exit flues of the elevated ovens, in connection with each other, to enable the products of combustion to be conducted around both or either; in the arrangement of the base dampers, in connection with the base flues of the elevated boiler, to enable the direction of the products of combustion around the boiler and ovens to be controlled as desired; in the arrangement of the top dampers in connection with the exit flues to enable the direction of the products of combustion through said flues to be controlled as desired.

Improved Harvester.

George Foster, Clarksville, Neb.—The essential feature in this device consists in an arrangement of knives, fingers, and endless bands, whereby the grass, after being cut, is deposited at the inner side of the platform in the rear of the drive wheels, so as to be out of the way of the machine at its next round.

Improved Railroad Switch Signal.

Hiram Conrad, York, Pa.—This is a railroad signal consisting of one or more torpedoes, which are moved upon the rail by the switch mechanism.

Improved Grain Weighing Apparatus.

William N. Julian and Joseph H. Bussert, Tarlton, Ohio.—There is a platform for the bag to rest on, and a ring for holding the mouth of the bag. They are suspended from the short arm of a scale beam, so as to have a slight rising and falling motion, and the platform is jointed to the frame. By suitable construction, when the receiving hopper on the scale beam goes down, the spout will be closed, and when the weight goes down it will be opened, so that the grain may be continuously spouted into the hopper while the filled bags are removed and empty ones put on, and the beam is caused to work a rock lever by a rod and arm, to turn a system of registering disks.

Improved Safety Guard for Wagons and Carriages.

Thomas Joyce, New York city.—This is a metal frame secured to the axle near each hub, and suitably braced. Should the axle break or a wheel be crushed in, or otherwise break down, the guards will come in contact with the ground and slide along it, preventing the wagon body from dropping so low as to throw out those riding, and enabling the wagon to be drawn home or to the repair shop without trouble.

Improved Horse Hay Rake.

Joshua Evered, Hopewell, N. Y.—In this wheeled horse hay rake the pivoted wire teeth are elevated by a lifting bar. The teeth slide through the staples, and turn on a fixed rod, while the bar makes a quarter revolution around the axle as a center, until the driver disengages pawls and ratchets by reversing a lever, when the teeth and lifting bar resume their former position.

Improved Wheel for Vehicles.

William M. Hoffman, Topton, Pa.—A wedge-shaped and notched metallic key is applied to the end of the spoke at a point near the side facing a beveled cushioning block, and is forced into the spoke end on the driving in the spoke by resting on the iron axle box. When the spoke is set completely in the hub mortise a sufficient portion of the spoke end is carried sideways to lock or bind with the beveled block, so that a perfectly secure fastening of the spokes is produced, while at the same time, by the wooden cushioning side blocks, a certain degree of elasticity is obtained.

Improved Car Coupling.

John C. Sauserman and George W. Anthony, Newport, Pa.—The coupling link is formed in the shape of an arrow, with spear-shaped head and wider slotted rear part, that is coupled by a strong vertical pin, passing through perforations of the drawhead whenever it is desired that the link shall project far enough to couple with the adjoining drawhead. The retention of the link in this position is secured by means of its concaved rear end, which rests against a second lighter pin. The middle part of the link is acted upon by the rounded-off jaws of vertical lever frames, which are firmly pressed against the link by strong springs. The entering spear head of the link strikes against the jaws, forces them sideways till the head has passed the same, when they lock firmly on the link and couple the same.

Improved Press.

Benjamin J. Day, Evansville, Ind.—The follower has a couple of bars sliding forward and backward horizontally under the feeding hopper and in the press case. The bars have a toothed rack, with which the driving shaft gears. The said shaft is geared to the main driver in order to work the follower forward and quickly, to utilize it for a beater, and also to apply great force for compressing the beaten hay. There is a head to the case, constructed in sections to admit of fastening the hoops after the bale is pressed and before it is released. The said sections are hinged to the case, and provided with weighted catches to hold them closed, and to automatically fasten them. The invention also consists of a fork, which closes over the opening through which the hay is put into the pressing case when the pressing begins, to hold the loose hay with which the hopper may be filled during the pressing, until the follower goes back behind it. Comb bars are combined with the follower and the press case, to prevent the matters to be pressed from gathering between the follower and the top of the press case. Lastly, a straining device is combined with the block attached to the baling band and the press head.

Improved Cutter Head.

Benjamin Pearson and Horace W. Pearson, Newburyport, Mass.—This invention consists of a rotary cutter, in which two blades are arranged side by side, and separated by a disk of thin metal projecting from the face of other disks, all so contrived that the cutters may be used for cutting the gains in the end of the felly for the ferrule by which they are connected. The disk of thin metal between the cutters runs against the ends of the felly, to gage the cutters to the felly lengthwise, and the disks from which the cutters project serve to regulate the depth of the cut.

Improved Method of Forming Metal Seams.

Mortimer M. Camp, New Haven, Conn.—This is a method of uniting or seaming the edges of a shell or pipe by means of a grooved flexible metal bar, the edges being inserted in the grooves, and the metal clamped or compressed thereon.

Improved Portable Cover for Vapor Bathing.

Frank Leslie, New York city.—This cover is a tube made of any suitable kind of flexible material, tapering from the base upward, and having a hoop at the ends to expand the tube to the proper diameter, and one or more intermediate hoops or bands to keep the cover expanded when in use, and allow it to collapse after the manner of a Chinese lantern, to enable it to be compressed and carried in a trunk or bag by travelers, and be used as occasion may require. The head of the bather is protruded through the aperture, and leather, serving as a collar, is drawn tightly around the neck. Straps set upon the shoulders of the bather, and serve to relieve the neck of the bather of the weight of the cover. The vapor is generated within the cover by means of a suitable apparatus.

Improved Egg Carrier.

Wendelin Weis, St. Paul, Minn.—This invention consists of securely interlocking strips, forming the cells for the eggs, in connection with a hinged and protecting top partition applied thereto. The hinged top part folds readily over the folded-up cell strips, so that not more space for return shipment is required than heretofore.

Sugar Cane Stubble Digger and Cultivator.

Henry Von Phul, Jr., and James Mallon, Holly Wood, La.—This is an improved stubble digger and cultivator, which can be readily adjusted to the width of rows, and to different depths. It consists of rotating disks, with pivoted curved prongs or teeth, being placed loosely on lateral shafts, which turn in suitable side bearings, being adjustable therewith in vertical direction on the supporting frame by crank-shaft, rack, and lever mechanism.

Improved Sulky Plow.

John A. Kneedler, Grant, Pa.—This is an arrangement of cranks whereby by operating a lever the driver can lower and raise the forward ends of the plow beams to cause the plows to work deeper or shallower in the ground, or to cause them to run out of the ground. By operating another lever, the plows may be raised from the ground, and held suspended while turning, and while passing from place to place.

Improved Wagon.

Jacob Becker, Jr., Seymour, Ind.—This invention relates to nove means whereby the rear wheels of a vehicle may be made to track with the front wheels while turning, as well as at other times, but yet they are not permitted to make too short and abrupt a turn.

Improved Strainer.

John Lipman and Martin Friedberg, Toledo, O.—This is a concave perforated, or reticulated, strainer, having a rim fitting closely to the interior circumference of the tumbler or other vessel, and fastening spring hooks for retaining the strainer firmly thereon. The device prevents the pieces of lemon or other substances from being carried into the mouth, and admits, therefore, the more convenient drinking of iced beverages.

Improved Attachment for Whiffletrees.

Richard Mansfield, New York city.—This improved mode of attaching whiffletrees is designed for street cars, in which the strain is mainly thrown on the staples or clevis connecting the whiffletrees to the draft eyes of the sway bar or car, so as to cause their rapid wearing out. It consists of a clevis attached by a cross bolt and nut to a recessed clip or band encircling the whiffletree or sway bar, to be connected by a detachable draft eye, attached by a screw nut through a square perforation of the socket bolt, to the ends of the whiffletree, or by a link to the car.

Improved Steam Cylinder Lubricator.

Joseph Kukelkorn, Brooklyn, N. Y.—This is an improved lubricator for steam cylinders, which consists in a reservoir with a central tubular stem, surrounded by a sleeve of the cover or top part. The sleeve is provided with an adjustable screw plug, having air channels for conveying a greater or smaller quantity of oil to the stem, or interrupting the supply of oil altogether. A grooved steam-acted valve and stationary bottom plug of the lubricator are provided, so that any required quantity may be fed in connection with the stroke of the piston.

Improved Wall Paper Striping Machine.

Jacob J. Janeway, New Brunswick, N. J.—This improved machine for striping paper hangings is so constructed as to enable the paper passing through the machine to be readily clamped and released without stopping the machine, and will heat and partially dry the middle part of the paper, so that the work may be done more rapidly, and so that the paper may dry evenly when hung upon the rack, thus adapting the machine to be run by power.

Improved Ice Receptacle for Corpse Preservers.

Friedrich Wesemann, Brooklyn, N. Y.—The ice receptacle is applied on ordinary corpse preservers by means of detachable supporting slide pieces and projecting lugs. The cover serves for the preserver and for the ice receptacle, being made in one piece, with a central smaller lid for inserting the ice into the ice box. As the cold air descends from the ice receptacle and settles on the corpse, it causes the rapid and complete cooling of the same along every part, and not at special parts only, keeping the body thereby in a perfect state of preservation.

Improved Windmill.

Thomas J. Ingels and Millard F. Ingels, Atchison, Kan.—In this invention a supplementary pivoted vane is so connected with the revolving wings or sails as to throw them out of the wind when the latter is too violent. There is an arrangement of parts, whereby a single-toothed bar connects with and operates devices for adjusting and regulating the position of the wings or sails.

Improved Water Closet Apparatus.

Archibald McGilchrist, New York city.—This is an improved water closet apparatus, so constructed as to render the use of a trap unnecessary, and at the same time to prevent any unpleasant odor from escaping through the pipe. It shuts off the water automatically and guards against an overflow, while allowing a sufficient amount of water to flow in after the valve has been closed. When a ball valve is raised, the contents of the basin and case will flow off through the sewer pipe. As the water lowers in the case, a float contained in a separate case sinks and opens a small valve, allowing the water to flow into an upper valve chamber. The arrangement of the valves is such as to cause the water to flow into a siphon-shaped pipe, and through it into the basin. When the ball is lowered into place, the water rises in the case, raises the float, and shuts off the water pressure.

Improved Scrubbing Brush and Mop Holder.

Michael Bigler, Marr, Pa.—This invention consists in conjoining two scrubbing brushes by a plate having a median neck which is grasped by a pair of gripper jaws that may be detached and used to hold the mop rag.

Improved Hemp Dressing Machine.

George Davis, Elizabeth, N. J.—For automatically varying the motion of the delivering rollers according to the quantity of material passing, the shaft has cone pulleys, which are geared with corresponding reverse cone pulleys on the driving shaft by an independent belt for each. The pulleys have loose belts with which tighteners are arranged to act alternately, the tighteners being on a rock shaft, which is held by a weighted lever when the hemp is running light so that the belts of the two smaller pulleys run loose, and the motion is given by the largest pulley; but when the quantity increases and raises the upper roller, levers connected to it raise the weighted lever, which first tightens the belt of the smaller pulleys in succession, giving a faster motion. By the diminution of the quantity passing through the rollers the weighted lever falls, and the reverse results are obtained.

Improved Car Coupling.

Thomas L. Shaw, Laurinburgh, assignor to himself and Hugh G. Fladger, Lilesville, N. C.—The top part of the drawhead is provided with a central vertical guide recess, which is concentric to a round lateral pin, and extended slightly into the interior bottom part, for the purpose of admitting a tumbler. The tumbler swings with its concave part around the pin, and serves as a support for the raised coupling pin, when resting in nearly vertical position on the bottom part of the drawhead. The pin drops into the usual top and bottom perforations of the drawhead, and is guided along a vertical concave front recess of the tumbler guide pin. The hook extension of the tumbler projects from below into the recess of the guide pin, and retains thereby the pin in raised position ready for coupling. The entering link strikes the lower front part of the tumbler, and carries the same in the guide recess in upward direction until it assumes a nearly horizontal direction, closing completely the upper part of the recess. The coupling pin is raised for uncoupling by hand, and causes, by the withdrawal of the link, the instant forward sliding of the tumbler, until the same assumes a nearly vertical position on the bottom part of the drawhead, and supports on its forward projecting hook end the pin in raised position, ready for coupling automatically on the entrance of the link.

Improved Brick and Tile Machine.

Hiram L. Huntington, Keyport, N. J.—In this improved brick and tile machine, there is a series of contracted throats radiating from the axis of the mud-mixing shaft below the mixer, through which throats the mud or clay is forced into receivers by pushers, which, in forcing it through, press it sufficiently for the bricks and tiles. When a receiver full of clay has been pushed out, a wire cutter rises up in front of the mouth of the throat and separates the mass in the receiver from the remaining portion; then the bottom of the receiver rises and carries the pressed clay against a series of wire cutters extending across the receivers, and separating the clay into bricks, which are then removed, the receiver bottom goes down, and the pusher goes back, ready for another operation. Each set of apparatus is operated in succession, and all the moving parts are worked directly from the extension of the mixing shaft below the mixer.

Business and Personal.

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Diamond Carbon, of all sizes and shapes, for drilling rock, sawing stone, and turning emery wheels, also Glaziers' Diamonds. J. Dickinson, 64 Nassau St., N.Y.

Wanted—Patent Office Reports from 1858. Newell Jones, Warrensburg, Ill.

Planing Mill Machinery Wanted—Address, price and terms, Hunter & Tilley, Berkley, Norfolk, Va.

Whole or Half Interest in Patent for Sale. Article retails for 25c. I. C. Cowles, 3 Granger Block, Syracuse, N. Y.

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Seasoning lumber—for descriptive circular of best method, send to H. E. Wells, Van Wert, Ohio.

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Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Arny, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

For Sale—One "Cottrell & Babcock" Water Wheel Regulator, in good order—by D. Arthur Brown & Co., Fisherville, N. H.

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Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Notes & Queries

M. E. W. can remove fruit stains by using the means described on p. 283, vol. 31.—E. G. F. will find full directions for mounting maps on p. 91, vol. 31.—T. A. R. must send a sample of the paint, before we can tell him what it contains.—W. S. V. will find directions for polishing shells on p. 122, vol. 27.—W. L. will find that we published a recipe for a copper dip on p. 90, vol. 31.—G. W. E. Jr. will find the formula for safety valves on p. 107, vol. 31. For information on small boilers, see the same page.—Y. will find directions for mitering frames on p. 342, vol. 30. For polish for walnut wood, see p. 315, vol. 30. For filling, see p. 347, vol. 31.—E. M. will find a recipe for coloring gold on p. 43, vol. 30.—M. will find the needed information as to removing superfluous hair on p. 228, vol. 28.—G. R. will find recipes for colored fires on p. 219, vol. 31.—J. C. S. will find directions for making marine glue on p. 43, vol. 32.—G. G. will find descriptions of Puscher's and other methods for painting on zinc on p. 116, *Science Record* for 1874.—A. P. will find a recipe for boot blacking on p. 45, vol. 31.—W. L. D. will find directions for making cement for joining glass on p. 379, vol. 31, and p. 90, vol. 30.—E. A. N. will find directions for making molds for plaster casts on p. 58, vol. 24.—P. W. will find a formula for calculating the size of a cylindrical vessel on p. 281, vol. 25.—G. W. R. will find a recipe for metal for models on p. 11, vol. 31.—R. V. T. will find a recipe for waterproof shoe grease on p. 155, vol. 26.—C. A. K. will find directions for nickel plating with a battery on p. 171, vol. 30. Mucilage is described on p. 202, vol. 31.

(1) C. W. M. asks: How can I make varnish for gilt work? A. Take gum lac 125, dragon's blood 125, annatto 125, saffron 32 parts. Dissolve each resin in 1,000 parts absolute alcohol; two separate mixtures must be made with the dragon's blood and annatto, in 1,000 parts of such alcohol; and a proper portion of each should be added with the gamboge to the varnish.

(2) M. H. K. says: I am putting up a short line of telegraph wire; on account of difficulty in getting a good ground connection, I think of using two wires. Can you tell me how to join them, cable fashion, in some simple and inexpensive way, so as to get the benefit of their united strength for some long stretches? I must secure insulation properly. A. Use steel wire covered with kerite for your wires, and you will have both strength and insulation. 2. My battery consists of carbons, porous cups, zincs, and containing vessels. What is the best and most lasting solution to use in them? A. For your battery, use nitric acid in the porous cups, and sulphuric acid diluted with ten parts of water for the solution containing the zinc.

(3) A. F. asks: What metal would answer best for covering the frame of a bread-delivering wagon, to carry the warm bread and leave it unaffected? A. Metal would be unsuitable. Painted cloth is usually employed for the tops of bread wagons.

(4) J. C. C. asks: 1. If I start from New York at noon of May 25, and travel westward, keeping exact pace with the sun, and I meet a man every ten miles, where will I meet the first man who will tell me it is noon of May 26? A. In longitude 180° west from the place in which time or longitude is reckoned.

How is the diurnal revolution of the earth demonstrated by the vibration of a pendulum? A. If a pendulum is set swinging in a north and south plane, at any place other than the equator, the plane of swing will be shifted.

(5) J. W. asks: When were surnames first used? A. Among the Romans, date unknown. They were used about A. D. 900 in France; and in England in the time of Edward II.

Why does plunging red hot steel into water make it harder, when the same process makes copper softer? A. It has never been satisfactorily explained.

What would be the length of the longest board, 3 feet wide and square on the ends, that could be placed diagonally across the floor of a room 12x16 feet? A. In general, a problem of this kind can best be solved by approximation. The solution would occupy too much space for insertion here.

(6) I. Z. asks: Can very thin sheet iron scraps be used for making iron bars by the usual process for making bars with the common scrap? A. Yes.

(7) T. A. G. says: 1. I have a small engine, 3¼x3 inches stroke. Can it be made to run a sewing machine? A. Yes. 2. How large a boiler would it take to run it for 5 hours at a time, the boiler to be made like a kettle and hang down in a small arch made on purpose? A. It should hold from 15 to 20 gallons of water. 3. What would be the best metal for such a boiler? A. Copper.

(8) S. J. says: I have a plan for the purpose of propelling a balloon. How much weight will a cubic foot of gas, such as is used for the purpose, raise? A. A cubic foot of gas will not raise any weight; but if it weighs less than the air, the latter will exert a lifting force equal to the difference of weight between equal bulks of the air and gas.

(9) R. A. B. says: In No. 18 you recommend a good heater and frequent blowing. What do you consider frequent blowing? A. It will depend upon the quality of the water, and the way the boiler steams. In ordinary cases, twice a day will answer.

In No. 59, same date, the last equation is: $v=8{\cdot}025\times\sqrt{\frac{h}{F}}$. I cannot read the fraction with certainty; please put it in words. A. Divide the hight by the friction, take the square root of the quotient, and multiply it by 8·025.

(10) G. S. asks: What is power? A. The amount of work done in a given time.

(11) J. G. A. asks: What is a good method for curing and drying figs to be put up in boxes? A. In the East, they are dried in the sun, or occasionally in ovens.

With what can I varnish a paper balloon, so that it will hold hydrogen gas? A. Boiled linseed oil.

(12) E. P. C. says: I am running a high pressure propeller with a cylinder 20x20 inches. The main valve has ⅛ inch lead and ⅝ inch lap on the steam side; but when the valve is in the center of its stroke, the exhaust port opens into both steam ports ⅛ of an inch. Do you think that, if I put two strips in the exhaust port of the valve to fill up the clearance, it would be an improvement to the engine? If so, how much would you advise me to put in? The engine makes 106 revolutions with 80 lbs. of steam, following half stroke. A. Put in enough to keep the exhaust open for about ¾ of the stroke.

(13) G. B. asks: 1. How is roofing tar prepared, to be used with paper and gravel? A. See the specifications of patented processes. 2. For what purpose is the gravel put on? A. To give consistence.

(14) E. A. asks: Would the draft of a street car be increased by connecting the whiffletree at 24 inches from the front of the car, instead of at 12? A. If the line of draft were parallel to the plane of the rails, in the two cases, there would be no difference. If this line were oblique to the plane of the rails, the draft would be easier for that position which had the greatest component of force resolved in a direction parallel to the plane.

(15) D. N. asks: How can I calculate the extra pressure of steam above the pressure in the water cylinder of a steam pump? I want a steam pump to throw water at 180 lbs. pressure per square inch; and if the water cylinder is 14 inches in diameter (area nearly 154 inches), 154×180=27,720, total pressure in pump; and if the steam cylinder is 24 inches in diameter, and the steam 62 lbs., the area is 452×62=28,024, which is a little over the total pressure in the pump. If they were both alike, the pump would stand still. How can I calculate how much extra pressure it will require to drive it at 50 or 100 strokes per minute? A. It is a matter that can only be determined by experiment, and the constants will vary for different kinds of pumps. The simplest way to make the experiment is to take indicator diagrams from the steam and water cylinders of the pump.

(16) G. A. M. says: We bought an engine, and it is claimed that it gives 3 horse power without using steam power high enough to make it dangerous. The boiler is upright, with one flue 7 inches in diameter; while the diameter of the shell is 23 inches, and hight 5 feet from ash pan to top of dome. The thickness of shell is 3-16, and the shell is of very pure iron. The boiler leaks with 80 lbs. steam. The engine is vertical, standing on separate base. The cylinder is of 3 inches diameter×4 inches stroke, making 200 revolutions per minute, with a plain slide valve, cutting off at about ¾ stroke. Engine exhausts into smoke pipe. I cannot make this nearly 3 horse power by any rule you have ever given. A. We scarcely think that the engine is working up to 3 horse power.

(17) D. K. says: D. S. T. says that he has been running for 18 months an engine with 10x16 inches cylinder, and some of the bolts that hold the face plate to the steam chest and the cylinder head are being cut away as if by acid. You reply that it was probably caused by water being carried over with the steam. I have been running 8 and 10 inch engines for the last 12 years. I have had considerable trouble of the same kind, but I do not think that it is caused altogether by wet steam. I am now running two engines from one boiler; the first engine is in the same house as the boiler, and has a short steam connection. About 18 months ago, I commenced using tallow as a lubricant in the cylinder; and after using it about six months, the pistons began to leak steam. On taking off the cylinder head, I found that the rings on the piston did not fill the cylinder, being too small in diameter. On taking the follower off the piston, I found that the bolts were half eaten away on the part that passed through the follower; and the whole surface of the inside arm, and inside surface of the outside ring, together with the whole inside surface of the piston head, which was exposed to the action of the tallow, were eaten away very badly. The surface of the metal seemed to be dissolved, so that I could scrape a portion of it away with my thumb nail. I then cleaned all the dirt off the piston, and packed between the rings with tin until the outside ring was large enough to fill the cylinder, put them to their places, and put a ring of tin against the edge of the rings so that the followers would press against them. Then I put the follower on, with new bolts, and started the engine, using lard oil as a lubricant for about six months. Then I examined the piston again, and found that it had not been eaten away at all. A. This is very useful information on a subject to which we have frequently called attention before, namely, the evil effects of the acid and other deleterious ingredients in impure tallow. Good tallow, so far as our experience goes, does not injure an engine; but it is so difficult to obtain the pure article, that many engineers prefer (as our correspondent does) to use oil, and we think that their precaution is a wise one.

(18) D. I. F. says, in reply to J. C. & Co., who asks how much should the tail end of a 20 foot belt be lower than the head: All first class millers claim that ¼ inch fall to each foot in length is enough. A. We are much obliged for this information, which will doubtless be useful to many of our readers. We would be glad to hear from other millers.

(19) H. B. I. says: On p. 10, vol. 31, J. G. H. says: "To run a saw mill, we have an engine 14x36 inches stroke with an 8 feet driving wheel, belting to a pulley on the main countershaft of only 3½ feet diameter, surface 15 inches. This pulley is so small (in order to give the necessary speed) that the belt will slip. Can we (by putting in another countershaft) improve the mill by belting from the engine and then to the present countershaft, thereby giving an opportunity to increase the pulleys to a size that will prevent slip? The engine is said to be 60 horse power. It is argued that this extra shaft would take so much more power that the engine would not drive the mill. Can you tell us about how much power it would consume to drive this extra countershaft, it being about 8 feet long?" To which you answer that the change would be a decided improvement, and, instead of a loss, more of the power of the engine would be utilized than at present. For this I cannot see any reason. The difficulty seems to be that the transmitting power of his main belt is not sufficient either for the strength of his engine or the work he has to do. How is he to increase the transmitting power of his belt by only enlarging his leading pulley, or by adding two wheels and a shaft to his already overloaded belt? In my practice, I have found that a 15 inch belt will sometimes slip when driven by a 14x18 engine and 8 feet driving wheel, which, with twice the number of strokes per minute, would transmit double the power that his arrangement will. I would recommend, therefore, that, if he must use a 36 inch stroke engine, and cannot get a 16 foot driving wheel in, he put on two fifteen inch belts side by side, if he has room to increase the width of his pulleys sufficiently. For a circular mill, I use a 14x18 engine and 8 feet driving wheel, or 14x13 and 6 feet driving wheel, with a 15 inch belt. For some years past I have recommended these dimensions, preferring the latter, and with no countershaft at all for either of them. They make a cheap, simple, and powerful mill. A. The reason for the advantage would be that he could use larger pulleys. If you run a large pulley at the same number of revolutions per minute as a small one, the velocity of the belt is greatest in the first case; and as the same power is transmitted as before, the tension of the belt does not need to be so great.

(20) G. M. B. asks: How can I construct a receptacle in a garret for water from the roof of a house? It must not let the water be frozen in winter or spoiled in summer. A. Make your garret tight; and the water in an ordinary tank of 2 inch plank, grooved, dowelled, and lined with sheet lead, will not freeze in an occupied house, nor spoil in summer, if well ventilated and occasionally used. Make the tank broad on the floor and not very high, and place it where there may be some support beneath the floor.

(21) N. C. P. asks: If I take two screw-drivers with similar points and handles, and one of them is 6 inches longer than the other, I have more power with the longer, and can turn a screw with it that I cannot with the short one? Why is this? A. It is because a screw driver is generally inclined somewhat, when in use, so that, in the case of the long screw driver, the force acts at the end of a longer lever arm. If both tools were secured so that they had to be held at right angles to the plane of the

(22) G. B. asks: How is roofing tar prepared for use, with paper and gravel? A. Spread the paper upon the roof and secure the edges with large tacks; heat the tar in an iron vessel and spread it upon the paper when in a fluid state; before the tar cools, apply the gravel, the coarser size first and then the finer. The gravel must be washed clean before being used.

I propose to construct a henery, which I wish to ventilate. The uprights are to be ceiled on both sides, and the roof also. There is to be no plate on the uprights; there will be a space between the uprights connected with a cupola, through space between rafters, which I wish to use for the ventilating shaft. Where should the openings in said shaft be? A. Make small openings both at top and at bottom, and be careful to have openings to admit fresh air direct from the outside, which openings may be at bottom. You will require some plank ties across the building at the eaves to prevent the roof from spreading.

(23) J. M. H. says: Our city reservoir is situated at a distance of 2½ miles from my office; there is a fall of 250 feet. The water enters the building through a 1½ inch (inside) pipe, but escapes through a short nozzle (⅜ inch) opening, turning an enclosed water wheel, escaping thence through a 5 inch pipe. Now under the most favorable conditions, namely, a perfectly straight pipe or connections from reservoir, how much water can pass through this ⅜ inch opening per hour? The city meter charges me 15,000 gallons daily. The 1½ inch pipe connects with street mains, distant about 100 feet. A. You omit to state two of the most important elements required in a calculation of this kind; first, the size of the main pipe, which is 2½ miles long, and second, the extent to which it is tapped to supply other buildings before it reaches yours. Friction in pipes is a very material impediment to the flow of water, and increases inversely to their size; and of course every tap reduces the pressure. But none of these conditions would have to be regarded, provided the flow of water at the nozzle was determined by experiment. Note the quantity discharged, say for the first fifteen minutes of each hour of the day, and divide the

sum by the number of hours taken; the quotient will be the average flow per quarter hour, and from this the discharge per day may be correctly ascertained.

(24) R. R. S. asks: How can I join the facia and crown at the foot of the rake and side rafter, where they are in line, and the foot of the rafter is cut square? A. We presume the difficulty arises from the fact that the facia or corona of your raking cornice is vertical on the face, and that of your level cornice is inclined on the face at a right angle to the pitch of the roof. Where the upper line of your crown molding on the rake meets that of the crown molding on the level cornice, commence a regular miter, returning the raking cornice in toward the building on a level, but with the facia set at right angles to pitch of roof; then let the level cornice of the building die against this return, which it can do, leaving a small triangular piece of the return exposed, and still have the upper line of its crown molding on a line with that of the raking cornice. If we have rightly comprehended your difficulty, this will be a solution of it.

(25) H. E. E. says: A neighbor has a water mill, with brick walling. I think common mortar was used, and the walls leak. What kind of cement is used in cementing cisterns, and how can I mix and apply it to this wall? Must we turn off the head of water and wait till the wall is dry, or can it be applied while wet? A. Sylvester's method for expelling moisture from external walls consists in using two washes or solutions for covering the surface of brick walls; one is composed of Castile soap and water, and the other of alum and water. The proportions are: Three quarters of a pound of soap to one gallon of water, and half a pound of alum to four gallons of water; both substances to be perfectly dissolved in the water before being used. The wall should be clean and dry, and the temperature of the air should not be below 50° Fah. when the compositions are applied. The first, or soap wash, should be laid on when at boiling heat with a flat brush, taking care not to form a froth on the brickwork. This wash should remain twenty-four hours, so as to become dry and hard before the second (alum) wash is applied, which should be done in the same manner as the first. The temperature of this wash may be 60° or 70°, and it should also remain twenty-four hours before a second coat of the soap wash is put on; and these coats are to be repeated alternately until the wall is made impervious to water. This process was adopted by William L. Dearborn, C. E., on the brick face walls of the gate house of the 86th street reservoir, in Central Park, New York, where an infiltration had shown itself; the application was successful, the walls proving impervious to the entrance of water under a pressure of 36 feet head, and they remained so for 6½ years when reported by him in 1870. In an experiment, four coatings rendered the bricks impermeable under the pressure of 40 feet head.

(26) W. B. C. asks: What is the simplest method of smelting lead ore, containing some silver and copper? A. The galena is smelted in a reverberatory furnace and the pig lead is remelted and refined, the silver being extracted from the pig lead and not from the ore.

(27) J. J. K. asks: How can I polish tinware? A. Rub with rottenstone and sweet oil, and then with soft leather.

(28) G. T. L. asks: What makes corn pop, that is, burst open and swell up to a white, spongy mass? A. The conversion of the water (contained in grain) into steam.

(29) J. S. asks: How can I make soluble blue, for laundry use? A. Grind indigo into an impalpable powder, and make into a paste with powdered starch.

(30) P. L. V. H. asks: Which was the first steamship that crossed the Atlantic? A. The Savannah, in 1819 built by Crocker and Fickitt, of New York city.

(31) M. D. H. asks: 1. What do scene painters use for sizing canvas? A. Try a thin glue size. 2. With what are the colors mixed? A. Water, size, and turpentine. Use the ordinary pigments. 3. What is a good work on the art of painting in water colors? A. Rowbotham's.

(32) C. K. asks: What substance is used to harden lithographic crayons? A. Melt them up and add a little shellac.

(33) L. K. Y. asks: Of what shape is the Leclanché battery, and of what metals and chemicals is it composed? A. See p. 362, vol. 31.

How can I make a fine powder to give burnishers a high polish without scratching them? A. If you refer to agate burnishers, use putty powder or tripoli.

Please give me a recipe for solder for white metal. A. See p. 251, vol. 28.

(34) C. D. B. asks: How can I make gunpowder? A. Take crystalline flour of saltpeter, free from chlorine, 75 parts, refined sulphur in rolls 6 parts, willow charcoal 15 parts. Grind the sulphur and charcoal together, add the saltpeter, mix, damp, press into cakes, dry, and granulate.

(35) G. B. M. asks: Why do various text books give different melting points for the metals? A. The melting points of the various metals have not been satisfactorily determined, for which reason there are several authorities. Wagner's "Technology" is a recent work, and is probably as good an authority on the subject as can be consulted. Watt's "Chemical Dictionary" will give you several melting points for each metal without specifying the most reliable. In such case each person must satisfy himself, by the estimation he holds of the several experimentors and the general character of their work.

(36) A. B. C. says: I have a thick coat of a blue color, which has gone quite rusty in places. What shall I do to get it to its proper hue? A. The best method would probably be to have it dyed.

(37) P. B. P. asks: How can I make an ormolu dip? A. Brush on a thin paste of nitrate of potassa, alum, and oxide of iron, colored with any soluble pigment.

How can I make a solution of sal ammoniac? A. Sal ammoniac (chloride of ammonium) is quite soluble in water.

What is gray iron? A. The lower grades of cast iron are so called from their grayish color.

(38) E. S. V. asks: 1. What is a good method of keeping ink from freezing? I have tried placing alcohol one quarter inch thick all around the bottle, but it freezes through it. Is there any substance known, either in a liquid or a dry state, that is a perfect non-conductor of heat? If so, would it, if placed around a bottle of ink, keep it from freezing? A. There are no perfect non-conductors, but the loss of heat may be retarded by surrounding the bodies to be protected by wrappings of such excellent non-conductors as cotton, woolen, or similar fabrics. All such bodies of a light and porous character, including in their cavities air in a state of rest, are among the best non-conductors. 2. Why does not alcohol itself freeze? It certainly is not a non-conductor of heat, else it would not let ink freeze through it. If it be a conductor of heat, why does it not part with its own heat, and freeze up? A. Because its freezing point is lower than the temperatures to which it can be exposed. At a temperature of —166° Fah. it thickens, and at a still lower temperature would freeze.

(39) J. A. C. asks: How is copperas made? A. Protosulphate of iron (copperas, or green vitriol) is prepared by dissolving 1 part of pure iron (or 1½ parts of its sulphide) by the aid of heat in 1½ parts of oil of vitriol diluted with 4 parts of water. On filtering the solution quickly, it deposits beautiful, transparent, bluish green crystals on cooling. These effloresce in a dry air, and form a white crust, which soon becomes of a rusty brown color, owing to their absorption of oxygen.

What acid will eat iron the fastest? A. Nitric.

(40) W. D. K. asks: How is the fulminate put into the common copper cartridge? A. The fulminate is made into a thick paste, and the requisite quantity forced into the cap, which is then carefully and thoroughly dried, and covered with a coat of varnish to protect it from the weather.

Please give me a good recipe for coloring woolen cloth a permanent black. A. Wool is dyed black by the following process: It is boiled for 2 hours in a decoction of nut galls, and afterwards kept for 2 hours more in a bath composed of logwood and sulphate of iron, kept during the whole time at a scalding heat but not boiling. During the operation it must be frequently exposed to the air, because the green oxide of iron of which the sulphate is composed must be converted into a red oxide by absorbing oxygen before the cloth can again acquire a proper color. The common proportions are 5 parts nut galls, 5 parts sulphate of iron (copperas), and 30 parts of logwood for every 100 of cloth. A little acetate of copper is commonly added to the sulphate of iron, to improve the color.

(41) C. V. asks: Is there any known solvent for mica? A. The different forms of mica are double silicates of alumina, which contain in addition a small quantity of water and some alkaline fluoride. It is soluble in a mixture of hydrofluoric and sulphuric acids.

(42) J. B. & B. ask: What is the best powder or composition to use for polishing or burnishing German silver moldings? A. Putty powder is much used for this purpose.

(43) W. B. asks: 1. Are pure hydrogen and oxygen gas, combined, explosive? A. Yes. 2. How can I produce and combine them on a small scale? I have a solid piece of steel about four feet square and three inches thick. I wish to make an aperture in it about four inches in diameter. Can I, with the above gases, bring heat to bear on the spot, intense enough to allow of cutting through with a bit? A. The hydrogen may be obtained by the action of dilute sulphuric acid upon zinc scraps, in a close vessel. The oxygen may conveniently be obtained by heating, in an iron or copper bottle, a quantity of chlorate of potash mixed with one quarter its weight of black oxide of manganese (powdered). Perhaps the best instrument for your purpose would be the ordinary concentric oxyhydrogen blowpipe, in which the oxygen is made to enter the center of the hydrogen flame, something on the principle of the argand burner, only on a very small scale. The action of this flame on your steel plate would be to speedily burn its way through the plate.

(44) F. P. L. asks: 1. What is used in giving canvas for oil painting the first coat? A. The filling or ground is generally made by painting the canvas with coats of thin oil color, which must completely cover the threads of the fabric, which latter must be free from projecting lines and knots. The color of the filling is a matter of great importance, as it is impossible to paint a richly colored picture on a dull, unsuitable ground. Upon the whole, a white filling is to be preferred, but inexperienced artists are apt to produce a cold and poor effect on a white ground by laying on the colors unskillfully. Pale cream and warm drab are other colors much used for filling canvas. 2. What will keep the canvas from wrinkling after the first coat is applied? A. The canvas must be strained on a wooden frame before any filling is put on.

(45) W. F. H. asks: How can I bleach or whiten leather that has been tanned in the ordinary way, without injury to the material? A. It is doubtful whether this can be accomplished, as the same agents which will preserve the coloring matter will affect the leather.

(46) F. C. R. asks: Will wine keep its natural flavor if shipped across the Atlantic Ocean? A. Wines are sometimes improved by an ocean voyage.

(47) J. G. M. & Co. ask: How can we lacquer tin to a blue color? A. Use Prussian blue ground in pale shellac varnish.

(48) I. L. asks: What is the best flux for reducing photographer's waste? A. Carbonate of soda.

What is a good method of japanning tin, for use for outdoor signs? A. Grind the pigment of the required color in shellac varnish.

(49) J. C. asks: 1. Please give me a recipe for making stove polish. A. Use finely powdered graphite. 2. How can I make a stove polish which, applied with a brush, produces a gloss while drying? A. Fuse 2 lbs. asphalt in an iron pot, add 1 pint boiled oil; mix, remove from the fire, and add a little turpentine when cool. Some makers add dryers.

(50) R. K. says: I have a lot of leaves for making manure. Can you tell me of anything to mix with them, to make them rot faster than water and wood ashes? A. A certain degree of moisture and air is necessary; and hence the gardener should turn the heap over frequently and apply water when the process appears impeded, excluding rain when the heap is chilled with too much water.

(51) W. H. B. asks: What is meant by "proof," in connection with alcoholic liquids? A. Alcohol is said to be proof when, at 60° Fah., it has a specific gravity of 0·92. If above this gravity, it is said to be below proof.

(52) A. B. W. asks: What is a vinaigrette? A. A small box or bottle, used as a smelling bottle, for holding aromatic vinegar contained in a sponge, or smelling salts.

1. Would not the drinking of vinegar (cider or wood) act as a disinfectant to the disagreeable odor given off with the breath? A. No. 2. Would such a remedy be healthy? A. If excessively used, no. 3. Would the effect be only temporary; and if so, about how long would it last? A. The effect would be temporary upon the breath; the period of its effect upon the stomach would vary with different constitutions. Bad breath is generally due to one of two causes, unclean teeth or imperfect digestion (dyspepsia). Cider vinegar certainly would not remove the first cause, and the second would not be improved by it.

(53) B. H. S. says: You state that aqua ammonia will take nitric acid stains out of cloth. I think you are mistaken; as I have tried it as soon as the acid has touched the cloth. A. If the coloring matter is not destroyed, aqua ammonia will in all probability restore it, as we have tried it hundreds of times with success. In case the coloring matter is destroyed by the nitric acid, neither aqua ammonia nor anything else can restore what is not there.

(54) S. W. C. asks: Having an iron safe, the fireproof material of which has broken loose, I wish to know how to replace the filling? A. Mix plaster of Paris with a strong solution of alum water, and use quickly.

(55) N. L. C. asks: Can you tell me of any substance resembling flour or corn starch that will always remain white after being sifted into gum arabic and exposed to the air? A. If otherwise suitable, some unalterable body, like finely pulverized barytes, would keep better than organic bodies such as corn starch, etc.

(56) F. N. B. asks: 1. Please give me a test for sulphur in well or spring water. A. Saturate a slip of paper with sugar of lead (lead acetate), and expose it near the surface of the water for a short time. If the paper is discolored, it shows the presence of sulphuretted hydrogen. Another method is to take a small quantity of the water, into which pour a small quantity of a strong solution of sugar of lead; the darkening of the water is proof of the presence of sulphuretted hydrogen. 2. Can water and sulphur be united artificially, to form what is known as "sulphur water?" A. Yes; sulphuretted hydrogen gas is very soluble in water, and may be obtained by the action of dilute sulphuric acid on sulphide of iron.

(57) C. B. asks: What is the cause of the sound on a cold night, imitating explosions of a light nature? I suppose it to be from the freezing of the ground. A. It is probably due to the freezing of the sap in green wood, such as the trunks of trees, etc., and is attributed to the expansion of the liquid on freezing, causing a rupture of the fiber.

(58) L. N. L. says: In the Agricultural Report for the year 1868, I find the following statement: "Wheat contains some lime, one ounce in a bushel of grain (and a little more in the straw), while it contains rather more soda than lime, about five times as much magnesia, nearly nine times as much as potash, and more than thirteen times as much phosphoric acid." Is this correct? A. We find that 100 parts of the dried grain give 2 per cent of ashes, and 100 parts of the dried straw give 4 per cent of ashes. In the following table you can compare the amount of the inorganic matters of the grain and straw. 100 parts of the ashes contain:

	Grain.	Straw.
Potash	30·02	17·98
Soda	3·82	2·47
Lime	1·15	7·42
Magnesia	13·39	1·04
Phosphoric acid	46·79	2·75
Oxide of iron	0·91	·45
Sulphuric acid	—	3·69
Silica	3·89	63·89
	99·97	100·00

The composition of wheat (grain), organic and inorganic constituents included, is: Carbon 46·10, hydrogen 5·89, oxygen 43·40, nitrogen 2·29, ashes 2·41. In an ounce of phosphoric acid, there are about 210 grains of phosphorus.

(59) A. W. asks: Which is the best acid for etching on lead? A. Use dilute nitric acid.

(60) G. F. P. says: I have seen very fine specimens of etching on lithographic stone, the hollows being as regular and even as though cut with a chisel. How is this accomplished? A. The design is transferred to the stone, which must be previously perfectly clean; the surface of the stone is then moistened with dilute nitric acid, to which a small quantity of gum arabic has been added to prevent the roughening of the stone.

(61) J. E. W. asks: What should I do with a canary that has lost his voice? He seems in good health, except that at times he will sit and pant as though he had some difficulty about his breath. A. We know of no remedy. We judge, from your description, that the bird has the asthma.

(62) R. M. asks: Are there any chemicals that will produce gas in a boiler fast enough to run a ½ horse power engine? A. No.

(63) C. H. C. says: In Dick's "Practical Astronomer" there is an account of a telescope invented by Messrs. Wilson and Rogers of England. It contains an intermediate glass called a corrector, composed of a plano-convex lens of crown glass and a plano-concave lens of flint glass, placed in the cone of rays that come from the object glass; it lengthens the focus to six feet, where a perfectly achromatic image is formed. Could I obtain a patent on such telescopes, or make them to sell, without a patent? A. C. F. Gauss, in his "Dioptrische Untersuchungen," 1840, says: "The dialytic telescope has, instead of the flint lens, a combination of flint and crown placed close together. This combination is not achromatic, as the violet image, if in the same focus as the red, is larger than the red. This defect is unavoidable, but it may be compensated by proper calculation of the oculars. But the dialytic lenses being movable toward the crown objective, the requisite difference of focus for each ocular may be attained." As the eye is not achromatic, the secondary spectrum of a good object glass is of slight importance. We cannot recommend the dialytic telescope as an object of study, but the usual forms might be profitably constructed.

(64) A. H. T. asks: How long should the focus of an eight inch objective lens for a telescope be? A. One hundred and fifty feet.

(65) R. D. asks: Will grapes grown in New Jersey serve for making raisins, and what is the process? A. A monthly report of the Department of Agriculture, of 1872, says: Several grape growers of California have succeeded in producing raisins of fine quality. Growers sowing a vineyard, on the foot hills near Nevada City, have produced, from 450 lbs. grapes, 150 lbs. raisins of superior flavor, claimed to be equal to the best Malaga, and worth 24 cents per pound. This furnishes a fine margin for profit, as it secures 8 cents per pound for grapes, which is a very remunerative figure for California. We think that the climate in the vicinity of New York is entirely too cold for the production of raisins.

(66) R. S. G. asks: 1. What is the latest and most approved method of generating oxygen gas? A. Heat together in a flask 1 part by weight of black oxide of manganese and 4 parts of chlorate of potash. 2. What is the proportion of carbonic acid gas to ordinary air, to produce asphyxia? A. Anything exceeding 4 per cent.

(67) H. D. asks. 1. Does the ordinary gun or rifle powder in use give perfect satisfaction? A No. 2. Wherein is it defective? A. The principal objections are the large volume of smoke, and the incomplete combustion, which necessitates the frequent cleaning of the gun. 3. How does the white gunpowder injure the mechanism of guns, as it is claimed to do? A. Of this powder there are several grades, the highest and most powerful of which is not suitable for a gun or rifle powder; and if so used is injurious on the same principle that gun cotton, dynamite, or nitroglycerin would be if used for the same purpose.

(68) A. M. says: While viewing a drop of water, the size of a pin's point, through a microscope, the animalculæ gradually became motionless and dim, and upon examination I found that the water had evaporated and left a stain on the object glass, which I wiped away. 1. I would like to know what became of the animalculæ that I had seen in the drop. A. The animalculæ could not have evaporated; they undoubtedly remained upon the glass. 2. Did any remain in the little dry stain? A. We should say so. 3. Did I terminate their existence by wiping away that stain? A. Yes. You had only to examine the glass again with the microscope to prove the presence or absence of the animalculæ. 4. What book is best suited for an amateur microscopist? A. Beale's "How to Work with the Microscope" is one of the standard authorities, being plain, simple, and easy to understand. It fully explains all the requisite details.

(69) S. N. M. says, in answer to R. O. B., who asked: Is there any rule by which a person can find the radius when the arc and chord are given? There is no formulated rule, but I can tell how to find the diameter from the given data, if the arc is not greater than a semicircle. By taking pains and a day or two of time, a table can be calculated, showing the lengths of the arcs of any number of degrees and parts of a quadrant, corresponding to the natural sines in the common tables, when R = 100,000, and also the ratio of a sine to the arc. Thus: 360° : 2Rπ :: any number of degrees and parts : length of the arc. Divide the length of the arc so found by the natural sine (of the tables); it gives the ratio of the sine to the arc. Example.—Given the length of arc = 2·6; length of chord = 2, to find diameter. Having made my table, I find this ratio, 1 : 1·3, to be the sine and arc of 75°. By the formula above: 360° : 6·2832(2Rπ) :: 75° : 1·22173, length of the arc, when R = 1. Then $\frac{1·22173}{·93979} = 1·3 = \frac{1}{2·6}$ the given arc. Then 75° : 1·3 :: 360° : 6·6857 = circumference of the required circle, and 2·128 its diameter. If the ratio of the sine to arc is

greater than 1:1·5708, the arc is greater than a semicircle, and indeterminate by this means. As the ratio of the arc to the sine increases slower in the first half of the quadrant than in the last half, the number of degrees may be approximately estimated by the given lengths of the ⅓ arc and ⅓ chord; and by a few trials, the ratio can be found without going through the long process of making out a full table of the quadrant. A. This is not a new method, but is worth investigation.

(70) J. N. McC. says, in reply to several correspondents, who ask as to burning slack: "My experience is that slack requires the grate bars to be very open. I have always used the widest I could get, not less than an inch between the bars; I have used bars with openings of 1½ inches. The only secret in using it with any kind of a furnace is to have the grate bars open enough, so that the fire can be kept open from the underside of the grates, with the poker. Some coal, of course, will go through at first; but coarse coal or wood can be used to start with, and you must rake out what falls through the grate, and put it in again. The coal will soon cake so that it will not waste. To build a furnace for the purpose, I would make it wider than usual, with doors in the side of the front, similar to furnaces for burning sawdust. For some varieties of coal, it will be found beneficial to wet the coal before throwing it into the furnace; it helps it to run together. Then put in the coal at the side doors, and let it alone till it cakes; then take your poker and roll it into the center of the fire. It will then be in large lumps and will not waste; and you will always have a good fire in the center. Never smother it with fresh coal."

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

R. B.—A very highly siliceous slate, perfectly compact and homogeneous.—J. E. E.—Your specimen does not contain silver.

J. E. D. asks: How can I make cream candy for feeding weak colonies of bees during the winter? How is the granular condition of the sugar overcome?—E. W. H. asks: How are honey locust seeds prepared for sowing?—N. N. asks: Can you tell me how to color coral after it has been burned? —P. W. says: I have a tame frog which in summer lives on flies. What shall I give it in winter?

COMMUNICATIONS RECEIVED.

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

On Steam Boiler Explosions. By C. R. C. and by S. G. H.
On Brass Bearings. By T. J. B.
On Utilizing Water Power. By H. C. K.
On a Cheap Locomotive. By F. G. W.
On Springs and Wells of Water. By ——.
On Tunneling. By J. H. S.
On a Flying Machine. By M. B. E. and by L. S.
On Phosphorus. By ——.
On Multiplication and Division. By G. B. G.

Also enquiries and answers from the following:

E. S. V.—K.—M.—J. B.—L. R. C.—W. H. L.—T. A. J. —P. B. S.—L. W.—I. E. N.—C. O'B.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Who makes balloons? Who sells machines for hulling barley, and also for grinding oatmeal? Where can machines for marking boxwood rules be obtained? Are there any makers of railway ticket printing machines in the United States?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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7,957 & 7,958.—SODA WATER APPARATUS.—G. F. Meacham-Newton, Mass.
7,959.—BUCKLES.—V. Price, Woodside, N. Y.
7,960.—STATUARY.—J. Rogers, New York city.
7,961.—MARTINGALE RINGS.—H. F. Corning, Hartford, Ct.
7,962.—PAPER, ETC.—B. Lawrence, New York city.
7,963.—STOCKING FABRIC.—W. Martin, Philadelphia, Pa.
7,964.—COAL SCUTTLE.—C. H. Morse, Rochester, N. Y.
7,965.—HEATING STOVES.—N. S. Vedder, Troy, N. Y.
7,966.—HANDLE TIPS.—H. W. Wright, Glastonbury, Ct.
7,967.—SAD IRON HANDLES.—W. J. Reagan, Royer's Ford, Pa.
7,968.—PEN.—R. E. Cannon, Lexington, Ky.

TRADE MARKS REGISTERED.

2,140.—LABELS.—Allen, Lane & Scott, Philadelphia, Pa.
2,141.—CIGARS.—Goldsmith & Newburgh, Cincinnati, O.
2,142.—JET.—Holzinger & Bruckheimer, New York city.
2,143.—BITTERS.—V. Keck, New York city.
2,144.—CLOTHING.—A. Nicoll, Brooklyn, N. Y.
2,145.—CIGARS.—W. H. Romerman, Jacksonville, Ill.
2,146.—SHIRT BOSOMS.—S. Sibley, Boston, Mass.
2,147.—ROOFING.—A. H. Soden, Newton, Mass.
2,148.—CORSETS.—Comfort Corset Co., Boston, Mass.
2,149.—VARNISHES.—Hyatt & Co., Newark, N. J.

SCHEDULE OF PATENT FEES.

On each Caveat $10
On each Trade mark $25
On filing each application for a Patent (17 years) $15
On issuing each original Patent $20
On appeal to Examiners-in-Chief $10
On appeal to Commissioner of Patents $20
On application for Reissue $30
On filing a Disclaimer $10
On an application for Design (3½ years) $10
On application for Design (7 years) $15
On application for Design (14 years) $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, DECEMBER 28 to DECEMBER 29, 1874.

4,205.—H. Smith, Hamburg, Waterloo county, Ont. Improvements in wind wheels, called "Smith's Improved Wind Power Wheel." Dec. 28, 1874.
4,206.—J. Tesseman and P. Smith, Dayton, Montgomery county, Ohio, U. S. Improvements in valve gear for steam engines and pumps, called "Improvements in Steam Pump Valve Gear." Dec. 28, 1874.
4,207.—F. P. Mackelcan, Montreal, P. Q. Improvements on a machine for pulling stumps, called "The Farmer's Stump Machine." Dec. 28, 1874.
4,208.—W. G. P. Cassels, Toronto City, Ont. Improvements in stoves, called "The Improved Water Evaporator." Dec. 28, 1874
4,209.—M. G. Wilson and J. H. L. Wilson, Sherbrooke, P. Q. Improvements in boilers, called "Wilson's Vegetable Boiler." Dec. 28, 1874.
4,210.—H. D. Gibbs, Batavia, Genesee county, N. Y., U. S. Improvements in devices for connecting the neck yoke with the draft poles of vehicles, called "Gibbs' Improved Neck Yoke Clasp." Dec. 29, 1874.
4,211.—F. H. C. Mey, Buffalo, Erie county, N. Y., U. S. Improvements on grain and malt dryers, called "Mey's Grain and Malt Dryer." Dec. 29, 1874.
4,212.—G. White, London Township, Middlesex county, Ont. Improvements on parts of carriages, called "White's Improvements on Carriage Axles, Springs, Shaft Couplings, and Tyres." Dec. 29, 1874.
4,213.—T. Gavin, Montreal, P. Q. "Ameliorations aux boites a tamiser les cendres de charbon de terre, par Thomas Gavin," called "Improvements in Sifters for Sifting Coal Ashes." Dec. 29, 1874.
4,214.—D. W. Siprell, Rivière du Loup, Temiscouata county, P. Q. Improvements on rack reamers, called "Siprell's Improved Reamer." Dec. 29, 1874.
4,215.—F. H. Date, Niagara, Lincoln county, Ont. Improvements on the manufacture of illuminating gas, called "Date's Manufacture of Illuminating Gas." Dec. 29, 1874.
4,216.—C. M. Clinton and L. Wood, both of Ithaca, Tompkins county, N. Y., E. C. Gregg and C. P. Gregg, Trumansburg, Tompkins county, N. Y., U. S. Improvements in wheeled horse rakes, called "Clinton and Wood's Improved Horse Rake." Dec. 29, 1874.

Advertisements.

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Inside Page - - - - - - 75 cents a line.

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6. Marble and Glass Putty, Felspar, Fluorspar, finest Silex, Cryolite, Talc, Asbestos, Yellow Cadmium, Pharoah Serpents.
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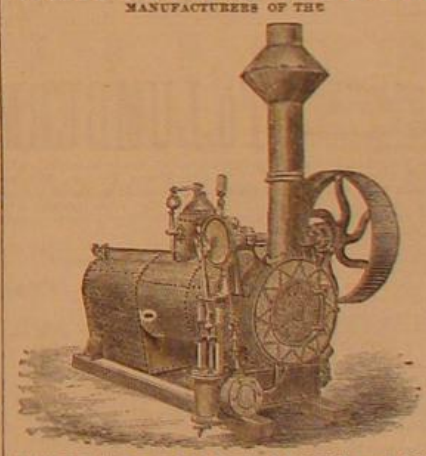

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VALUE OF PATENTS,
And How to Obtain Them.
Practical Hints to Inventors.

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

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

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

To Make an Application for a Patent.

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

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Vol. XXXII.—No. 6. [NEW SERIES.] NEW YORK, FEBRUARY 6, 1875. [$3.20 per Annum, Postage prepaid.

HOLMES' NEW BARREL MACHINERY.

Several months ago we laid before our readers a detailed description of the operations involved in barrel-making by means of a variety of entirely novel machinery. The article referred to will be found on page 191, Vol. XXX., and we took occasion therein to trace the course of the staves, beginning with their preparation in the jointing machine, thence to their being set up in barrel shape, the bending by heat, the leveling of the cask so that it would stand perpendicularly on end, the trussing, and, lastly, the chamfering, howeling, and crozing. We left the barrels entirely complete, with the exception of the heads, the machines for the manufacture of which we failed to describe for the very excellent reason that they were still in the hands of the inventors. We are now, however, enabled to make good the deficiency; and in the following description and accompanying engravings, the reader will learn of the three ingenious devices which produce the above mentioned essential portions of the barrel, and, besides, of a novel machine which combines the powers of both trusser and leveler, and of still another apparatus that bends, punches, and rivets metal hoops.

Every one knows that barrel heads are not usually made of a single piece, and that for ordinary casks they are generally of several portions jointed and doweled together. To make the joints and to prepare the pieces of heading, which have been previously sawn to the proper length, for the dowels, is the object of the machine exhibited in Fig. 1. This consis s in a large rotating metal disk, in the face of which are fixed three cutters, equidistant from each other. In front of the disk is a standard and rest. Upon the latter the piece of rough heading is laid, and its edges are pressed against the disk by hand, so that they are thus rendered perfectly smooth and straight. The work is then removed and laid upon another rest on top of the machine, where it encounters two swiftly revolving augers or bits, which are forced against the edge by the foot treadle shown, and which speedily bore the holes for the dowels. There are no shavings visible about this machine, since the disk acts as a fan and blows them away through the shoot shown at the right hand of the engraving. The heads of a large number of barrels can thus be pre pared per day by a single man, and the joint knives are so arranged that either a hollow or straight joint can be made, as desired.

The dowels are next inserted by hand, and the separate pieces put together, forming rough squares, ready for the next process. This consists in leveling, facing, and dressing the material on one side, and it is accomplished by the machine represented in Fig. 2. A prepared head is laid upon the table and in front of a planer cylinder, on which are several blades, and which is swiftly rotated by the driving pulley shown on the left. The pulleys on rhe right actuate four corrugated feed rolls which are held firmly against the work by weighted levers acting upon the bearings. The revolution of the feed rolls carries the head over the planer knives, which rapidly smooth off the under side at the rate of from fifteen to twenty-five heads a minute. The machine will also dress piece heading, taking off just sufficient material to produce the requisite finish.

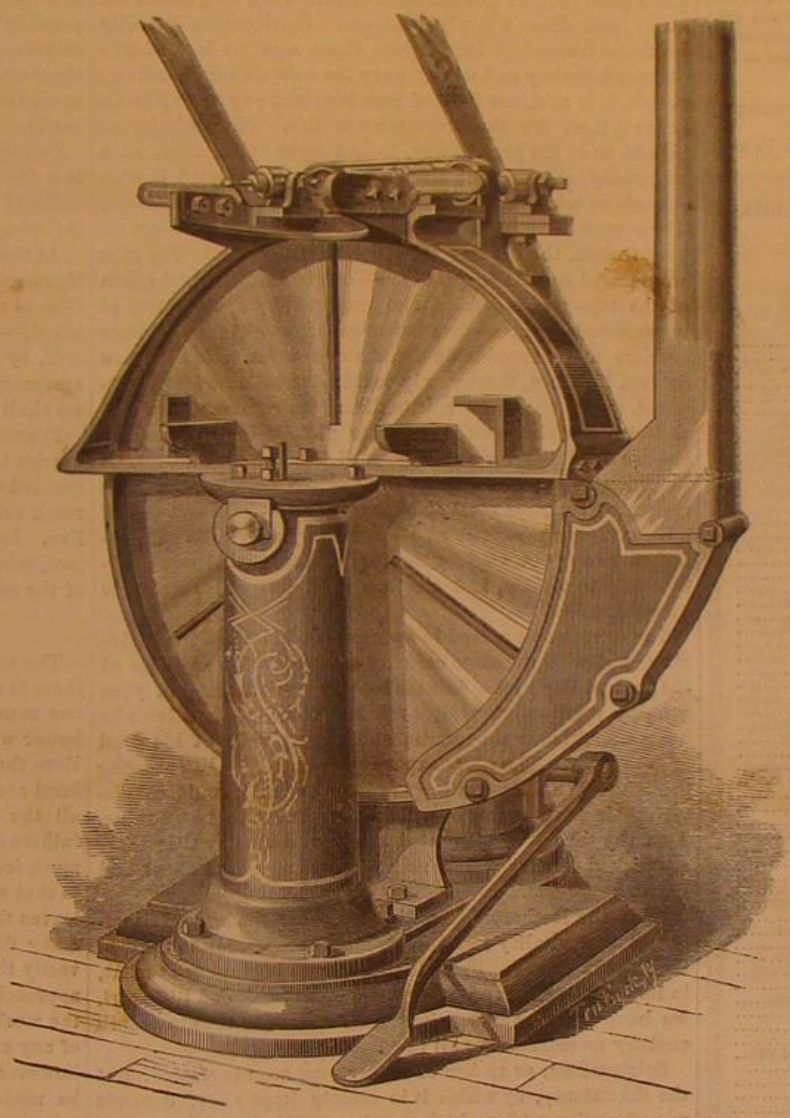

Fig. 1.—BARREL HEAD JOINTING AND BORING MACHINE.

The next operation is turning the heads in circular form and, at the same time, beveling the edge with two bevels, the upper bevel being less than the lower one. The machine employed is represented in Fig. 3, and is a remarkably ingenious contrivance. The head is placed between two disks, one of which, that on the right in the illustration, is provided with a number of spring pins near its periphery, which press the work against the opposite disk. The pin disk is not connected with the driving machinery. Its spindle enters the cylindrical standard on the right, in which is placed apparatus by means of which the disk is thrown forward and locked in that position, firmly holding the work. Through the rotation of the opposite disk, the pin disk is also carried around, but for only one revolution, at the end of which stop mechanism, in rear of the standard and not shown in the engraving, is actuated to unlock the clamp, so that the pin disk springs back and allows the work to fall out. In case it be desired to accomplish this unlocking before a revolution is completed, the handle (shown protruding from the center of the top of the standard) serves to actuate the mechanism necessary therefor. Before the unfinished head is put into the machine to be rounded, its center is found and marked by an apparatus for that purpose.

When the head is put into the machine, the centering pin, which is jointed to the hand lever beside the standard, is pushed forward by the use of the lever, and is brought in contact with the center mark on the head, thus centering it perfectly and saving all the material. The centering apparatus can be used or not, as desired. The disk on the left is rotated by mechanism by the driving pulley, which is thrown into or out of gear by the horizontal handle shown.

[*For remainder, see page* 86.]

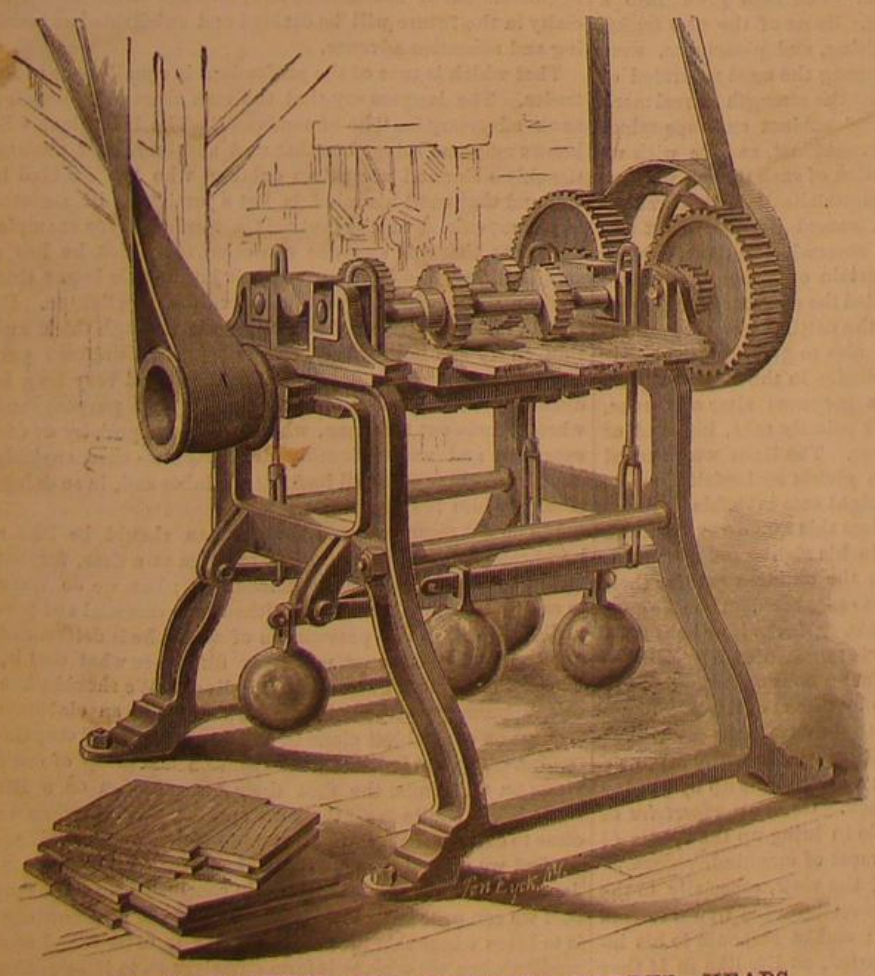

Fig. 2.—MACHINE FOR DRESSING BARREL HEADS

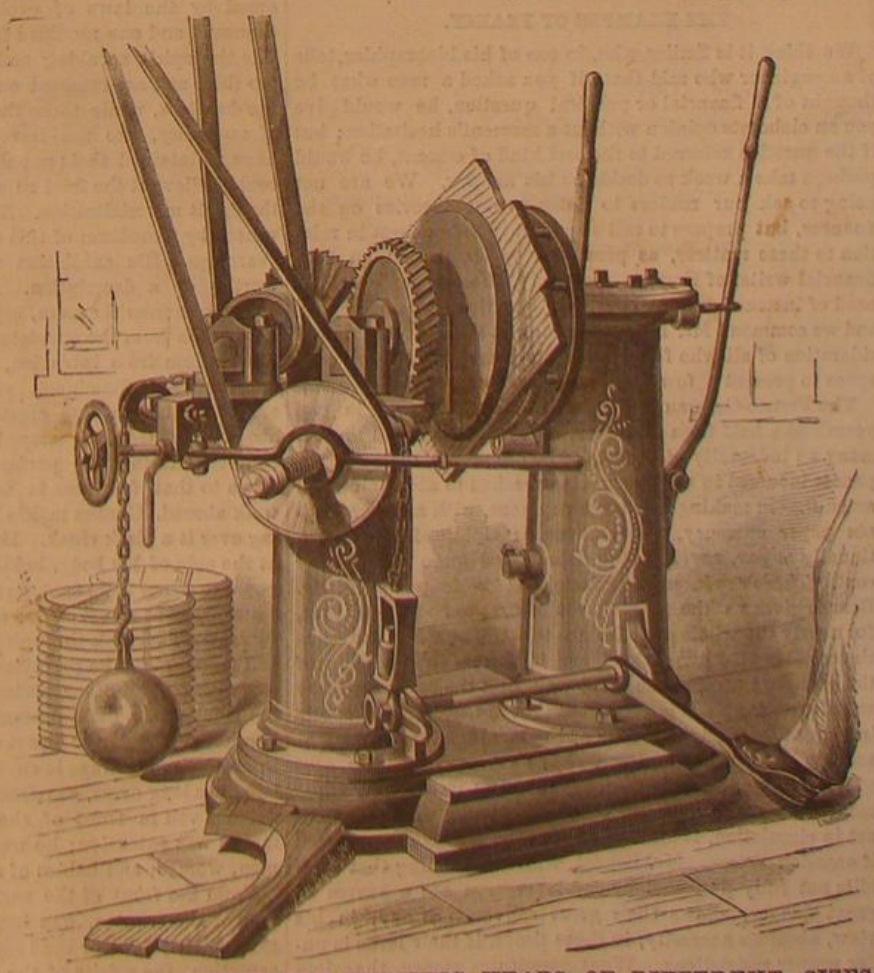

Fig. 3.—MACHINE FOR TURNING HEADS OF DIFFERENT SIZES

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VOLUME XXXII., No 6. [NEW SERIES.] *Thirtieth Year.*

NEW YORK, SATURDAY, FEBRUARY 6, 1875.

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THE EXAMPLE OF FRANCE.

We think it is Smiles, who, in one of his biographies, tells of an engineer who said that, if you asked a man what he thought of a financial or political question, he would give you an elaborate opinion without a moment's hesitation; but if the question referred to the best kind of cement, he would perhaps take a week to decide on his answer. We are not going to ask our readers to listen to our theories on the finances, but propose to call attention to a few facts in relation to these matters, as presented by Mr. Bennet, an able financial writer of France. Certainly, if any people are in need of instruction on the currency question, it is ourselves, and we commend Mr. Bennet's pamphlet to the attentive consideration of all who feel inclined to learn. We have only space to present a few of its salient points.

The Franco-German war ended in May, 1871; and in two years and a half from that time, the French had paid to Germany an indemnity of $1,000,000,000 in specie, their own expenses incurred in the war having reached to about an equal amount. In making this large payment, with an inconvertible paper currency, the latter was maintained almost continually at par, never having depreciated more than 2¼ per cent. These are interesting facts, and in his pamphlet Mr. Bennet gives us the reasons. It is first to be noticed that, for nearly the whole period since the war, France has been the creditor of other nations, and it was on the occasion of the exchange turning the other way that the paper currency was depreciated. It is estimated that the amount of specie in France is largely in excess of the legal tender circulation, and the Bank of France has a specie reserve of 52 per cent of its outstanding circulation. In other words, the paper money of France is strengthened by specie, which, though not in circulation, is still in the country, and can be utilized if occasion arises. Mr. Bennet, while contending that bank bills not fully protected by specie reserve are a source of great danger, shows their great convenience and, in his view, absolute necessity, in these times, if their issue is under proper restrictions. What constitutes money, the origin of banks, and matters of this nature are treated by M. Bennet in a clear and thorough manner, and we hope that his pamphlet will be widely circulated. Our own finances have not been managed in so wise a manner, and the condition of affairs in the country is not so prosperous at present, that we can afford to disregard the "Example of France," which country, incurring a war debt nearly two-thirds as large as our own, in the short space of ten months is apparently on the direct road to a sound financial system, without having experienced a serious monetary crisis.

THE "SCIENCE" OF SPIRITUALISM.

On page 359 of the last volume of the SCIENTIFIC AMERICAN, we presented some of the teachings of science regarding spiritualism; today we further elucidate the subject by brief allusions to some of the facts in the history of this latest epidemic of superstition.

It broke out about twenty-five years ago, and the manifestations were popularly known as Rochester knockings or spirit rappings. The first mediums were three sisters; their name was Fox. They invented the raps, the rap language, and a good part of the spiritual lingo. They originated the *séance*, and drove a lively business. Spiritualism speedily became a recognized institution; there was no lack of mediums; notoriety and money were the substantial incentives; people, it is said, are fond of humbug, and pay more liberally for it than for the necessaries of life. The majority of people, as at the present day, looked upon spiritualism as a supremely silly thing; the scientific world treated it with ridicule or with a silence inspired by disgust and contempt. There were investigations; and although many of them were very foolish, the rapping trick was fairly exposed The raps were traced to the persons of the Fox girls The mechanism of the raps was concealed and protected by the defences of womanhood; to the modest investigator the girls' skirts were barriers more formidable than stone walls. Had women dressed like men, there surely could have been no spirit rappings, and probably no spiritualism; we commend the fact to Herr Teufelsdroeck, the great philosopher of clothes, and we shall look for a discussion of it in a future edition of his "Sartor Resartus." Of the devices employed by the early mediums, the most elaborate and successful was that of a bar of lead suspended at its center by an elastic cord attached to and operated by the leg; of course this was available only to women, and the men were obliged to resort to something else.

The devotees appeared in swarms, and at the very beginning, and with the same capacity of swallowing as those of the present day; let a jackass bray in the presence of your genuine spiritualist, and, at a hint from his medium, he hears therein only the gentle and loving voice of his dead grandmother. The early exposures counted for little among the faithful; a thousand bogus raps, they said, could not disturb their faith in the one that they knew to be genuine. Also the theory was invented at a very early day that there are wicked spirits, which make honest mediums cheat and lie.

Thus the Rochester knockings became modern spiritualism, with a vitality and diffusiveness comparable to those of the Canada thistle. From the ridiculous beginning of what, in its inception, was probably an innocent freak of a little girl, we have today a superstition which will make the nineteenth century memorable for all time.

Spiritualism, as an ism or theory, was soon perfected. But the charlatanry, by which it is mainly kept alive, depends upon juggling tricks which may be modified and improved. For jugglery, like all human arts, is improvable, and is governed by the laws of evolution. The raps grew into a thousand and one modified forms. Some of the new tricks, like the spirit speaking and writing, and planchette, were too thin, and are retained only among the most saturated of the devotees, while those that had the strength of real merit of ingenuity, like the Davenports' cabinet and rope tying, have maintained their popularity. At last, and we wish we could believe it the final culmination of such things, we have the spirit materialization. The materialization trick was invented by a medium of this city, named Gordon, about two years ago. His exhibition was somewhat artistic, and is worthy of a description. A curtain of mosquito netting, stretched across the room, separated the operator and his paraphernalia from the spectators; the netting served to protect the medium from intrusion, and also to give a more ghostly appearance to the objects exhibited. In the middle of the spiritual sanctum was erected a gorgeous altar or throne, about which Gordon, arrayed in a priestly robe, incanted or chasséed during the performance. The light was turned down to that faintness in which ghosts and spirits love to walk abroad. Gordon makes his right arm invisible by drawing over it a black cloak. He raises this arm away from and at the side of his body, holding in his right hand a common paper mask or false face, such as the children get for their amusement at a cost of five or ten cents each. Then he gently moves the mask through the air, or ducks it or bobs it up and down, etc. The performance is repeated with variations, other masks and other motions, for an hour or two. Some of the masks are a little dressed up by means of a white handkerchief thrown over a part or dangling from the lower end; in such simple ways is an old lady with a white cap, or a baby in a long dress, constructed; a bride is got up by placing a gauze veil in front of the mask. Gordon's *répertoire* of masks was extensive; he was able to bring up the spirits of men, women, and babies of all races of mankind.

From the front of the netting, the view, especially to the eyes of the devotee, was impressive. Gordon was a solemn great high priest, or head center; and in response to his incantation, the spirits of the departed, as life-like as if they were flesh and blood, appeared at his side. The materialized spirits were often recognized. It was a common thing to hear, from the crowd of eager spectators, sighs and sobs, and such expressions as "Is that you, Jane?" "Is it my grandmother?" "Is your name Smith?" "It is my darling Bobbie; are you happy?" To all of which, through Gordon's skillful manipulation of the masks, came the appropriate responses.

But Gordon's career as a materializer lasted only a few weeks. One evening, in the midst of the performance, a gentleman of the audience leaped over an intervening table, dodged Gordon's confederate, dashed through the mosquito netting and had Gordon securely in his arms. Gordon was thus caught in the act; he held a mask in his hand, and others were taken from the folds of his robe and other places.

In our next article, we shall give further particulars concerning other forms of "spiritual materializations."

TO OUR FRIENDS.

In dealing with our legions of friends, it is our earnest desire to give satisfaction to every one of them. At this season of the year, when old subscribers are renewing and new names are coming in by the hundred every day, it is impossible to answer all enquiries the very day they are received. But should any suppose that we have overlooked their requests or slighted their interests, we hope they will at all times promptly inform us. Speak plainly, and do not hesitate to complain.

Our mail writers and folders are under special injunctions to write our subscribers' names upon the envelopes legibly, and fold each paper neatly. We shall be glad to be informed if anybody receives slovenly work from this office.

At the beginning of the year, many thousands of subscriptions are renewed, new clubs formed, etc. If any person fails to receive the paper or any premium to which he is entitled, we will thank him to inform us promptly.

If, by any chance, any editor or publisher, who by any agreement is to receive our paper, should fail to receive it, we shall be glad to be informed.

Persons who have written to us upon business or sent enquiries for the paper which have not been answered, are requested to repeat their enquiries. Letters sometimes fail to reach us. Be particular to mention the State in which you live. In some cases we are perplexed to know where to direct, when no State is given and there are many post offices of the same name.

HAVE A SPECIALTY.

The sooner people begin to comprehend that practically there is no business, calling, trade, or profession which any one man can master in all its branches in a lifetime, the better will it be for every individual's prosperity. We believe that half the failures in the great struggle for livelihood are due to men trying to do too much, trying to fulfill all the requirements indicated by a name because their fathers did, but forgetting that, in their fathers' time, that name included an aggregate of labor of very different extent to that which it now encompasses. Every day as it closes leaves the world richer in knowledge, and the aggregation of many days produces a store of learning which increases vastly the quantity which the beginner must master ere he approaches proficiency. A couple of centuries ago all that the world knew of the healing art was within the easy grasp of any average intellect. Now, there is no physician living, however eminent, who pretends to have mastered or even to be moderately versed in all the details of medicine and surgery. So it is with Science, with law, with mechanics, with journalism, until each calling has reduced itself to an agglomeration of specialties; and, without doubt each specialty in the future will be divided and subdivided as learning and education advance.

That which is true of the professions is equally true of the trades. The lawyers say that the man most to be dreaded as an adversary is "he of one book." The individual who knows only one thing, but that root and branch, is unquestionably abler and wiser than another who has dabbled in this and that until his mind is but a jumble of ill assorted ideas, superficial at the best. If a mechanic, for example, finds that there is any one operation for which he has a special liking, and can accomplish it just a little better than anything else, that is the thing for him to stick to. He should make up his mind to cling to it through thick and thin, to try and improve certain parts until a uniform perfection is attained. It does not take the world very long to discover who is the best man for this or that purpose; and when it finds out that man, who has made a specialty of one operation and unquestionably does it better than anybody else, the world must avail itself of his labor and, in so doing, must pay him his own terms.

We do not mean to argue that a man should be like a horse, capable of entertaining but one idea at a time, for that would be to advocate narrowmindedness; but we do mean to say that no man should be without one essential and prevailing object, in the prosecution of which he is determined to excel, and it does not make any difference what that is, whether cleaning a gutter or saving lives. We should liken this uppermost purpose in a man's brain to an elaborate treatise on one subject alone in a library of general encyclopædias. The last indicate the expansion and grasp of one's views on all things, the first their concentration on a life work. The simile is all the more apt, for, after all, when we come to examine everything we know outside our one calling, we find we are only in possession of a more or less copious index. And we are led to the certain conclusion that the very best we can ever hope to do in the attainment of knowledge is to learn where this fact or that theory is to be found most readily when we wish to inform ourselves as to its signification. The wider a man's education the bigger his index; and

perhaps we may safely say that one of the cardinal differences between the educated and uneducated is that the former are capable of instantly selecting the proper means of refreshing their memory, while the latter might spend days in search of the same.

Suppose, for example, that the reader has carefully studied the SCIENTIFIC AMERICAN over a dozen or more volumes. Now if a question occur, the answer to which he has seen in any volume, doubtless he will be able to turn to the proper page, or to its vicinity, and so easily obtain the desired information. But on the other hand, if an individual who had never read the volumes, although knowing, of course, the general nature of their contents, should undertake to find some special information, he would have to pore over the long indices of every volume, and search the pages, wasting perhaps valuable time. In this case the knowledge acquired has a direct pecuniary value, for "time is money"—and this apart from its intrinsic benefit to its possessor.

All this adds weight to our first advice, namely, have a specialty, and push it. Be sure that you are right before you select it. We do not believe that any man can rise to eminence in a calling which he dislikes, and herein lie the oft repeated mistakes of parents in forcing children into trades and professions against the latter's inclinations. A boy who has a feeling for art, who spends every moment with paint and brush, will chafe under coarse mechanical labor; while another whose delight is in his tool chest will rebel against the slavery of books and brain work. Both, when they become their own masters, will eventually abandon their distasteful tasks; and it is only a question of their continuity of purpose whether they become "rolling stones," drifting from one business into another all their days, or workers, firm and steadfast because buoyed up by a constant sense of enjoyment of their chosen labors.

Intermittent toil is wasted effort: so also are attempts to manage two or three different pursuits at once. There must be one definite aim; and toward this every thought must be concentrated, for nothing is more certain than that fame, wealth, and happiness are the rewards of only those who

"Still advancing, still pursuing,
Learn to labor, and to wait."

"OURSELVES, AS OTHERS SEE US."

It is pretty generally conceded that a newspaper may "blow its own trumpet" with moderation, and still not be considered egotistical, provided, however, that there really exists good reason for awakening the echoes with the brazen (adjective to be taken in its literal sense only) throat aforesaid. But when there is no substantial basis to warrant the instrumental flourishes, a discriminating public speedily unearths the fact, and, letting the aspiring soloist severely alone, permits him to exhaust his lungs in inglorious solitude.

These sententious observations occurred to us just now, while busily looking over a multitude of newspapers which have been pouring in lately from every quarter of the country. Scissors in hand, we have clipped from each journal a certain paragraph which to us is especially interesting—naturally, since it relates to ourselves. Each one of these scraps of paper is a blast from somebody else's trumpet for our benefit; and when we regard their number, we can hear an imaginary chorus which fairly overwhelms the feeble notes which we occasionally raise in our own behalf. This is very encouraging; there is a general verdict of "well done" which is more than reassuring, and certainly we may arrogate to ourselves the idea that we are far from resembling the luckless performer on the metaphorical clarion, whose efforts neither merit nor meet appreciation.

Compliments and kind wishes must, however, be acknowledged: and besides, perhaps there are some of our readers who may be sufficiently interested in our labors to desire to know what other people say and think regarding the same. Therefore, we print a few of the pleasant things written about us—if we had space, we would publish all—just to show the tone of the whole. At the same time, we gratefully tender our cordial thanks, not merely to the authors of the opinions below quoted, but to all of our professional brethren who have kindly said a good word for the SCIENTIFIC AMERICAN.

"We can cordially recommend it," remarks the *Mattoon* (Ill.) *Gazette*, "as an instructor that quietly and unobtrusively makes its weekly visits, and oftener than otherwise gives information that is so pat, so timely, and so much needed that you are disposed to sit down and drop the publishers a postal card, and inquire by what sort of divination they discovered just what you wanted to know."

The divination of nearly thirty years' experience in seeking just such information, is our answer to our contemporary's query.

The *Weekly Mirror*, of Lyons, Iowa, "can imagine no class of reading that would tend more to the advancement of boys in the useful arts and employments of life, or at the same time is presented in a more attractive form. Drop the trashy publications and take the SCIENTIFIC AMERICAN, which cannot fail to benefit any who reads it."

This last sentence is especially true. No one ever made a cent by reading maudlin love stories or yellow covered novels. Hundreds have made thousands of dollars by ideas suggested while reading the SCIENTIFIC AMERICAN.

The *Moline* (Ill.) *Review* thinks that, "of its class, this paper is the best in the world; and it is a compliment to the good sense of our manufacturing city to know that few papers are more largely read."

This reminds us of the remark of an eminent clergyman of this city, who said that whenever, in visiting a strange dwelling, he found a copy of the SCIENTIFIC AMERICAN about the room, he was assured that he was in the abode of people of intelligence and education. The *Corner Stone*, of College Corner, Ind., evidently has a like opinion, as it remarks

"Always full of the best of thoughts, it should find a place in every home."

The *Albany Sunday Press* chimes in with: "The man, or reading and studying child even, who is without it keeps himself at a disadvantage with others having it, for he who knows most of this world is sure of receiving the most of its productions. It would be impossible to compute the sum which is gained through the knowledge imparted by such a publication."

Here are a quantity of such laudatory opinions that, actually, we feel a sense of diffidence pervade us as we cull them from the various paragraphs; especially when the *Unionville* (Mo.) *Ledger* begins by saying that

"Words utterly fail us in attempting to describe this splendid periodical."

We—well, our natural modesty—we cannot—However, to proceed with others less embarrassing:

"Nearly thirty years ago we scanned its pages with extreme delight, and we have never since laid it down with a feeling of disappointment."—*Bellefonte* (Ark.) *Record*.

"This is one of the most valuable papers that a farmer or mechanic of any kind could possibly have in his household."—*Harrison* (Ark.) *Highlander*.

"Nothing like it can be found elsewhere."—*Waverly* (Iowa) *Republican*.

"One of the best papers for the farmer, the merchant, machinist, laborer, and in fact for everybody."—*Oregon* (Ill.) *Grange*.

"It is a promoter of knowledge and progress to every community where it circulates."—*Galena* (Ill.) *Daily Gazette*.

"There is rarely a number issued that is not fully worth a year's subscription."—*St. Charles* (Mo.) *News*.

"It contains more solid information than can be obtained in almost any other way for the same money."—*Trenton* (Mo.) *Republican*.

"Foremost of all industrial publications."—*Wichita* (Kan.) *Eagle*.

"Its reputation is so well established that no eulogy from us could increase the public appreciation of its great merits."—*Moncton* (N. B.) *Times*.

"Almost indispensable to any one who has a thirst for scientific news, or a desire to keep posted on the mechanical improvements of the day."—*Waterville* (N. Y.) *Times*.

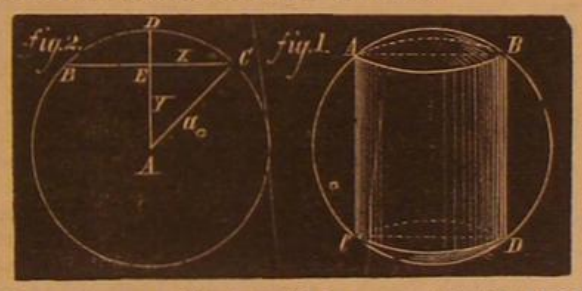
"Clear of technical terms, fully up with the times, and explains the latest improvements and discoveries in every department of Science."—*Dakota* (Iowa) *Independent*.

The above is but a portion of the collection before us, but we will not take room for more in the present number.

A PROBLEM RELATING TO THE SPHERE.

A correspondent, in a recent letter, asks us to solve the following problem: "What sized auger will bore out just half of a ball eight inches in diameter?"

This is a new question, so far as we know, with regard to the volumes that can be cut from a sphere; and though there is nothing very difficult in the solution, it affords an opportunity for showing the general methods employed in discussing such questions, and the rules that are given for finding volumes will be useful to many of our readers



By a reference to Fig. 1, it will be apparent that, if a hole is bored through a sphere by an auger, the volume cut away is that of a cylinder, the diameter of whose base, A B or C D, is equal to the diameter of the auger, together with the two spherical segments, each of which has the same base as the cylinder, and a hight equal to half the difference between the diameter of the sphere and the hight of the cylinder. Now if we can obtain expressions for the volumes cut away, in some value of the diameter of the cylinder, we can readily form an equation from which the diameter can be ascertained. To do this, the following notation will be employed; and to make the solution as general as possible, we will suppose that, instead of half of the volume of the sphere being cut away, any portion whatever, represented by m, is removed:

x = radius of auger.
$2y$ = hight of cylindrical part of cut.
a = radius of the sphere.
$a-y$ = hight of each spherical segment cut away.

The volume of a cylinder is equal to the area of the base multiplied by the altitude, and will be, in the present instance, $3{\cdot}1416 \times x^2 \times 2y = 6{\cdot}2832 \times x^2 \times y$.

The volume of a spherical segment is found by adding three times the square of the radius of its base to the square of its hight, and multiplying the sum by 0·5236 times the hight. Hence, the volume of the two segments in question will be $[3 \times x^2 + (a-y)^2] \times 0{\cdot}5236 \times (a-y) \times 2 = 3{\cdot}1416 \times x^2 \times (a-y) + 1{\cdot}0472 \times (a-y)^3$.

The volume of a sphere is equal to the cube of its diameter, or eight times the cube of its radius, multiplied by 0·5236, or $8 \times a^3 \times 0{\cdot}5236 = 4{\cdot}1888 \times a^3$.

The volume of that part of the sphere which is to be cut away by the auger is $4{\cdot}1888 \times m \times a^3$.

Now, having two different expressions for the volume cut away, we obtain the equation of condition by putting them equal to each other: $6{\cdot}2832 \times x^2 \times y + 3{\cdot}1416 \times x^2 \times (a-y) + 1{\cdot}0472 \times (a-y)^3 = 4{\cdot}1888 \times m \times a^3$.

As there are two unknown quantities, x and y, it will be necessary to form another independent equation of condition. Fig. 2 is a section of the sphere, in which B C is the diameter of the auger, E C or x the radius, A C or a the radius of the sphere, and A E or y half the altitude of the cylindrical portion of the cut. From the right angled triangle, E A C, we obtain $x^2 = a^2 - y^2$.

Substituting this value of x^2 in the first equation of condition, and performing the operations indicated, the equation assumes the form: $6{\cdot}2832 \times a^2 \times y - 6{\cdot}2832 \times y^3 + 3{\cdot}1416 \times a^2 \times y - 3{\cdot}1416 \times a \times y^2 - 3{\cdot}1416 \times a^2 \times y + 3{\cdot}1416 \times y^3 + 1{\cdot}0472 \times a^3 + 3{\cdot}1416 \times a \times y^2 - 3{\cdot}1416 \times a^2 \times y - 1{\cdot}0472 \times y^3 = 4{\cdot}1888 \times m \times a^3$. For the special case, given by our correspondent: $a = 4$, $m = \frac{1}{2}$, hence $y^3 = 32$, and $y = \sqrt[3]{32} = 3{\cdot}1748$ inches; and the diameter of the auger that will cut out half the volume of the sphere is

$x = \sqrt{(4)^2 - (3{\cdot}1748)^2} = 2{\cdot}4332$ inches.

As the numbers from which x and y are determined are not perfect squares and cubes, the roots are not exact; but by carrying them out to a sufficient number of decimal places, any desired degree of accuracy can be attained. The values given above, for x and y, are very nearly correct, as can be shown by the following proof:

Volume of cylindrical part cut away: $3{\cdot}1416 \times (2{\cdot}4332)^2 \times 6{\cdot}3496 = 118{\cdot}1033$ cubic inches. Volume of the two end segments: $(2{\cdot}4332)^2 \times 3{\cdot}1416 \times 0{\cdot}8252 + (0{\cdot}8252)^3 \times 1{\cdot}0472 = 15{\cdot}9371$ cubic inches. Total volume cut away: $118{\cdot}1033 + 15{\cdot}9371 = 134{\cdot}0404$ cubic inches. Half the volume of the sphere: $4 \times (4)^3 \times 0{\cdot}5236 = 134{\cdot}0416$ cubic inches.

The difference of only $\frac{12}{10000}$ of a cubic inch between the two independent calculations shows that the above values of x and y are exceedingly close to the absolute results; but any of our readers can reduce the difference still farther if they so desire.

SCIENTIFIC AND PRACTICAL INFORMATION.

A SULPHUR REGION.

The Winnemucca (Nevada) *Silver State* says: "Right here in Humboldt, within a hundred yards of the Central Pacific railroad, and in the immediate vicinity of the silver mines of the Humboldt range, are beds of sulphur, capable, it is believed, of supplying the whole world with that article for centuries. These sulphur deposits are located in the Humboldt valley, not much over a mile from the Humboldt House, and probably thrice that distance from the base of the Humboldt range. But little is known in reality of the extent of the beds, except that they cover a large area in the valley, and have been prospected in one place to a depth of several feet, where the excavations expose hundreds of tuns of the pure article, which can be made available for commercial purposes at no greater expense than loading it on the cars and shipping it to the great commercial centers."

VALUE OF DISCIPLINE.

A suggestive instance of the value of discipline in times of emergency is found in the circumstances attending the loss of an Austrian man of war, recently, off Sicily. After the vessel had struck and it was found that she must shortly go to pieces, the captain ordered every man into the rigging. The command obeyed, the word was passed for all hands to strip and be ready to jump overboard at the signal. The instant the latter was given, every one leaped. A few seconds after, the ship keeled and went to pieces. Every man reached shore safely, except one who neglected to remove his clothes as ordered.

A NEW EXPLOSIVE.

A new kind of prismatic powder is being tested by the German military authorities. Its specific weight is greater than that of ordinary prismatic powder (1·69 against 1·65) and its effect is so powerful that it is said to render the Prussian 28 centimeter 11·02 inches cannon a match for the English 11 inch gun.

IGNORANCE IN MASSACHUSETTS.

The Deputy Constable, appointed to look after the children employed in the factories of Massachusetts, reports that fully 60,000 children are growing up in ignorance on account of their being set to work at too early an age.

NEW DISCOVERIES ON THE ACTION OF GALVANISM ON THE THROAT.

The faculty of Jefferson Medical College, Philadelphia, have recently conducted a series of interesting experiments upon the body of an executed criminal, which have revealed several novel and important facts in physiological science. Dr. W. W. Keen, after dissecting the chords of the neck which connect with the larynx, galvanized each in turn. When the left chord was galvanized, this only responded, and the same was the case with the right. It was found that there was no crossing of the chords from one side to the other, and that the action of each was distinct and independent. The doctor also examined and galvanized separately the external and internal intercostal muscles (between the ribs) and found that their function was not uniform but different. Physicians have long been at variance on this question, but the present discovery seems to settle the matter, since it proves that the external muscles are for expiration and the internal for inspiration. It has been believed by some that, by the application of galvanism, vitality can in a measure be revived. This impression is incorrect; for while the application of a battery, to the cadaver from which life has been extinct but a short time, will serve to produce muscular action, the result shows that only a portion of the body, and not the brain, is excited by external power.

A BUTTER SALTING TEST.

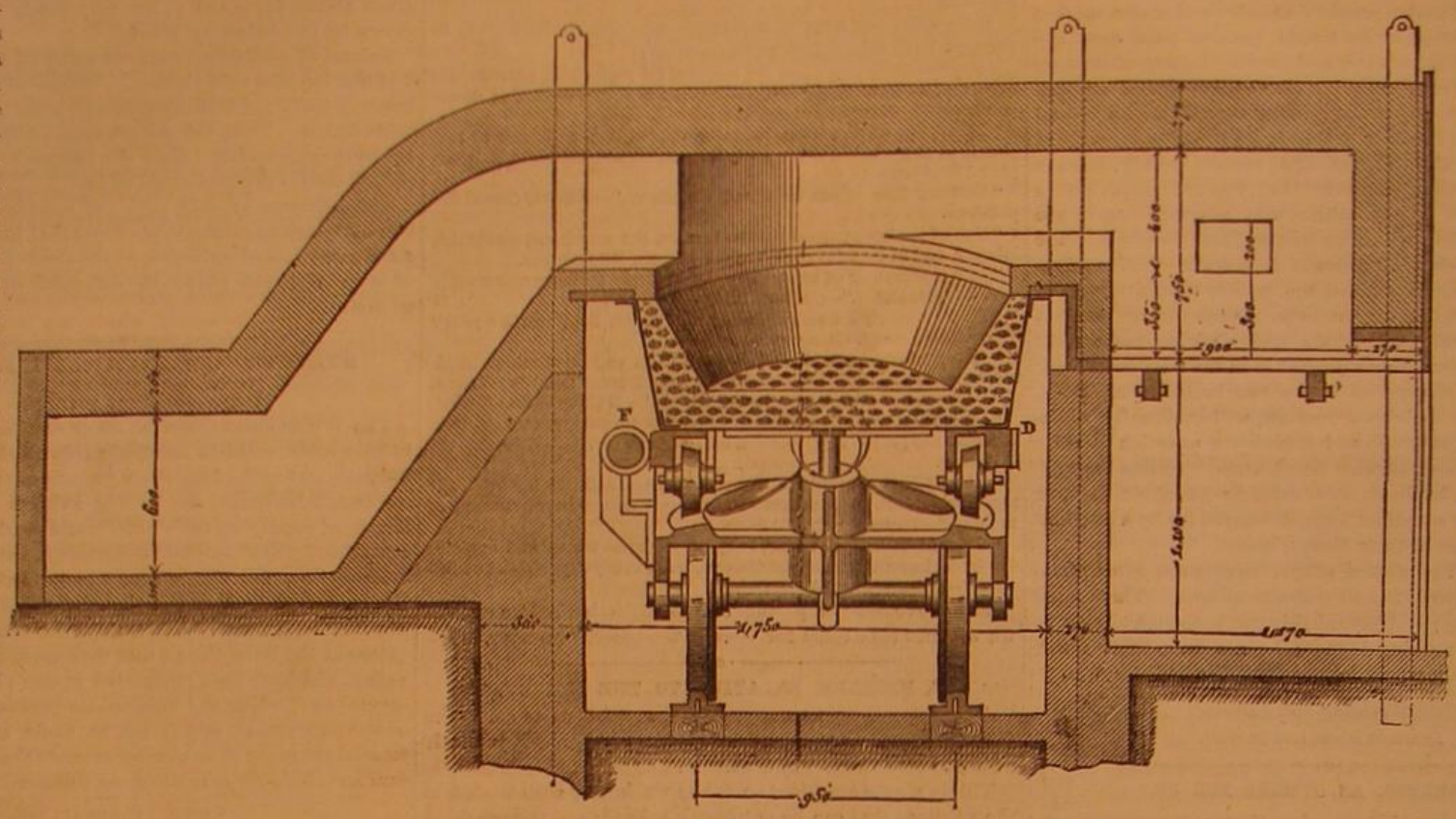
A select committee of the New York Butter and Cheese Exchange is at present investigating the important question as to the best salt to be used for butter making. American and English salts are in competition, and the result which will be reached is of great pecuniary moment to dairymen generally. The report will appear during next April, and will be based on practical tests of butter salted by the various varieties of salt. The committee is to judge simply from the samples, no information being given as to the manner in which each has been prepared.

THE PERNOT ROTARY PUDDLER.

The new puddling furnace represented herewith has its characteristic feature in an inclined hearth, not more than one half of which is ever covered by the molten metal. This modification, it is stated, has given important advantages, as the higher part of the hearth forms a rapidly oxidizing surface for the thin layer of metal by which, because of adhesion and by centrifugal force, it is constantly covered,

The hearth is supported by two pairs of wheels, which rest on a circular track, and is guided in its rotation by its central spindle passing down through the center of the supporting bed. Rotary motion is given to it by a worm, F, which engages in the cogs on the circular portion, D, on which the hearth rests. The whole is mounted on trucks, as shown, resting on a suitable railway. The metal about the hearth has a lining of scoria or ore a few inches thick.

The hearth, mounted upon its car, is wheeled directly into the furnace, in a position as near as possible to the metal plate that supports the masonry above. When the hearth is at a reddish white heat, the interstices are closed with fragments of ore, and the operation of puddling is carried on by rotating the hearth some three or four turns per minute, care being taken to spread the contents evenly over the surface. The formation of blooms is the same as in ordinary puddling, except that, owing to the rotation of the hearth, the work can always be done directly in front of the door. Water circulation can be employed for cooling. The ordinary charge is about 1,100 pounds, and this is divided into seven or eight blooms, the average time of forming which is about half an hour, including the period necessary to transport them to the forge. A complete operation, comprising the squeezing, lasts about two hours, the cleaning of the grate and reheating of the furnace occupying about half an hour of this period.

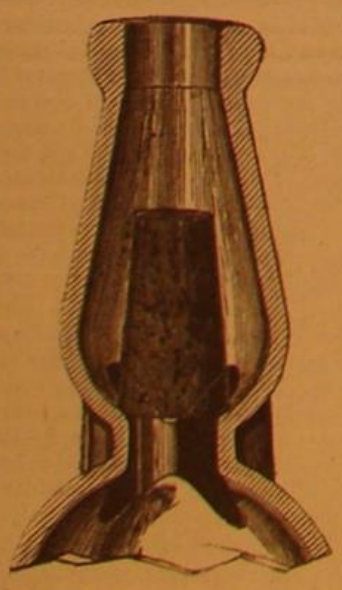


THE PERNOT ROTARY PUDDLER.

At the foundery of St. Chamond, France, in one week, there were produced, in 11 heatings of 25 hours each, 25 tuns of fine puddled iron, while by hand puddling the same iron (gray charcoal) did not yield over 12 tuns. In the former case the loss did not exceed 30 pounds of raw per 1,000 pounds of finished product; in the latter the loss was fully 200 pounds. The consumption of fuel, at the same time, was reduced from 3,300 to 2,640 pounds.

A SELF-CORKING BOTTLE.

This is an ingenious plan for arranging the cork inside the bottle, so that, when the latter is filled, the stopper rises into place and so closes the mouth. The neck of the bottle, at the



point where it joins the main portion, is provided with projections, four in number, which prevent the cork placed above them from pulling through. During the filling, the weight of liquid coming from above keeps the cork down upon the ribs, and the fluid, of course, flows in between said projections. As soon, however, as the bottle is full, the cork necessarily rises with the contents, and, being tapered upwards, wedges into the mouth. To open the bottle, the cork is simply pushed down; then, as the bottle is inverted to discharge the liquid, the cork will rise upward and so leave a clear place of exit at the orifice. The ribs on the neck of the bottle act as strengthening pieces, and may be molded with the vessel in the ordinary way. Patented April 28, 1874, by Messrs. Henry and Thomas Miller, of Pittsburgh, Pa.

A Universal Language.

A language which could be understood all over the globe, says a contemporary, would be exceedingly useful in science, commerce, and social intercourse. Enthusiastic philosophers have more than once tried to invent a universal language, but have not succeeded; and the students or traders who desire to communicate have still to learn a number of languages, or to betake themselves to translations. To overcome these difficulties, a learned German, Dr. Bachmaier, has invented a method of correspondence in which numerals stand for words and ideas. Assuming (in round numbers) that four thousand words are sufficient for all purposes, he prepares a dictionary with columns of numbers from one to four thousand, each number having a word against it which it represents in every language. For example, if the word fire is number fifty-two, the same number will stand against *feu* in the French, and against *Feuer* in the German dictionary, and the same in any other that may be compiled. From this it will be understood that an Englishman entirely unacquainted with French or German might easily make a communication in either of those languages. He would look at his alphabetical list of words and set down the corresponding numbers. The Frenchman or German would look at his list of numbers, would set down the corresponding words, and thus have before him his correspondent's statement, and would have equal facility in answering. To make known masculine and feminine, nouns and adjectives, tenses and inflections, and other grammatical requirements, Dr. Bachmaier affixes certain simple marks to the numerals. He has already published three dictionaries—English, French, and German,—and is at work on other languages. At the meeting of the Oriental Congress last autumn, copies of these dictionaries were exhibited, and by the most competent judges were warmly approved.

Silica in Cancer.

In the November number of the Edinburgh *Medical Journal*, Mr. Fawcett Battye narrates his experience with an entirely new remedy in cancer. This is silica, powdered very fine, and administered internally twice or thrice a day, in one grain doses, combined with a third of a grain of morphia. He found it to diminish the pain in a marked degree, and by the tenth day to disperse it altogether. He does not precisely claim, however, that the patients recovered. They were relieved and benefited; and when they took it continuously, the disease was retarded. No satisfactory explanation of its action is advanced.

The Preservation of Smoked Meat.

Professor Nessler says that the keeping qualities of smoked meat do not depend upon the amount of smoking, but upon the uniform and proper drying of the meat. It is of considerable advantage also to roll the meat on its removal from the salt, before smoking, in sawdust or bran. By this means the crust formed in smoking will not be so thick; and if moisture condenses upon the meat it remains in the bran, the brown coloring matter of the smoke not penetrating. The best place to keep the meat is in a smoke house in which it remains dry, without drying out entirely as it does when hung in a chimney.

Scientific Progress in Australia.

Our advices from Port Adelaide, South Australia, report the foundation of an institute in that city for the advancement of art, science, and literature. The first stone of the building was laid on October 31, 1874, a large sum of money having been given for the purposes of the institution by wealthy residents. Two gentlemen, Messrs. Elder and Hughes, have given $100,000 each to found a university, and the colonial government has appropriated 95 acres of land for a site and 50,000 acres as an endowment.

Mysterious Fire.

The Niagara Falls *Gazette* gives the following account of a mysterious fire which was discovered in a house occupied by Mrs. P. A. Porter, at that place: "About noon, one of the servants noticed a little smoke issuing from the floor in the butler's room, which adjoins the dining room, on the first floor of the house. Smoke had been noticed in the house the day before, but no indications of dangerous fires had otherwise been apparent. A messenger was sent for Mrs. Porter's business manager, who was at church. Upon his arrival search was instantly made for the fire, which was evidently making headway somewhere between the floor and ceiling below. The trouble was finally found under the dining room floor, in a place where it would seem impossible for fire to originate. The floor has a deep layer of sawdust beneath for the purpose of deadening sound. Beneath the sawdust, and about an inch and a half above the ceiling beneath, is a thin flooring, keeping the sawdust from the lathing and plaster. The fire was found burning the under side of this thin flooring, between the flooring and the ceiling. It had evidently been smoldering for two or three days, but had burned through to the sawdust in only two or three small places. How fire could originate in such a confined place, several feet from any chimney or flue, remains an unsettled question. The only plausible theory that has been advanced throws the responsibility for the trouble upon some mischievous mouse."

Apropos of the above, a French paper states that quite an alarming proportion of the number of private houses burned down is to be traced to the thefts of mice, who are particularly fond of the wax matches which are chiefly in use in Europe. They steal these matches and carry them away to their nests, where, at some more convenient time, they commence their meal, and a single nibble in contact with the phosphorus may ignite the whole collection.

COMBINED KNIFE AND PEPPER BOX.

This is an ingenious arrangement of a pepper or salt box in a knife handle. The latter is hollow, and into it screws the box, which is shaped as in Fig. 2. The receptacle is filled from the top and then inserted in the handle, a neat cap, attached to its extremity, passing over and making a finish to the end of the same. Perforations around the bottom of the box allow of the escape of the condiment when the box is slightly drawn out.

The device will be found useful for picnics and camping parties, as it saves the room taken up by the ordinary pepper and salt cellars, and besides secures a supply of the useful seasoning materials being constantly, and literally, on hand. Patented April 21, 1874, by Messrs. R. W and R. F. F. Brown, of Utica, N.Y.

Carbolic Acid a Preservative for Hides.

In South America and Australia, it is stated that the immersion of hides for 24 hours in a two per cent solution of carbolic acid, and subsequently drying them, has been successfully substituted for the more tedious and expensive process of salting.

THE TULIP TREE.

This noble tree deserves a place on every lawn, as it seldom fails to develope itself into a stately specimen in any good, deep, well drained soil. In habit of growth, it closely resembles the common maple, but its conspicuous orange-tinted blossoms and scaly fruits at once suggest its near affinity to magnoliads, to which it belongs. The flowers are not unlike those of a tulip, and hence the name by which it is most generally known. The broadly expanded leaves, instead of being palmate as in the plane, are irregularly four-lobed, and somewhat resemble a saddle in conformation; and it is sometimes called in the vernacular the saddle tree, from this peculiarity. Our illustration gives an excellent idea of the flowers, foliage, and fruit. The flowers are profusely borne during the summer months; and although not strikingly ornamental on the tree on account of their being somewhat hidden amid the ample foliage, when cut and arranged in a vase with the foliage that naturally belongs to them, they have a distinct and striking appearance. This tree is from 100 to 150 feet in hight, but in Europe it rarely exceeds 70 or 80 feet. In the old arboretum at Chiswick, Eng., there used to be two specimens of this fine tree, one having much larger and brighter colored flowers than the other; and, doubtless, other varieties of it exist where plants are raised from seeds. All through the summer the foliage is of a fresh, pale green; and, in the autumn, it dies off a brilliant golden yellow. Striking effects might, therefore, be obtained by grouping it with *quercus coccinea* or the purple-leaved beech. In addition to its ornamental properties, its distinct and noble port commending it at once to the notice of intending planters, it is valuable as a timber tree, the wood being firm in texture and capable of taking a fine polish.

FOLIAGE, BLOSSOM, AND FRUIT OF THE TULIP TREE.

The Diving Bell.

M. Toselli states that he has been making experiments with his submarine vessel, or "marine mole," as he calls it (of which we gave a description on page 19 of our last volume). He is struck with the correspondence, of many of the phenomena, to those observed in ballooning; and considers that it is at the bottom of the sea that the problem of aerial navigation will be solved. In a liquid mass which is still, the machine moves quite well in obedience to the screw propeller, which is driven by the hand. But if the vessel meets a current, it is vain to think of contending with it. Another difficulty, as in balloons, is orientation. Once a balloon has got to some distance from the earth, it becomes impossible to tell the direction in which it is going. The needle is useless. And, similarly, in the "marine mole," when it is only 0·39 of an inch under the surface, and nothing is seen in motion but the fish, the compass is found of no use. To go to a certain point, an artificial meridian has to be arranged outside. M. Toselli remarks, too, on the great distinctness with which sounds are heard. At a depth of 110 feet, the screw of a steamer, passing about 660 yards off, sounded in the (hermetically closed) mole as if directly overhead. The contrivance of M. Toselli, affording, as it does, a novel opportunity of observation, may furnish some instructive data in physics.

The Remarkable Mineral Treasures discovered in Massachusetts --- Rich Mines of Gold, Silver, Copper, and Lead.

Since the gold excitement a quarter of a century ago, says the Boston *Advertiser*, when the "forty-niners" flocked to the Pacific coast, there has been no discovery of the precious metals so important and yet exciting so little general interest, as the developments made during the past three months in the little town of Newbury, in Essex county, Mass. Four months ago the existence of any such ores was known to but two persons, and they were by no means aware of the magnitude of their discovery. When the matter got into the local papers, one gentleman of this city thought it worth while to investigate it, and the result has been, in brief, preparation for mining on an extensive scale, with prospects of returns far more remunerative than were ever known before.

The discovery dates back only to 1868, when a Byfield man, named Rogers, said to be a rather dissolute character, in his wanderings over Highfield Pasture first noticed the ore. Something in the weight of the stones which he picked up, and occasional gleams as the sun glanced on small, smooth surfaces, induced the belief that there was metal in their composition; and if metal, then something of value. With this idea he collected a number of the best specimens, and some time after took them to Mr. Albert Adams, a quiet bachelor farmer residing in Newbury. Mr. Adams became greatly interested in the matter, believing that a great discovery had been made. He began to study mineralogy and geology. Becoming convinced that metal was present in quantity, he was soon confident that it was silver and lead. He pursued his investigations very quietly; and finally concluded to secure by purchase the land on which the specimens were found. For this purpose advances were made to an old farmer named Jaquish, who had long owned the pasture, and the lot, measuring twelve acres, was transferred to him for $350 early in April of last year. He then began digging. The surface finds, or float ore, were naturally more or less oxydized by the action of the elements, but at a depth of six feet he struck the true vein. Several tuns were then taken to his barn and further examination made.

Dr. E. S. Kelley, of Boston, and Professor R. H. Richards, of the Institute of Technology, subsequently examined the premises and minerals. From their report it seems that the rocks in the vicinity are gneiss nodes, and quite hard. The strike or line of outcrop is about N. 70° to 80° E. the dip about 30° to the N. W. As he found it, the line of the vein was about N. 72° E. by the compass. Four specimens were assayed. The first, coarse grained galena, assayed for silver, yielded $56.37; and the second, fine grained galena, $75.23 per tun. The third, a comparatively pure piece of gray copper, containing also some quartz and galena, assayed for silver, copper, and incidentally for gold, yielded, of silver, $1,270 per tun; gold, $129 per tun; and about 27 per cent of copper. The fourth specimen, weighing about three pounds, tried for lead, was found to be nearly pure and hammered quite readily. The lead was fifty-two per cent of the whole matter.

After this a large extent of the adjoining property was secured, and in September last systematic mining operations were begun by the sinking of a shaft ten feet square. As the shaft increased in depth, the vein—which is what is known as a fissure vein, that is, metal between two walls of granite, where in all probability it was thrown by volcanic action—broadened from three feet at the surface to seven feet at present working, twenty-five feet down. As the men descend, the vein grows richer and purer, the proportion of silver and gold increasing, while that of lead remains about the same. The south wall has not yet been reached. The men are therefore working on the pure metal, the north wall being perfectly perpendicular. In consequence of this fact, which is totally without a parallel in mining history, there is but the smallest possible expense incurred in removing the ore—about one dollar per tun. About ten tuns are taken out, being hoisted up in baskets, every twenty-four hours. To work this quantity, only four men are required by day, and a relieving gang of equal number by night. This ore, which is piled in a storehouse, as at present mined yielded $90 per tun of silver, $70 of lead, and $11 of gold; a total of $171. The cost of smelting and separation is $20 per tun, so the profit is about $150 per tun. Near this first shaft, on the forty acre lot, they have sunk the second shaft, begun in last October. This is of about the same size as the first and is down almost as deep, the vein working about four feet in width and the ore being of similar purity. This vein, like that first found, broadens as it is dug out. Four men work in this shaft at night and four during the day. Shaft houses have been erected over the mines, and a large storehouse and a boarding house for the men built near by. Housing the shafts will enable the men to continue work during the winter.

Mining experience has demonstrated that a fissure vein is always without bottom. This vein is estimated by geologists to extend in its general direction, 20° east of north, about six or seven miles in length. Bearing this fact in mind, the wealth to be reasonably expected from this "find" can only be estimated by comparison. The Comstock lode in Nevada, hitherto supposed to be the richest silver mine in the world, yields only $45 per tun on the average, while the Newburyport yields just double that. The Mariposa mines, which were sold a few years ago to a company for $10,000,000, yield only $15 per tun of silver. The Belcher mines in Colorado, which yield about $40 per tun, divided $900,000 among the stockholders as the profits of work during the month of August, 1874; and these mines had not the additional profits accruing from the product of lead.

Chalk in Artificial Fuels.

We have remarked paragraphs in sundry home and foreign scientific journals relative to the utilization of chalk, such as is found in natural beds, as a source of heat. Various descriptions of improved fuel have appeared, in which the above material has been mixed with bituminous coal and various earthy substances, and the compound thus produced is stated to have increased calorific properties. How this result can be directly ascribed to any active effect of the chalk, we fail clearly to comprehend.

Chalk is a body already the result of a combination of carbonic acid and lime. By heating at a high temperature, the material may be decomposed; and it absorbs an amount of heat equivalent to that produced at the moment of combination. Carbonic acid and lime result, and these themselves are also burnt bodies, neither of which can individually produce heat. If the carbonic acid, after contact with an incandescent combustible, is transformed into carbonic oxide, it is simply through the absorption of exactly the quantity of heat which would be produced by the transformation of carbonic oxide, in turn, into carbonic acid. So that, theoretically and according to all present chemical ideas, it is impossible to conceive that lime, no matter in what form it be utilized, can be a source of heat.

It remains therefore to account for the advantageous results which are claimed to have been secured by the admixture. In domestic heating, the types of apparatus commonly employed are the grate and the stove. A grate fire utilizes about one tenth of the heat developed by the combustible, that is, about this fraction goes to warm the room, while the remaining nine tenths flies up the chimney. It is radiant heat that warms our apartments. Now if, by mixing chalk or limestone with the fuel, the combustion is retarded, the chalk, by absorbing a portion of the heat which otherwise would be lost, serves to increase the radiating surface, it thus probably augments the quantity of heat utilized.

In stoves an analogous state of affairs exists, and it is not impossible to conceive that such, in the instances noted, may be advantageous. But for the production of steam, wherein active combustion is required, it is certain that the addition of such foreign matter to the fuel can exercise no useful effect.

Talent and Tact.

Talent, it has been said, knows what to do, tact knows how to do it; talent is wealth, tact is ready money; talent has many compliments from the bench, tact touches the fees of the client; talent makes the world wonder that it gets on no faster, while tact excites astonishment that it gets on so fast. Tact makes no false step; it takes all hints, and, by keeping its eye on the weathercock, is able to take advantage of every wind. This promptness in seizing an opportunity, and diligence in following it up, is scarcely less valuable than industry. Instances might be given indefinitely of the results that have followed the immediate utilizing of an accidental discovery in mathematical demonstration, in chemical analysis, in mechanical invention, and in manufacturing operation.

Correspondence.

Remarkable Optical Phenomena.

To the Editor of the Scientific American:

Last evening, a curious optical phenomenon was visible at this place at sundown. For three days the weather has been very sharp (thermometer 10° to 12° below zero); and yesterday afternoon, flaky clouds lay in the west. Just at sunset, the full disk of the sun, considerably magnified, was seen behind a thin veil of cloud, but shorn of its rays, lusterless, and resembling the full moon, which it did not much exceed in brightness. The full disk was so clearly seen in all its parts that it was a matter of surprise that it was not brighter. This surprise was increased on observing, about twenty degrees to the right and a little above, a dazzling brilliancy, as if the sun were struggling to burst through a rift in the the clouds. It was hard to believe that the real sun was the lack-luster orb that was slowly passing down through the distant hemlocks, and not the one of which the radiance was making the whole west a blaze of light. The phenomenon lasted for some ten or fifteen minutes, and until the disk of the sun had completely passed out of sight. The luster then slowly faded away. The explanation that I give is that two clouds of snow crystals lay in such positions that the one cuts off the light from the sun, the other reflected it to our eyes.

To-night, another optical phenomenon has attracted my attention. The frame of a picture in my room has the appearance of being bent, when seen across the room, the lamp being on one side. This is beyond our power of explanation at present. At the point where the light strikes upon the frame, which is a gilt one, it seems bent or broken.

Troy, Pa. O. B. J

Early Submarine Telegraphy.

To the Editor of the Scientific American:

In your journal of January 9th, Mr George B. Prescott gives a brief account of some of the earlier experiments in sub-aqueous telegraphy. As this is a matter of much scientific as well as historical interest, I trust you will afford me space for a few notes on the same subject.

Prior to the employment of gutta percha for this purpose, various attempts were made to insulate sub-aqueous telegraphic conductors, which were attended with only partial success. The plan usually adopted was that of winding the conducting wire with thread saturated with insulating compound, and inclosing it in a tube. Dr. W. O'Shaughnessy made the first actual experiments of this kind for telegraphic purposes. He built a line, 21 miles in length, of iron wire, supported on bamboo poles, near Calcutta, India, in 1839. His line also embraced 7,000 feet of submerged wire, insulated with cotton thread saturated with pitch and tar. This was the first telegraph line of any length ever constructed in any country, and was worked successfully.

The first public telegraph line in England was opened from London to Gosport, 88 miles, in February, 1845. In the summer of 1846, an attempt was made under the direction of Professor Wheatstone to extend this line across the harbor to Portsmouth by means of a submarine wire a mile in length, but it failed to work successfully. This wire was, I think, insulated with india rubber, and enclosed in a leaden tube.

Gutta percha was first introduced into England in 1845. In March of that year R. A. Brooman patented the method now universally employed, for preparing the raw material for use in the arts. Covering everything into which gutta percha could be manufactured, this was called the Master Patent. In September of the same year, Henry Bewley patented a machine for making tube, hose, etc., similar in principle to the American lead pipe machine of Tatham, patented in 1841. In 1846 C. W. Siemens of London sent a sample of gutta percha to his brother Dr. Werner Siemens, who had been appointed a commissioner by the Prussian government to consider a telegraphic system, to see whether it would answer for coating subterranean wires. The latter soon discovered its remarkable insulating properties, and recommended an experiment upon a large scale, which having been sanctioned, he laid down a line of about five English miles near Berlin, Prussia, in the summer of 1847, which worked successfully. (*Journal of Society of Arts*, April 23d, 1858.)

In 1847 and 1848 more than a thousand miles of gutta percha covered wire was laid down in Prussia, which for several years proved successful, after which it gradually failed owing to the impurity of the material. In March, 1848, Dr. Siemens made several successful experiments in the harbor of Kiel for the Schleswig-Holstein government, using a gutta percha cable of considerable length for firing submarine torpedoes. The same year he laid across the Rhine, at Cologne, a gutta percha coated wire, which was protected by a strong chain.

In 1846 the Gutta Percha Company was formed in London for the purpose of working the Brooman, Bewley, and other patents. In June, 1846, Mr. Samuel T. Armstrong of New York received from one of the directors of this company a small quantity of the raw gutta percha, together with an invitation to visit the works in London. He left for Europe in March, 1847, spent six months in England and on the continent, visiting all the gutta percha factories then in existence, and finally purchased the patents for the United States, returning to New York in September, 1847. While in Europe he doubtless witnessed the manufacture of the insulated wire for Dr. Siemens, an immense quantity of which was furnished in 1847 by the same Gutta Percha Company of London.

In the latter part of 1847, W. S. Wetmore, of New York, imported a consignment of gutta percha for Mr. Armstrong. It was probably some of this lot with which Mr. Craven experimented, as mentioned by Mr. Prescott. I have been told that Mr. Craven and his wife covered a wire themselves at their home in Newark, N. J., which he laid down as an experiment at the Passaic river crossing, in that city. On the 22d of May, 1848, Mr. T. M. Clark, Secretary of the Magnetic Telegraph Company, wrote to the Treasurer, George H. Hart, Esq., of Philadelphia:

"The wire has been down there (at Passaic river) nearly a month, and it has worked to a charm. It has been tested in various ways to see if there is any difficulty about it, but none has ever yet appeared. I am well satisfied that the plan is a good one, provided the wires can be kept out of the reach of anchors." This cable was therefore probably laid the last of April, 1848. Mr. Prescott states that James Reynolds covered the first cable that was laid across the Hudson River from New York to Jersey City, but makes no mention whatever of Mr. Armstrong, who was the proprietor of the establishment at which the cable was covered, and the owner of the Brooman and Bewley patents under which it was made, Mr. Reynolds (who was then employed by him) being the man who built and probably ran the machine used in coating the wire. This machine was the same in principle as Bewley's and Tatham's, previously mentioned. The cable referred to consisted of a No. 9 iron wire covered with half an inch in diameter of gutta percha. It was laid at 5 o'clock on the morning of the 15th of June, 1848, by the steamboat United States, from Cortlandt street, New York, to Jersey City, under the personal supervision of T. M. Clark and John W. Norton, directors of the Magnetic Telegraph Company. This cable had a leak in it from the start, but New York and Philadelphia telegraphed through it—by alternately cutting off the battery at the receiving station—for four days, when the wire was cut by an anchor

Mr. Craven applied for a patent on the 12th of May, 1848, for his process of insulating wire by means of gutta percha. William Gordon also applied for a patent for the same thing on the following day, May 13. Both of these applications were rejected on the ground that, the insulating property of gutta percha being well known, its use to protect wires was not a patentable invention. Reynolds applied for a patent on his machine, June 9, 1848, which was rejected for lack of novelty. But notwithstanding all this, one George B. Simpson of Washington succeeded in engineering a bill through Congress, giving him a patent for insulating wires with gutta percha, which was issued May 21, 1867, and is now in force. Even if the subject matter were patentable, it is difficult to see how any one in this country could rightfully claim the invention, as it was made by Dr. Siemens in the winter of 1846–47, and the first importation of gutta percha into the United States was not until near the close of 1847. Mr. Prescott says: "One of Mr. Reynolds' workmen named Champlin, shortly after this cable was laid, went to England and communicated the process to the Gutta Percha Company" etc. This statement cannot be correct; for as we have seen, the cable in question was not laid till June 15, 1848, while the Gutta Percha Company probably covered Dr. Siemens' four miles of wire in the summer of 1847, and certainly the 1,000 miles subsequently laid down by him in 1847 and '48.

W. H. Barlow took out a patent in England, April 27, 1848, for covering wire with gutta percha by means of heated grooved rollers. The Bewley machine has, however, been much more generally used for this purpose than any other, having of course received more or less improvement at the hands of subsequent inventors.

Elizabeth, N. Y. F. L. POPE.

Our Visual Organs.

To the Editor of the Scientific American:

The communication of W. S. Turner, published in your issue of January 9, covers only a portion of the subject treated upon.

By hearing a discussion between some medical men upon the general theory of inverted vision, I was led to conduct a series of experiments, more to enlighten my own mind than to convince others. Of many test experiments, during three or four years, only two or three can be here referred to.

I first tried the stereotyped experiment with the eye of an ox, and soon found a vast difference between looking into or out of an eye, and looking through one. In the latter case, the image is inverted; in the former, it is in its true position. I subsequently constructed an immense eye by boarding up the windows of a large workshop, leaving only a small hole, into which was fitted a double convex lens, from a pair of No. 15 spectacles, my own vision being substituted for the sense of sight to this artificial eye. By placing myself some distance back from the lens, I saw upon it an inverted picture of the landscape lying in front of the building, and a covered carriage before the window was very distinctly represented in the foreground. But by placing my eye close to the lens, I no longer saw an inverted picture painted upon it, but was enabled to look out, through the lens, upon the outer world and view the entire landscape within range of my vision, not inverted, but in its true position. To compare this with the legitimate office of our visual organs: if a person could be found who could not actually look out upon his surroundings, but, to the contrary, saw the picture as painted upon the crystaline lens situated within the interior of his eye, would any scientist suppose that the person's visual organs were performing their proper functions? If not, is it logical to suppose that we receive cognizance of the outer world only through the telegraphy going on between the internal nervous tissue of the eye (retina) and the brain through the optic nerve? A person reading a book while lying supinely, with his head falling over in an inverted position, would naturally hold his book before his face to suit his inverted vision; and this is just what Nature does by crossing the optic nerves, carrying the right nerve to the the left lobe of the brain, and *vice versa*.

By investigating still farther, it was found that the anterior portions of the eye (except the outer cuticle, which is tough and hardy) are supplied with a microscopic network of sensitive nerves, well lubricated by a subtle nervous or magnetic fluid, and that this delicate system of nerves forms a conjunction with a more extensive system of nerves running from the spinal column, and these, through the latter, come into communication with every portion of the brain.

I am thus led to the conclusion that through this wonderful arrangement we are enabled through our senses to approach close to and look out through the crystaline lens of our visual organs upon the outer world, unconscious of the fact that an inverted image of things seen is daguerreotyped upon the retina of those organs; and further, that the office of the retina, like the mirror in a telescope, is to collect the rays and reflect them upon the lens, thereby rendering a perfect image. CHARLES THOMPSON.

St. Albans, Vt.

Electroplating Iron Surfaces.

To the Editor of the Scientific American;

I have considerable experience in the beautiful art of electroplating; and having received numerous letters from your readers, asking for information respecting the method of depositing silver upon iron, I give you the following:

It is by no means an easy matter to coat iron with silver. It may, however, be successfully done if sufficient care be taken. Silver may be deposited upon iron either directly or indirectly, the latter plan being much the best, especially for the inexperienced electroplater. In depositing silver upon iron, observe the following instructions: The article should first be rendered free from rust by rubbing with emery cloth, or by dipping it into a pickle composed of sulphuric acid, 2 ozs., hydrochloric acid 1 oz., water 1 gallon. After the article has remained some time in this pickle, it should be taken out and the rust removed by a brush and wet sand. If the oxide cannot be easily cleaned off, it must be returned to the pickle. As soon as the article is rendered bright, it is washed in a warm solution of soda, for the purpose of removing all grease. Lastly, it is well rinsed in hot water, and immediately placed in the plating solution, which should contain only about one fourth as much silver as that used for plating copper and brass articles. The battery power must also be weak. When the object receives a slight coating, the process may be carried on more rapidly by increasing the battery power, and by placing the article in a much stronger plating bath, using about 1 ounce of silver in a gallon of solution.

The indirect method consists in first coating the iron with copper, which insures success. Copper adheres firmly to iron, but silver does not; hence copper acts the part of a go-between. After the article has been cleaned, as above described, it is coated with copper by placing it in a solution composed of carbonate of potassa 4 ozs., sulphate of copper 2 ozs., liquid ammonia about 2 ozs. cyanide of potassium 6 ozs., water about 1 gallon. The sulphate of copper may be dissolved in warm rain water, and, when cold, the carbonate of potassa and ammonia added; the precipitate when formed is redissolved. The cyanide of potassium should now be added, until the bluish color disappears. Should any precipitate be found in the bottom of the vessel, the clear solution may be poured off from it. The solution is worked cold, and with moderate battery power. Let the article remain in the bath until a thin film of copper is deposited, then remove quickly, rinse in hot water, and place in the silvering solution, where the process may go on as rapidly as if plating a copper article. JAMES POOL.

Friendsville, Ill.

Patents and Patent Laws.

To the Editor of the Scientific American:

Some time since a large and enthusiastic meeting of the shoe and leather dealers was held in Boston, Mass., the object of which was to protest against the alleged unjust conduct of the owner of certain patents connected with the manufacture of boots and shoes. The inventor, after trying in vain to collect his dues for the use of his inventions, proceeded to take legal measures to obtain them, and has been insolent enough to sue some very wealthy and influential parties, and to attach their property. The remarks made and the resolutions passed were very strong and earnest, and have attracted much attention; and in addition, there was a general attack upon inventors and patentees, and the whole patent system received no small amount of condemnation.

I do not know the inventor, nor am I in any way whatever interested in any kind of pegging or other machinery for the manufacture of boots and shoes. But I have read the proceedings of that meeting, and stood pretty well the patriotic allusions to "Bunker Hill" and the "Heroes of the Revolution," etc.; but I have always noticed that when, in business, the American eagle is very much spread, and "Bunker Hill" and the "Boston Tea Party," etc., are much paraded, the cause behind is either very weak or positively bad. I think also that in this case two questions will at once arise in the mind of every honest and fair-minded man. First: If the invention is good for nothing, and there are other devices just as good or better, why have the shoe manufacturers used this invention? Secondly: If they have used and still do use it, why not pay him the royalty like honest men? It may be that the inventor has been very unjust in his proceedings, but it is but fair to infer that his claims for royalty upon his highly useful invention have been long and persistently refused by those who have made money by its use; for unless this is the case, no sane man would institute the measures he has taken to obtain redress.

In one corner of the village graveyard in Billericay, Mass., there is a monument which bears the following inscription

1845.
In memory of
MAJ. SAMUEL PARKER,
who died October 14th, 1841, aged 69.
This stone is erected by those who have been benefited by his mechanics genius.

Who was Major Samuel Parker? He was the original inventor of the leather-splitting machine; and by his genius and his labors, tens of thousands of leather dealers and shoe manufacturers have been enriched, and the wealth of our nation and of the world very greatly increased. His invention has saved tens of millions of dollars worth of property from utter waste. For all this, Major Parker received nothing from the leather dealers and the public but outrage and wrong. They infringed upon his patent, hunted him from court to court, and robbed him of all he had. Four years after his death some of them came and placed the small, cheap granite monument above mentioned upon his grave. Truly, of the leather dealers and the business world, in return for the immense services he had rendered them, the great inventor asked bread, and they gave him (after his death) a stone. Doubtless they thought it an ample return for all he did and suffered. Looking back, I cannot help thinking that the men who had robbed and wronged him for years only insulted his memory in placing a monument upon his grave, though it is some gratification to know that in doing this they also unconsciously recorded upon the stone their own meanness and dishonesty!

In view of the facts above narrated, it is certainly most gratifying to learn, from the speeches and resolutions at the late meeting, that the shoe and leather dealers of the present

time are in the highest degree noble, honest, and honorable men, who in all their dealings love nothing so much as justice. Yet it seems evident that the meeting was intended to be an encouragement to the crusade which is beginning throughout the country, the object of which is to destroy or to render nugatory the rights of inventors and patentees. The Granger combination, supposing that invention and improvement in agricultural implements have reached their highest point, have begun a systematic warfare upon patents and patentees, and the great manufacturing interests seem disposed to follow the lead of the Grangers in their efforts to break down the legal protection—always slight enough—which the inventor has of the profits upon his invention for a short term of years. But however much certain class interests may be benefited, or seem to be, by the destruction of the rights of inventors and patentees, the public cannot afford quite yet to spare them. Amazing as has been the progress of invention, the field is hardly yet entered upon, and in every direction new inventions and improvements upon old ones are called for, and the vital interests of the world demand that all the rights of those who produce useful inventions should be sacredly guarded.

One gentleman at this meeting proposed that, when a man applies for a patent, notice of his application should be given broadcast over the country for six months. Of course to do this a description of his invention must necessarily be given. Now there is nothing perhaps so cheap in this country as perjury; and a small chance indeed would the real inventor have, after his secret has been published to the world for six months, to obtain his patent. Scores of scoundrels with well trained witnesses would claim the invention, proving that they had long used the same thing, and perjury would win the day. As it now is, the inventor who seeks to obtain a patent is obliged to use the greatest care and secrecy to prevent being cheated out of his rights. As to the inventor's contemplated effort to get his expired patent renewed, the question is not (as stated at the meeting) whether his family are starving or not; but whether he has received a full and sufficient compensation for the great benefit his inventions have been to the boot and shoe manufacturers, and to the public. I hope, therefore, that the Committee on Patents will not be influenced in their decision by the loud clamor of deeply interested men about Bunker Hill and the Boston Tea Party; but that they will judge the matter upon its merits only, and decide it justly. The claim for the renewal or extension of a patent for a useful invention is a right in equity which belongs to the inventor who has not been adequately rewarded for his invention. It is a right based on long usage in the management of patents by the United States Government, and all honest men will endorse the usage as a matter of justice, right, and true policy. The difficulties which beset inventors are many. Men devoid of either conscience or honor are constantly on the watch to find out good inventions, which are likely to become profitable. If the inventor is poor, these men commence a system of annoyance to compel him to sell out his patent for a trifle to avoid long and costly litigation in the courts; and they too often succeed in their nefarious attempts. Even if the inventor is not hunted by these human wolves and driven into ruinous litigation to maintain his rights, yet (if his invention is of any magnitude) such is the indifference and prejudice, with which almost every new invention of importance is received by the public, that a large portion of the seventeen years allotted to him expires before he can overcome them and start his invention. In fact it is too often considered that the inventor is a fair subject for jeering and insult, and that neglect and derision are the only suitable reward for the man who attempts to create some new thing for the use of the public. Empty your factories tomorrow of all the patented machinery therein, and see how much will remain of them besides the bricks and mortar of their walls.

Because among the large number of inventions patented there are some which are useless, and because in the patent business (as in every department of life) there are some dishonest men, the large mass of inventors and patentees—whose usefulness to society is greater than that of any class of men whatever—are denounced and almost outlawed by those who every day and every hour are receiving the benefits of their genius, skill, and labor. In view of this, it is high time that the public should take this important subject into consideration, and see that justice is done to the Inventors of the Nation. P.

Cure for Catarrh.

A medical authority asserts that the severest catarrh cold can be removed in about ten hours by a mixture of carbolic acid, 10 drops, tincture of iodine and chloroform, each 7·5 drops. A few drops of the mixture should be heated over a spirit lamp in a test tube, the mouth of which should be applied to the nostrils as volatilization is effected. The operation should be repeated in about two minutes, when, after the patient sneezes a number of times, the troublesome symptoms rapidly disappear.

Pigeon Post in France.

The French military authorities are about to organize a carrier pigeon post between frontier fortresses, on the plan already adopted by Russia, Italy, Austria, and Germany. Two thousand pairs of pigeons, it is said, are being trained for the purpose.

It is one of heaven's blessings that we cannot foreknow the hour of our death; for a time fixed, even beyond the possibility of living, would trouble us more than doth this uncertainty.

Success in Life.

What is success? The answer to this question, says one of our English contemporaries, depends on the different courses which men pursue, and the ends they have in view. The general object of pursuit is that which people most want—money. The money test of success is that which they best understand. To make a certain income, therefore, is among the first duties which the world prescribes. People cannot all appreciate the poet or the thinker, and they estimate his works accordingly by the prices which they realize. There are other ideas of success, however, than this trading notion. The soldier seeks it in promotion by deeds of valor; the scholar in the discovery or enunciation of truth; the poet in the praises of his generation; the lawyer in professional advancement; the politician in the ascendency of his party and his accession to office. When Agassiz, engrossed in scientific pursuits, was told that he ought to look more after the practical ends of life, in leaving a provision for his family: "I have no time," he replied, "to make money."

The making of "getting on" an end in life is purely an English notion. The ideal of man is generally in happy continuance. As to making advancement in the world, as we understand it, the object of existence, an Asiatic would think his life thrown away. "Why should he get on? He is where he is by the Almighty's will, and why should he interfere with the Divine appointment?" It is this anxiety to succeed which gives to English practical life its fierce competition and earnest tone. The attainment of almost any position or dignity being made possible, to suitable talent and well directed effort, inspires hope. What a blessed possession is hope! It is the salt of human life that sweetens all toil and difficulty. Phœnix-like, it "springs eternal" from the ashes, of the pyrites we place in the crucible, as gold; it is the panacea to the disappointment that makes the heart sick; it is the dawn of the radiant orb which, after a season of darkness, is yet to shine in noonday splendor; it is the buoyant element that keeps our bark afloat till we reach the harbor, for without hope there can be no endeavor. *Excelsior* is only hope intensified. Whatever a man's position or calling may be, he should aim at the first rank and the foremost place. "It can't be done" is a cry of indecision, indifference, and indolence. Such a plea is a mere excuse for not attempting at all. Difficulties should serve but to reveal a man's true strength, to test his power of will, to train him to the exercise of his noblest faculties. Failures discipline the strong; only the weak and unstable are overwhelmed. Diligence in business should form part of a man's religion, as it is indissolubly associated with the spiritual in worship.

To attain a position in society, or achieve success in a profession, other qualities must be added to those required to work out results in material nature, because a different class of opposing forces are here encountered. They are not of the nature of those that are overcome by the engineer in the tunneling of a mountain or the bridging of a valley: but such uncertain and subtle elements as public opinion, the want of means, adverse criticism, infirmities of temper, failing health, indecision of character, and other hindrances equally fluctuating, latent or deceptive. Perseverance is essential. All the performances of human art are instances of its resistless force. Attention to the minutest particulars of duty, conscientious watchfulness in little things, that are not really little although trifling in appearance, surmount all obstacles. He who is not disheartened, but boldly and fearlessly grapples with difficulties, never fails. The determination which plods unweariedly through drudgery and details is the foundation of greatness of character and of ultimate success. It accomplishes more than genius.

The New Paris Waterworks.

The great reservoirs at Montsouris for the reception of the waters of the Vannes possess great interest for the hydraulic engineer. It will be remembered that in July last a portion of the arched roof gave way. The accident has now been repaired, and the water will be let into the upper reservoir in a few days. The arches have been reconstructed as before—that is to say, two bricks thick—but the piers and supporting walls have been strengthened, and the vaulting supported in such a manner that, should one or more arches fall in, they will not carry the rest with them. The area of the reservoirs is 363,800 square feet, and they are two stories high, with an enormously thick wall in the middle of the whole, which divides the reservoir into four chambers, two below and two above. All the masonry of the lower chambers has been finished for a long time, but the conduits and pipes for the distribution of the water remain to be executed. The upper chamber, of which the vaultings have been reconstructed, and which has an area of 181,900 square feet, and will contain 75,000 tuns of water, will be the first filled. The hundred arches which cover this chamber are being covered gradually with mold to the depth of 10 inches; and when this is done, and the arches show no tendency to give way, the mold will be sown with grass seed. The quantity of earth will be about 2,600 cubic yards. Several hydrants are placed around the edge for the purpose of irrigating the grass. The second upper chamber is now being constructed, and is about one quarter finished. Around the reservoirs, earth is now being thrown up to the hight of the roof of the lower chambers, with the double view of adding support to the walls and of keeping the water within fresh. At one of the angles of the main structure rises a structure 132 feet square, and with walls 6 feet 7 inches thick. This is the receiving chamber, and has been for some time in use. Its capacity is about 320 feet square by 13 feet 2 inches deep; the bottom and sides are covered with bluish white tiles, and the water is so pure and translucent that a motto inscribed on the tiles at the bottom is plainly visible. At the bottom of this smaller reservoir may be seen the orifice of a pipe 5 feet 9 inches in diameter, which will carry the water to a point 16 feet 5 inches above the level of the ground; opposite to this is another pipe of the same dimensions, which, when there is an overflow of water, will carry it to the main sewers. Just in front of this receiver are three pipes, two of them 3½ inches in diameter and the third somewhat less, bound together by means of a cast iron hood and fitted each with valves; one of these will serve to fill the upper chambers of the main reservoir, a second the lower chambers, and the third, and smallest, already supplies the highest portions of Passy with water. At the base of the recipient chamber is a telegraphic office, which is in communication with another at the reservoirs at Arcueil, with the prefecture of police, and several other public establishments, to aid in the regulation of the whole service of the city. The public is admitted to view the recipient chamber, and the purity of the water, which will shortly supply a very large proportion of the population, is a constant theme of admiration.

Gramme's Electric Machines.

M. Gramme has made a communication to the Paris Academy of Sciences respecting the improvements which he has made in his electric machines. The original machines ignited four inches of platinum wire 0·0118 inch in diameter; the improved machines will heat to redness four times that length of the same wire, without any increase in the weight of the materials or in labor. This augmentation in the intensity of the current is principally due to the employment of the new thin plate magnets of M. Jamin. The new electro-galvanic machines have only one central ring instead of two, and two electro-magnets in place of four, in the former machines. They weigh only 390 lbs. instead of 1,650 lbs; only measure 19 inches by 1 foot 9 inches in hight, in place of 2 feet 4 inches by 4 feet 5 inches; but deposit 4 lbs. 9 ozs. of silver per hour in lieu of 1 lb. 5 ozs. The power required to work the new machines, as compared with the old, is only as 50 to 75. They have the following advantages: (1) They only require half the space; (2) they are three fourths lighter; (3) they economize three quarters of the copper in construction; (4) they require thirty per cent less motive power. These improvements have been achieved by the suppression of the exciting coil, the bringing of the electro-magnet into the circuit of the current, by an improved arrangement of the copper garniture of the bars of the electro-magnets, and by a slight increase in speed. The original electric light machine fed a regulator of 900 carcel burners, its weight amounted to a tun, and it occupied a space of 2 feet 4 inches square by 4 feet in hight. This machine heated itself, and gave rise to sparks between the bobbins and the conductors. The new machine is composed of a framework in cast iron, two electro-magnetic bars, and a single movable central ring, instead of six bars and three rings. Its normal power is two hundred burners.

Dogs and Books as Vehicles of Disease.

A case of scarlet fever has recently happened in England, in which the disease was communicated to two children by a dog. It is believed that the animal, which had been the constant companion of a scarlet fever patient, had had its hair impregnated with contagious matter. This suggests the possibility of dogs, cats, and other household pets transferring the malady from one house to another, and renders it advisable to keep them out of the way during prevalence of the fever. Another little considered source of disease may be books in public libraries, particularly volumes which are freely circulated and which cannot be prevented from reaching the hands of patients afflicted with contagious diseases.

A Railroad on the Ice.

A brilliant Duluth newspaper proposes a railroad on the ice from Duluth to the Sault—the whole length of Lake Superior. It would simply spike the rails to the ice, without grading, filling, excavating, ballasting, or ties. The track, it says, could be taken up every spring and stowed away. The road would be about 400 miles long, and a dead level. It claims that the ice lasts till April; is thick enough to sustain a train of cars; the freight cars could be transferred to the ice without reloading, and the rails could be spiked to the ice, or they could be fastened in a frame and laid on the ice without spikes, "which would do just as well."

If some ingenious man will provide a way to float the track when the thaw comes, the railway might be used summer and winter, with no occasion to take her up. If Duluth did not then become the capital of an empire, then locomotion would be at a discount.

Horse Clipping.

The *Evening Post* is our authority for saying that Commodore Vanderbilt's mind has been exercised about the cruel, if not actually criminal, custom of clipping the hair from valuable horses, with the idea of adding to their beauty. This veteran horse fancier, who has hardly his superior in America, remarked, in presence of several gentlemen, that he would himself willingly give a handsome premium to any-one who would compile a correct report of deaths occurring among the valuable horses in the city of New York from colds and other diseases engendered by this practice. "In fact," added the Commodore, "I thought of this matter before getting out of bed this morning, and I really don't understand how it is that Mr. Bergh has not got after these inhuman fashionables. They certainly deserve his special attention."

Sperm oil is the best for oil stones. Do not use kerosene.

[*Continued from first page.*]

The saw is mounted on a separate carriage and has its own belt. Upon one side of the blade are secured two peculiarly arranged knives, so that, when the cutting mechanism is moved up against the edge of the head by the foot treadle, both sides are cut at once; and, at the same time, through its rotating, the work is turned in circular form. The saw carriage is provided with a counterpoise to bring it back into position when the treadle is released. The machine is so constructed that, with one and the same concave saw, all kinds and sizes of heads can be made, and the turning of one hand wheel quickly sets the machine to any size required; and the saw is so presented to the wood that it runs with the same freedom and smoothness, and requires no more power or set than an ordinary circular saw of the same diameter; and its work is done with great celerity and excellent finish. The machine has also an attachment which gives the heads an oval form, to compensate for the shrinkage of material. The attachment can be used or not, as desired; if not used, the heads will be perfectly round. This completes the operation of making the heads, which are then transported to the proper place and inserted in the barrels.

The next machine, to which we shall now call attention, serves to level the barrels and also to truss them. This, in our previous description, we explained as done by two separate devices, the first by a machine which compressed the barrel endwise between two disks, and the other by iron hooks and projections coming up through the floor, which, engaging with the truss hoops, forced them into place.

In the apparatus represented in Fig. 4, the devices are all connected with the leveling disks, and, by means of handles on each of the latter, are all opened at once. The barrel with the truss hoops on is then inserted, and a pressure of the foot treadle closes all simultaneously. By means of the clutch lever the machine is then thrown into action The pulley shaft actuates (through gearing) a screw shaft, which forces the movable disk toward the stationary one, thus, through the drivers, pushing the truss hoops to their proper places on the barrel, and, at the same time, leveling the ends of the same. This machine, we are informed, will truss and level 2,000 flour, sugar, cement, or any other kind of slack barrels, of various sizes, per day.

Fig. 5 represents the device used for bending and giving to metal hoops the requisite flare, and also for riveting the ends together. The bending and flaring is done by passing the hoop through the rolls shown, which are adjusted by set screws from above. The mode of doing this is clearly represented in the illustration. The ends are pierced by placing them under the punches arranged at the end of a lever actuated by an eccentric cam on the spindle of the lower roll. This done, the ends of the hoop are brought together, and the holes in each made to coincide by placing them over the two projections at the side of the lower portion of the apparatus. The hoop is then raised and the apertures slipped over the rivets, which are previously placed in the U shaped holders, just above the part last described. The side lever below the cam slot is square, and two lugs are formed thereon. Under these the hoop, with the rivets now inserted through its holes, is pushed; and in their descent the lugs strike the rivets and close them, completing the operation and leaving the hoop ready for placing upon the barrel.

We need hardly point out to our readers the remarkable ingenuity and inventive skill displayed in all of the above machines. They are, without doubt, destined literally to revolutionize the entire cooper's trade, since they are the first complete set of substitutes for hand labor in that difficult calling. As we remarked in a previous article, this machinery has been the inciting cause of serious strikes among the coopers. These uprisings, however, like all similar movements based upon the mistaken ideas which regard the continuance of trade monopolies as of more importance than the benefit to be gained by the public through inventive progress, have proved far more damaging to their originators than to those whom they were intended to coerce.

We are indebted to Mr. L. M. Palmer: at whose establishment, in Brooklyn, E.D., the immense number of barrels required by several great sugar firms are manufactured, some 5,500 per day: for the necessary facilities in obtaining the above interesting facts. The machines were invented and are manufactured by Messrs. E. & B. Holmes, of 59 Chicago street, Buffalo, N. Y.

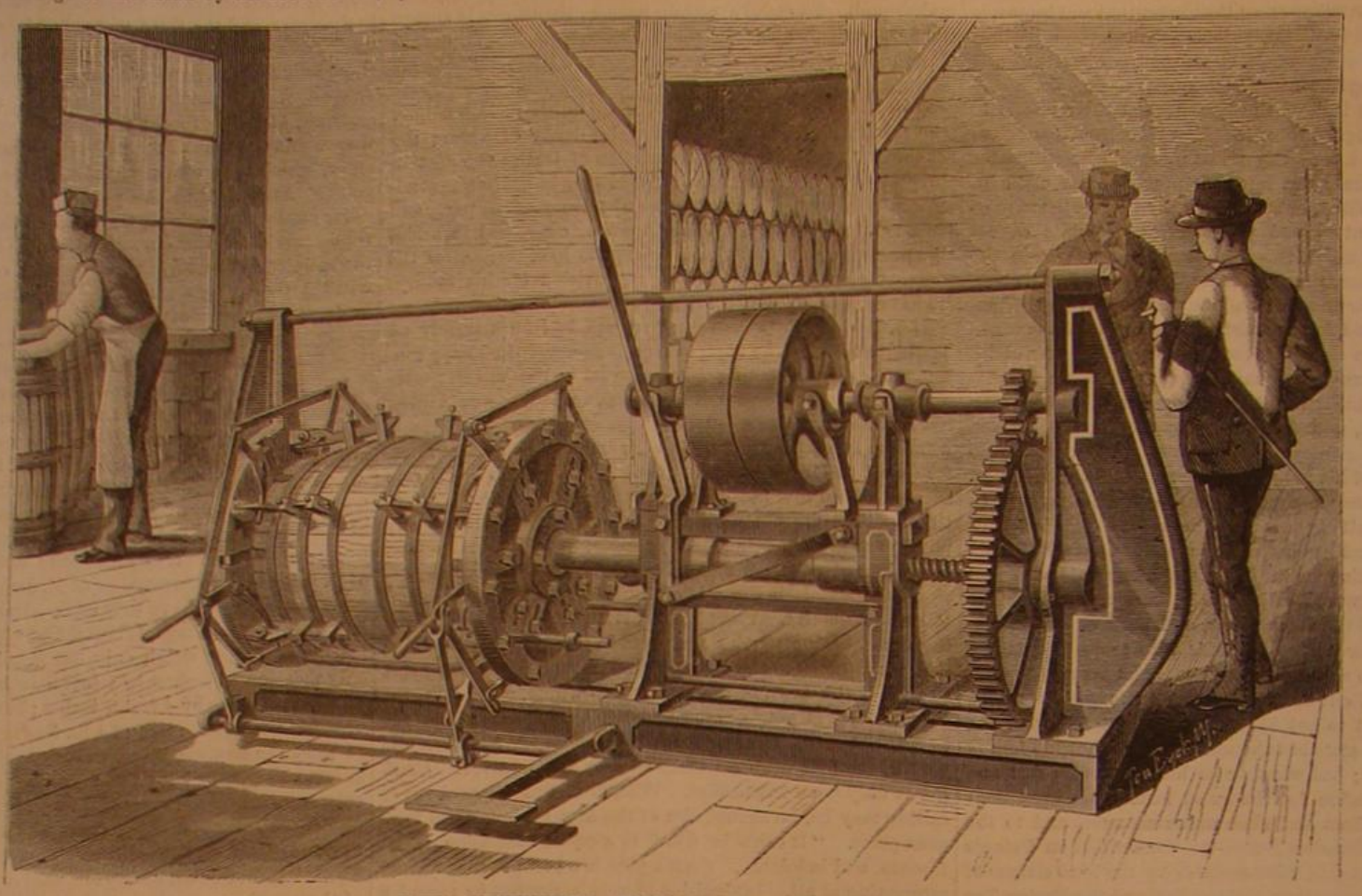


Fig. 4.—BARREL LEVELING, TRUSSING, AND HOOPING MACHINE.

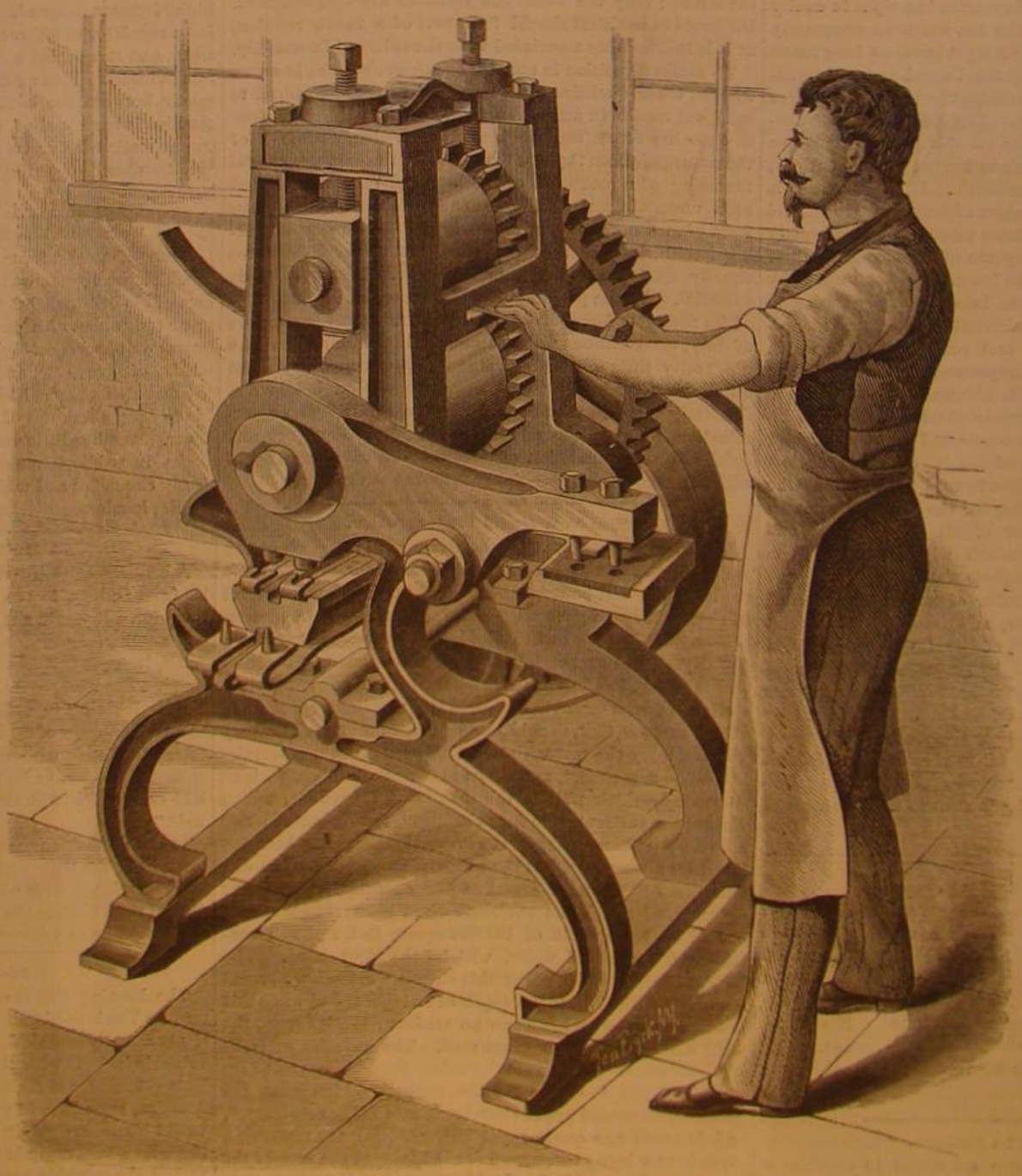


Fig. 5.—MACHINE FOR BENDING THE BARREL HOOPS.

Reproduction of Old Thoughts.

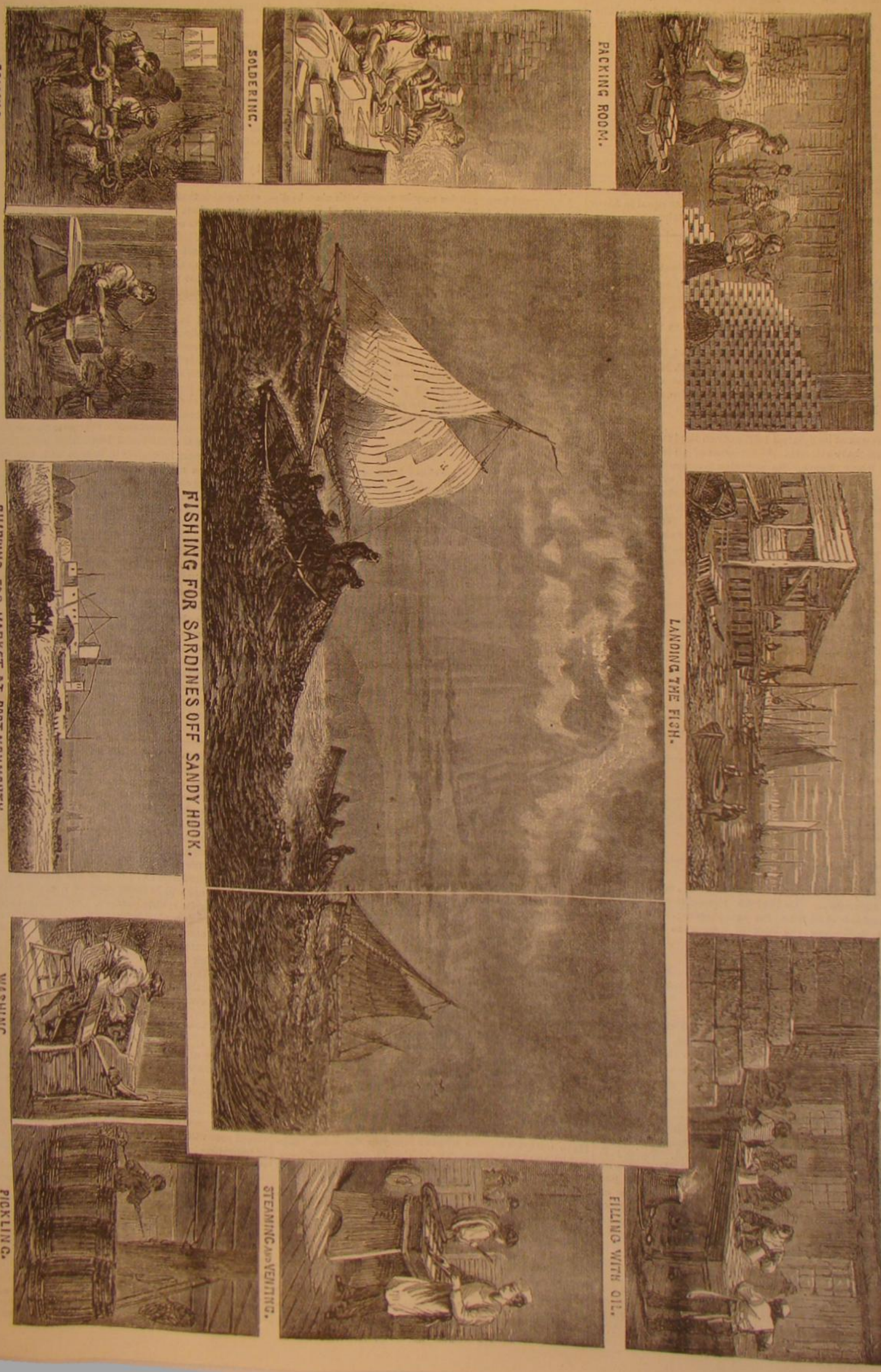
On the above theme, a writer in *Blackwood* thus discourses: Nothing is more strange than the incessant reproduction of old thoughts under the guise of new and advanced opinions. It would seem as if the human mind, with all its restless activity, were destined to revolve in an endless circle. Its progress is marked by many changes and discoveries; it sees and understands far more clearly the facts that lie along the line of its route, and the modes or laws under which these facts occur; but this route in its higher levels always returns upon itself. Nature and all its secrets become better known, and the powers of Nature are brought more under human control; but the sources of Nature and life and thought—all the ultimate problems of being—never become more clearly intelligible. Not only so, but the last efforts of human reasoning on these subjects are even as the first. Differing in form, and even sometimes not greatly in form they are in substance the same Bold as the course of scientific adventure has seemed for a time, it ends very much as it began; and men of the nineteenth century look over the same abysses of speculation as did their forefathers thousands of years before. No philosophy of theism can be said to have advanced beyond the book of Job; and Professor Tyndall, addressing the world from the throne of modern science—which the chair of the British Association ought to be—repeats the thoughts of Democritus and Epicurus as the last guesses of the modern scientific mind.

Clean files by holding them in a jet of high pressure steam

THE SARDINE INDUSTRY.

The purity and delicacy of the little fish which haunts the Bay of Biscay and the Mediterranean is known everywhere, its excellent keeping qualities, when preserved in oil, enabling it to be transported for an indefinite distance. It has much in common with the sprat in flavor, but also reminds the epicure of the anchovy, which, we believe, is peculiar to the Mediterranean and other coasts of France. It is a member of the herring family, as is also the anchovy; and, like all the species, is generally found in shoals. The sardine is identical with the pilchard, caught in such immense numbers on the southwestern coasts of England; but the latter is the mature fish, while the smaller fry are largely preyed upon by cannibal foes, especially the cod and the sturgeon.

A very excellent substitute for the sardine, however, is the menhaden, or mossbunker, which, in the spring and fall, is found in great numbers along our coasts. It is slightly spotted on the back, and is sometimes called the ocean trout. The objection to these fish, for general use, is that they are very bony. The American Sardine Company, says *Harpers Weekly*, from which we select the engraving, by a mechani



cal process known only by themselves, have removed this objection.

Our illustrations show the several processes through which the fish are passed after being taken. They are first brought to the scaler, which consists of a long shaft, on which are twelve wheels filled with long blunt teeth, which revolve very rapidly, and take off every scale in an incredibly short space of time. From the scalers they are passed to hands who chop off the heads and cut out the entrails. They are then placed in the washing troughs, above which are a number of revolving circular brushes, by contact with which the insides are thoroughly cleaned. They are then placed in pickle vats, where they remain for a few hours, until they are sufficiently salted; after which they are spread upon large tables, where they are placed in the cooking cans. They are then taken to the steaming tanks, of which there are seven, each having a capacity for holding 1,000 boxes. From the steaming cans, they are again taken to the tables and transferred to the permanent cans, when they are oiled and spiced, and then handed over to the tinsmiths to be soldered. The time from the fish being brought to the factory until they are boxed and labeled, is three days.

These fish are shipped in large quantities to every part of the country, and by many are considered quite equal in flavor to the sardines imported from France and Italy.

ASTRONOMICAL NOTES.

OBSERVATORY OF VASSAR COLLEGE.

For the computations of the following notes (which are approximate only) and for most of the observations, I am indebted to students. M.M.

Positions of Planets for February, 1875.

Mercury.

Mercury is at its greatest elongation from the sun on the 13th of February, when it sets at 6h. 10m. P. M., and should be seen in the twilight, north of the point at which the sun disappeared. On the 28th of February, Mercury sets at 6h. 8m. P M.

Venus.

Venus was at its greatest brilliancy on the 12th of January, and must have attracted the attention of all observers during the whole month. Its meridian passage being near 9 A. M., it could be followed with the naked eye during the morning, and for some time after it passed the south point. Its crescent shape could be seen with a small telescope.

On the 1st of February, Venus rises at 4h. 13m. A. M., and sets at 1h. 48m. P. M. On the 28th of February, Venus rises at 4h. 18m. A. M., and sets at 1h. 54m. P. M. If its motion is watched among the stars, it will be seen to be moving rapidly toward the east.

Mars.

Mars is coming into a better position as to time of meridian passage, but is lower and lower in the south. It rises at 1h. 50m. A. M., of the 1st, and sets at 11h. 36m. A. M. On the 28th it rises at 1h. 16m. A. M., and sets at 10h. 36m. A. M.

Jupiter.

We are coming into better position relatively to Jupiter, but it is still best seen in the early morning hours.

On the 1st of February, Jupiter rises at 11h. 49m. P. M., and sets at 10h. 31m. the next morning. On the 28th, Jupiter rises at 10h. 3m. P. M., and sets at 8h. 45m. A. M. the next day. Early in the month Jupiter is directly south near 5 A. M., in the middle of the month at 4 A. M., and near 3 A. M. at the last of the month.

Saturn.

On the 1st of February, Saturn rises at 7h. 32m. A. M., and sets at 5h. 26m. P. M. On the 28th, Saturn rises at 5h. 36m. A. M., and sets at 3h. 58m. P. M.

Uranus.

Uranus is in a good position, as it comes to meridian at midnight and at a high altitude.

On the 1st, Uranus rises at 5h. 10m. P. M., and sets at 7h. 20m. in the morning. On the 28th, Uranus rises at 3h. 18m. P. M., and sets at 5h. 32m. the next morning. An ordinary telescope will show the disk of Uranus, so that it can be known from a star.

Neptune.

Neptune rises on the 1st at 10h. 27m. A. M., and sets at 11h. 33m. P. M. On the 28th Neptune rises at 8h. 42m. A.M., and sets at 9h. 50m. P. M.

Sun Spots.

Photographing has been interrupted since the last report by the holidays, and later by clouds and wind. From January 7 to January 16, the sun was observed with a small telescope nearly every day, and the spots were very few and small.

How to Grow Lean.

From a quotation in the London *Medical Record*, we learn that M. Philbert states that the principal measures for reducing obesity come under four heads:—1. *Régime*; 2. Hygiene; 3. Exercise and Gymnastics; 4. Waters with sulphate of soda. The basis of the *régime* rests on the prevention of the introduction of carbon into the system, or on favoring its transformation, and augmenting the amount of oxygen. The food must, therefore, be non-nitrogenous, varied with a few vegetables containing no starch, and some raw fruit. But the temperament of the patient must be kept in view. The lymphatic should have a red diet, beef, mutton, venison, hare, pheasant, partridge, etc., and the sanguine should have a white diet, veal, fowl, pigeons, oysters, etc. Vegetables, not sweet or farinaceous, may be allowed: grapes, gooseberries, apples, etc. *Café noir*, tea with little sugar and the addition of a little cognac, may be used. We must forbid sugar, butter, cheese, potatoes, pastry, rice, beans, peas, etc.

The hygiene consists in favoring the action of the skin, in wearing a tight roller to support the walls of the abdomen, in taking plenty of exercise on foot or on horseback, playing at billiards, fencing, swimming, gymnastics, etc.

The Banting treatment is not very different. It consists in abstaining from bread, butter, milk, beer, potatoes, pudding, and from sugar in every shape. It allows some biscuit or dry bread, every kind of fish except salmon, and every kind of meat except pork, all vegetables except potatoes.

Purgatives have a good deal to do with the success of treatment of cases of obesity, and some have thought scammony as effective as sulphate of soda.

Useful Recipes for the Shop, the Household, and the Farm.

Water containing lime compounds—very common in country wells—may be rendered fit for use, for many purposes in the arts, by the addition of a little chloride of ammonium.

Glycerin added to paper stock increases the flexibility of the paper.

Copper and brass articles may be coated with zinc, by dipping them into a boiling concentrated solution of sal ammoniac containing finely divided zinc.

Platinum bronze, said to be entirely unoxidizable and especially adapted to the manufacture of cooking utensils, is made of nickel 100 parts; tin 10: platinum 1.

A mixture of 358 parts phosphate of soda and 124 parts boracic acid is mentioned as another good copper-welding compound.

Pure glycerin may be tested as follows: When treated slowly with sulphuric acid, it should not turn brown; with nitric acid and nitrate of silver, it should not become cloudy; and when rubbed between the fingers it does not emit a fatty smell.

Silicate of soda (water glass) stops fermentation.

Adulteration of soap by starch is shown by dissolving the soap in alcohol, which leaves the starch behind.

Anhydrous phosphoric acid is the most perfect known substance for drying gases.

Never allow drinking water to be drawn from a cistern supplying a water closet.

Extend pipes from water closet traps or one (larger) from the main waste pipe into the nearest chimneys. The pestilent gases will thus be carried off, instead of being allowed to escape into the house.

To make artificial veneer, soak the wood for 24 hours and boil for half an hour in a ten per cent solution of caustic soda. Then wash out the alkali, when the wood will be elastic, leather-like, and ready to absorb the desired color. After immersion in the color bath, dry between sheets of paper under sufficient pressure to preserve the shape.

Dry furnace heat, productive of throat and lung diseases, may be moistened by hanging a wet towel in front of the register, the lower edge of the towel being allowed to dip in a shallow vessel of water.

After taking up a carpet, sprinkle the floor with very dilute carbolic acid, before sweeping.

Avoid wearing heavy overcoats or furs for hours in succession; the tendency is to weaken the powers of resistance of the wearer leaving him liable to inflammation of the throat and lungs.

To cut india rubber, dip the knife blade in a solution of caustic potash.

A wall of soft burned bricks built up within a cistern makes an excellent filter.

Never store any articles of food or drink in old petroleum barrels. They are poisonous even after being cleaned.

To mold figures in paste, take the crumb of a new drawn white loaf, mold in a mass until the whole becomes as close as wax and very pliable. Then heat and roll with a rolling pin. Mold it to the required shape, and dry in a stove.

Frozen potatoes can be cured by soaking in water three days before cooking.

In drilling wrought iron, use one pound of soft soap mixed with a gallon of boiling water. This is a cheap lubricator, and insures clean cutting by the drill.

To cure scratches on horses, wash the legs with warm strong soap suds and then with beef brine.

To remove paint splashed upon window panes, use a hot solution of soda and soft flannel.

Frosted feet may be relieved of soreness by bathing in a weak solution of alum.

Never use glazed earthenware pipes for upward flues.

Effects of Copper and Brass on the Color of Vermilion.

It has often been observed that, when vermilion inks are employed for printing from copper plates or copper-faced types and electrotypes, the color changed to a dirty brown or black. In the manufacture of playing cards, it was impossible to use brass stencils without injury to the color. Karmarsch has been studying this subject for a number of years, and some of his experiments and results, having been made public, have been repeated by Heumann.

Karmarsch at once recognized the fact that the change of color was due to the formation of sulphide of copper, but he supposed that the sulphur necessary to produce this came from impurities in the vermilion. For, said he, it is highly improbable that the vermilion is decomposed at ordinary temperatures, and the text books in chemistry point to no such facts.

Heumann, of Darmstadt, however, has recently proved that this highly improbable decomposition does nevertheless take place. Karmarsch's proposition to boil the vermilion in a solution of purified potash seemed to Heumann rather useless, still he followed his plan. He took very pure vermilion, perfectly free from metallic mercury, which did not discolor the potash solution when boiled in it, nor could a trace of sulphur be detected in it. Nevertheless, when a strip of bright copper or brass foil was placed in it, it immediately became covered with a film of black sulphide of copper. When the vermilion, that had been boiled three times in fresh potash lye and washed, was rubbed on the strips of metal with a cork, they were blackened. Perfectly dry vermilion requires to be rubbed with some pressure; but when stirred up with a little water, it suffices *to merely* rub it on the metal with the finger. When rubbed quite hard with the cork, a part of the film separates from the metal, and, mixing with the vermilion, imparts to it an almost black color; while the copper, at the point where it was in contact with the vermilion, looks as if it had been amalgamated. It is even possible to write on copper and brass with a piece of sublimed vermilion; and after rinsing with hydrochloric acid, the writing appears in silver-colored characters.

The ease with which vermilion is decomposed is shown by this experiment, and, of course, that property cannot be removed by boiling with potash solution. Karmarsch, however, states that there are two ways of freeing commercial vermilion from those sulphur compounds which alone effect the formation of sulphide of copper: First, that already mentioned of boiling in potash, and second, mixing the vermilion to a paste with water, and putting in strips of copper, which take up all the free sulphur, and take away from the vermilion that property of blackening copper. This result can only be explained on the supposition that the vermilion employed for the experiment actually contained sulphur which could be removed, and by which the copper was changed, while the vermilion itself was not in sufficiently intimate contact to suffer decomposition.

Heumann, following Karmarsch's example, placed a bright copper coin for some time in a paste of vermilion and water, and found on rinsing the coin off that the metal had remained almost unaltered. Only on those spots which had accidentally been rubbed with a glass rod, used to stir up the precipitate, was the metal blackened. Wherever the copper coin lay against the side of the vessel beneath the paste, so that the metal came more intimately in contact with the vermilion, amalgamation and blackening took place at once.

The results obtained by Karmarsch are, according to this, only possible when the copper coin lay perfectly quiet in the pigment, and so was able to take up only the free or dissolved sulphur.

Since in printing with vermilion, or in rolling or brushing it through stencils, the contact is sufficiently intimate, in many places at least, to decompose the pigment, it is evident that boiling the vermilion in potash solution cannot prevent the injury to its color, although this may perhaps be reduced. Moreover, when rubbed up with oil, the pigment is not so strongly attacked as when dry or wet with water. Iron decomposes vermilion only at a high temperature, and hence may be rubbed with it without injury to the color. Zinc only decomposes it slightly when rubbed with the wet color; and as the sulphide of zinc produced is white, the change of shade is scarcely perceptible. Nickel, too, we believe, does not act upon vermilion, and hence the advantage of nickel-faced type over copper-faced for use with vermilion ink.

British Telegraphic Progress in 1874.

The most important telegraphic improvements in the British system of Telegraphy, consist in the extended use of American inventions, that have been employed here for years. For example, *Engineering* says:

An important change has been effected during the year by the more complete adoption of the "Sounder." This is a step in the right direction, and the "Sounder" will eventually become the principal instrument in use by the department. Its introduction will be slow and gradual, but unquestionably its use will be found attended with the greatest success. The Duplex system has been found to answer admirably, and where business had increased to such an extent as to require extra accommodation, it has been at once introduced to the improvement of the working. On short circuits the ordinary Duplex system has been used, but in longer circuits the system known as "Stearns'" has been adopted. At the present time the total mileage of wire working on the Duplex principle is over 12,000 miles, the largest circuit being 450 miles.

A Large Prize.

The King of Belgium has established an annual prize of $5,000 to be awarded for the best works or investigations upon certained determined subjects. The competition is confined exclusively to Belgians, except in every fourth year, when the citizens of any nation may compete. The first general concourse takes place in 1881, when the above mentioned sum will be awarded for the best work on methods of improving harbors on low and sandy coasts, similar to those of Belgium.

Gas Dangers.

Too much care cannot be exercised in seeing that leaks do not exist in the gas pipes or that burners in unoccupied rooms are not left partially turned on. Ordinary illuminating gas, when mixed in certain proportion with air, forms a dangerous explosive mixture, liable to blow up on contact with flame. A fearful explosion occurred almost under our windows recently, and three people were injured, through a girl entering, with a lighted lamp, an apartment which received the escape from a leak in the gas main.

Recent American and Foreign Patents.

Improved Vibrating Propeller.

Charles P. Macowitzky, Corpus Christi, Tex.—This invention is an improvement on the propellers for which the same inventor obtained previous letters patent, and it relates to the arrangement of the sliding frame, to which the paddles are pivoted, with relation to the side or shell of the boat or other vessel, and to the rack bar by which the paddles are vibrated. By reversing the paddles upon one side, the vessel may be turned in a very small space—almost upon her axis. A vessel with this system of propulsion will be enabled to avail herself of winds, and go under sail entirely, if so desired.

Improved Wheel Plow.

William Dickie, Gillespie, Ill.—This invention is a wheel plow in which novel devices are provided to allow of its being easily raised from and lowered to the ground, adjusted to work at any desired depth in the ground, and to run level whatever may be the depth of the furrow being plowed, and when both wheels are running upon the unplowed land.

Improved Cooking Stove.

Edwin O. Brinckerhoff, New York city.—In this stove, by suitable arrangements of flues and dampers, the products of combustion are caused to pass over the top, back, bottom, front, and sides of the oven, so that the said oven will be heated evenly and thoroughly with the least possible amount of fuel.

Improved Car Coupling.

Charles Surplice, Ludington, Mich.—Levers are provided by means of which the drawheads are moved laterally, and there are scroll springs at the back ends of the drawheads, which give them flexibility. The drawheads are allowed to rise by means of wedge-shaped keys, which are operated by levers. The other ends of these levers work beneath the horizontal bars and on horizontal levers, and are so held in any position. The keys work under angular plates which limit the lateral movement of the drawhead. Arms on the ends of shafts raise the hooks by levers at the front ends of the coupling. The coupling bar is made to engage with the hooks. This coupling bar is retained in a horizontal position by the shape of the cavity in the drawhead and the form of the hook, so that the cars will couple automatically when they come together.

Improved Wood Sawing Machine.

Henry Filley and Alanson D. Wood, Hersey, Mich.—By an ingenious application of cams, arranged alternately with reversed curves on the driving pulley, two double motions of the saw are made to one revolution of the driving pulley. The cross head is connected to an endless rope, which passes over pulleys and is connected to a hand lever, which is used to raise and lower the saw by moving the cord up and down. This lever is also used to press the saw into the work, and is provided with a cord and weight for applying the pressure.

Improved Vibrating Propeller.

Clement Theobald, Elliston Station, Ky.—This is a submerged incased propeller, consisting of reciprocating bars arranged under the water on each side of boat, and provided with a series of short hinged side paddles. The forward stroke of the slide boards throws the paddles sideways along the boat, and on cushioning springs, so as to offer hardly a resistance to the water, while the return stroke throws them on the braces into position for producing the propulsion of the boat.

Improved Auger.

Charles F. King, Covington, Pa.—This auger has a detachable cutter head, which may be readily replaced when injured, and which allows the use of the auger with cutters of various sizes. The detachable cutter head is placed over the screw point, and connected by grooves with dovetailed side recesses, fastening the screws to the lips of the auger.

Improved Automatic Pumping Engine.

Hiram S. Maxim, New York city.—The construction of the fire chamber is such as to leave a thin stratum of water all around the sides, so that the formation of steam will begin very soon after the fire has been started. The fire pot is made in the shape of a short tube open at both ends, and in its lower part is placed the perforated burner, which is secured to the end of a supply pipe, through which the combustible is introduced. When the pressure in the boiler increases, a diaphragm is raised against the weight of a block, and the force of a spring closes a valve more or less, according to the amount of pressure in the boiler and vessel. A small hole is drilled through the valve to enable enough of the combustible to always pass through to support a small flame, and thus prevent the flame from being extinguished by the closing of the valve, so that, as the valve again opens upon the diminution of the pressure, the flame will immediately increase, the formation of steam being thus increased and diminished automatically. With the steam pipe is connected a four-way casting, with the inlet and outlet arms of which are connected the parts of the said steam pipe. With the upper arm of the casting is connected a safety valve. With the fourth arm of the casting is connected the throttle valve. The pump is attached to the frame work upon the side opposite to the engine, is single-actung, and the water escapes from it through the valve chamber into the four-way casting, with one arm of which the discharge pipe is connected. Other ingenious devices are provided to ensure constant oiling and a steady flow of water, and to regulate the feed.

Improved Railway Switch.

Samuel T. Dutton, Worcester, England.—This invention provides a means for rigidly securing the facing points of switches, to prevent the possibility of the points being fouled by the opening of both tongues at one time. The switches are made from twenty to twenty-two feet in length, and are connected and moved separately, in such manner that only one tongue can be moved at a time. The switch is connected to the single rod by cranks at two or more places in its length, thereby holding the switch firmly and equally against the stock rail at different points. To secure the facing tongue close up to the rail, at the point of each tongue is placed a cam, moving on a stud on the point chair, each cam being connected to and moved by the opposite switch. It follows that, when either of the switch tongues is opened, it will cause the other tongue, which then becomes the facing switch, to be secured in its place, and, as the open or free switch cannot be closed while a train is passing or standing in them, the facing switch thereby remains secured.

Improved Well Drilling Machine.

John E. B. Morgan and Henry Kelly, Osage, Iowa.—The mast over which the rope for working the drill rod goes can be readily folded down on the frame, for convenience in storing and moving. Devices are provided, so contrived that the rope can be let out at any time, as the drill descends, without stopping the machine. Whenever it is required to raise the drill rod out of the well for pumping it out, the power employed for working it may be employed therefor merely by throwing in the clutch; and when the clutch is thrown in gear, the stop lever arrests the drill-operating lever and holds it, so that the drill ceases working while being raised.

Improved Combined Roller and Harrow.

William W. Anderson, Wartrace, Tenn.—When the machine is drawn forward, cutters cut in pieces stalks and weeds and cultivate the wheat, while rollers will roll it, leaving the ground smooth for the harvester. When only a roller is required, the machine is turned, so that only the rollers will touch the ground.

Improved Lawn Mower.

Leonard G. Youngs, Morris, Ill., assignor to himself and Richard Hughes, same place.—This invention relates particularly to the construction of the axle and ratchet lever for vertically adjusting the frame and hand guide bar of the machine, and also to the connection of the finger bar with the frame, to adapt the former to be raised entirely off the ground when the machine is to be moved from one point or place to another.

Improved Railway Axle Boxes.

C. A. Hussey, New York city.—The first invention is designed to prevent the entrance of dust and sand into the axle boxes of railroad trucks, and thereby prevent the heating and wearing of the journals and brasses over them. This is accomplished by means of leather packing, arranged to form a tight connection from the box against the wheel, so that the lubricating fluid may be poured into the box, to allow the journal to run in oil. The invention does away with the old dust plate and the cotton waste packed in beneath the journal. The axle box is made shorter, smaller, and consequently lighter and cheaper than the common box, while it accomplishes the object in the most perfect manner, that is, the complete lubrication of the journal and its consequent protection from heating and wearing. Mr. Hussey has also another invention, which is an improved method of preserving the journals and brasses of railroad axle bearings from heating and wearing. This is accomplished by producing a circulation of water or other liquid through the brass or box, which receives all the friction of the journal. The brass of the axle is chambered out in any suitable manner, and elastic tubes are connected therewith for conducting and discharging the water to and from the brass. A lively current of water is produced from an elevated reservoir, which keeps the brass and journal at a low temperature. The ordinary absorbent (cotton waste) may be used in axle boxes having this cooling current applied to the brasses with safety from heating and wearing. Both inventions have been patented through the Scientific American Patent Agency in Canada, England, and most of the countries on the continent, and one of our leading railroads is about to adopt one or both improvements in their cars.

Improved Drawbar and Buffer.

Charles Billmeyer, York, Pa.—This invention relates to novel means for reinforcing and sustaining the ordinary transverse car springs to which the drawbars are attached, and consists in combining three springs with the same beam, bolt, and nut.

Improved Gin Saw Sharpener.

Josiah Mizell and John Revell, Colerain, N. C.—This invention relates to machines for sharpening the teeth of a series of saws arranged upon the same shaft, the object being to direct the feed of the rotary file from one tooth to another while the same sharpener is thus adapted to saws of different diameter, and the saw that is being sharpened is steadily centered between the legs.

Improved Vapor Bath.

John Becker and William D. Hoffman, Sigourney, Iowa.—This invention relates to a mode of using electricity as a vehicle, in connection with steam, for the introduction of medical remedies through the pores of the skin. The invention consists in arranging the evaporation pan in such a way as to afford a general or special delivery of the vapor; in the use of doubly adjustable electrodes, and in providing the bath closet with a tube that has an internal conductor and binding screw.

Improved Gas Cooking Apparatus.

Thomas Peacock, of Wood Green, and John C. Peacock, of Finsbury Park Road, England.—This is a simple arrangement of metallic casings, in which the air necessary to support combustion, after passing through holes in the internal casing of the door, is conveyed to gas jets, and the heated products circulate all around the oven, and finally make their exit, cooling as they descend, through holes into the flue to the chimney. The back of the apparatus is formed with a double casing, with intermediate space forming the flue. The gas jets in the door are enclosed in a small separate case, which is open at the top.

Improved Cart Brake.

Justus B. Mead, Jr., Darien, Conn.—This invention consists of brakes for the wheels of a two-wheeled vehicle, arranged on the box independently of the shafts, so that they will turn around with the wheels and be utilized for tilting the box when the cart is backing up to the place to dump. The invention also consists of the brakes pivoted to the sides of the box, one to each wheel, and connected in a peculiar manner to one lever, whereby both may be operated by it.

Improved Extension Ladder and Fire Escape.

Abraham Oberndorf, Jr., and Ernest Frank, Baltimore, Md.—This invention relates to certain improvements in fire escapes, and it consists in the combination of friction wheels, ratchet tramways, and guide blocks, with the four corner posts of separate and independent stories, which slide into each other after the manner of a telescope. It also consists in the combination of horizontal swinging bars and vertical rods, with detents which fit in the ratchet teeth and support the stories, for the purpose of affording means for operating the stories. The invention also further consists in the combination with hoisting pulleys of a windlass consisting of separate and independent barrels, corresponding in number to the number of the movable stories, which rest upon a core or shaft, or revolve with the same by means of a clutch wheel and spline, as may be desired.

Improved Hay and Cotton Press.

William C. Banks, Como, Miss.—This invention relates to certain improvements in cotton presses, and it consists in the peculiar construction and arrangement of the devices for adjusting the follower block and its pivoted supporting bar in its position to one side of the box, for the purpose of obviating the obstruction usually afforded by the same when the box is being filled. It also consists in the peculiar form of the box, which has increasing transverse dimensions as it tapers from the mouth to the place where the bale is compressed.

Improved Safety Catch for Elevating Carriages.

Henry Opperman and Alexander Black, Steubenville, Ohio.—This invention relates to the cages in which men and materials are transferred to and from the inside of a mine, the object being to provide a safety attachment by which danger from the breakage of a rope or other part of the holding device will be surely and effectually prevented.

Improved Sight Protector.

M. H. Mendenhall, Wabash, Ind.—The object of this invention is to provide an improved device for use in reading by the aid of artificial light. The same consists in a lamp-containing box, or case, cut away at one side and provided with a pivoted or hinged plate for deflecting the light, the latter being adjustable and adapted to be clamped or secured at various angles. The rays of light may be concentrated and practically increased in power; or their amount and direction may be varied at will, by changing the position of the pivoted deflector. The eyes of the reader are at the same time protected from light and heat. The device is adapted for general use, and particularly with sewing machines.

Improved Shingle-Dressing Machine.

Samuel M. King, Lancaster, Pa.—This invention consists in novel and very effectual means whereby both sides of a shingle may be planed and faced smooth by a single operation, thus greatly lessening the cost of manufacturing the article.

Improved Wash Stand.

William Schwarz, New York city.—This wash stand has a lid to which is hinged a looking glass. There is also a water receptacle and basin, a blacking stand, which may be drawn out at will, and a convenient drawer. The whole, when closed up, presents the appearance of a bureau.

Improved Sail for Vessels.

James C. Nichols, New York city.—This invention consists in combining, with the gaff of a fore-and-aft sail, an independent sail, connected with the mast by means of a jackstay and rings, and adapted to be furled to the gaff.

Improved Engine for Rock Drills.

James Brandon and Albert W. Trankle, New York city.—Steam passages connect each end of the cylinder with the steam chest, and enable the piston to be reciprocated. This piston has annular grooves connected by longitudinal grooves. The channel ways thus formed between these heads connect with channels and with the live steam chamber. There is, in consequence of this relative construction, an equilibrium of steam pressure always maintained on both sides of the pistons, except just before the heads reach the limit of their throw. The steam is momentarily cut off and serves to reverse the position of the pistons and the valve.

Improved Alarm Combination Lock.

Henry W. Dilg, Portland, Oregon, assignor to himself and William Zimmerman, same place.—In this lock, the tumblers are provided with false and true slots, which are not radial to the center, but in line with a prolongation of the pins or tongues of the main bolt. A spring hammer with alarm bell is connected with the tumbler wheel, and set by a stud, in connection with alarm tumblers, so that any attempt at opening the lock without setting them to their combination will be indicated by the continued ringing of the bell.

Improved Medicated Bath Apparatus.

Jean Joseph Louis Brémond and Paul Alexis Ernest Brémond, Paris, France.—The object of this invention is to provide a means for the cutaneous application of medicines for the purpose of healing diseases. It consists in an airtight chamber, provided with means of ingress and egress, and having a hole through the top, through which the patient's head protrudes, the said chamber being lined with such material as is not likely to be affected by the corrosive action of the medicines. At one end of the chamber, near the top, is an enclosed place, provided with sliding doors, in which rests a vessel containing the medicated solution, and in the bottom of said vessel rests one leg of a glass siphon, about one sixteenth of an inch in diameter. The other leg passes down the inside of the chamber, and communicates inside with a funnel-shaped mouth, at right angles with a steam pipe, after the manner of an atomizer.

[Improved Clevis.

Leander Ellsworth Smith, Dixon, Ill., assignor to Theron Cumins, Henry T. Noble, and Orris B. Dodge, of same place.—This is a simple double hook and cast stud which serves to brace the plow clevis and to allow of its speedy lateral adjustment.

Improved Locking Latch.

Henry Rogers, Eureka, Cal., assignor of one half his right to Hiram Allen Haskins.—The novel feature in this lock is that the simple throwing over of an eccentric from one side to the other releases or locks the main bolt, which is still farther secured, without any possibility of being tampered with from the outside, by a knob bolt, which slides in a slot of the inner face plate, and enters a recess of the eccentric, when the same is thrown into position for locking the main bolt.

Improved] Table Hinge.

Andrew Grimm, Union Hill, N. J.—This is a novel combination, with a table having a hinged leaf, of a hinge having its pintle directly under the leaf joint. One wing is screwed to the leaf, while the other is formed in the shape of a slide piece, which moves in a recessed casing screwed to the table. This is acted on by chambered springs of a suitable strength, while the leaf is rested on a projecting shoulder of the casing.

Improved Wagon Spring Seat.

John Griffith, Bellefonte, Pa.—This consists in the attachment of strong supporting standards to the sides of the wagon, and the connection of the standards by a pivoted clip with torsionally acting springs that are securely applied to the seat by central and side socket clamps.

Improved Stop Valve.

John Demarest, Mott Haven, N. Y., assignor to the J. L. Mott iron works of New York city.—This is a combination of annularly-grooved valve and pipe, the former having a large upper and a comparatively small lower flange, while the latter has an enlargement or seat with a packing ring. By this relative construction of pipe and valve the ring is carried down by the piston, so that it remains between the valve body and the pipe, making a perfectly watertight joint. When, however, the piston is withdrawn, the lower flange raises this packing ring, and allows it to clasp the body of valve.

Improved Car Ventilator.

Franklin N. Clark, Wellington, Ohio.—This ventilator is attached to a plate of metal which is fitted into the window, and inside the latter supports a water reservoir. An expansible air receiver is placed outside the window. The reservoir receives the air from the air receiver tube, and discharges the same by an inside pipe, the latter having an annular funnel-shaped orifice. The effect is to purify the air admitted.

Improved Tongue Ring for Neck Yokes.

Seth D. Bingham, Maumee City, Ohio.—The invention consists in a tongue ring for neck yokes formed of the leather covers and a metal plate. The upper ends of the plate and of one part of the cover are left free to be passed around the neck yoke and to be secured by rivets. By this construction the rings may be made and applied to any neck yoke.

Improved Plow.

Chauncey M. Van Every, Bronson, Mich.—There is a horizontal plate on the top of the plow standard, and a plate attached to the beam. The latter plate has dowel pins to hold it strongly against being turned horizontally on the beam, and it has near one end a concave and under-cut flange with vertical notches, in which corresponding points on the end of the standard plate fit. The beam plate is rounded and fitted in a concave and under-cut shoulder of the standard plate, all so that, when both plates are attached to the beam by a single bolt, the plow will be firmly but detachably secured, so that it can be shifted readily at any time to alter the lead of the beam.

Improved Leather-Scalloping Machine.

Isaac P. Hall, Miamisburg, Ohio.—A roller is made of a length equal to the breadth of the strip of leather to be operated upon, and in its face are formed two zigzag grooves having the form of the required scallop, and in which are placed two small blocks, which serve as knife-holders, and which slide along the grooves as the roller is revolved. To the sliding blocks are pivoted the ends of two rods, the other ends of which receive pins attached to a bracket, which is secured to the bench. To the sliding blocks are attached knives which project upward, so as to enter zigzag grooves in another roller, which is made to overlap the ends of the roller first mentioned. The rollers may be made of various lengths, according to the breadth of the leather strips to be operated upon.

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More than a Million Screws—50 Sizes and Styles—from ¼ to 1¼ inches long—made for sewing machine work. Will sell at less than ½ cost. Send sample of screw wanted, stating quantity, and will return sample of nearest we have to it, with price. Hull & Belden Co., Danbury, Conn.

One of the largest advertising houses in the country is that of Geo. P. Rowell & Co., 41 Park Row, New York. We have had transactions with them to a considerable extent, and do not hesitate to commend their method of doing business. Parties desiring to advertise in a large number of papers cannot do better than to communicate with them.—[New York Observer.]

Wanted—To Lease or Buy a 2nd hand Diamond Drill. Wm. Ross Coven, Georgetown, D. C.

Babbitt Metal—Made from the same receipt, for over 30 years—the celebrated J. B. brand—never known to fail. J. W. Baker, 821 North 2nd St., Philadelphia, Pa

Wanted—To Sell Canadian Patent for Cole's Automatic Boiler Feed Regulator and Low Water Alarm Combined. Address H. S. Cole & Co., Milwaukee, Wis.

Partner Wanted—To take a third interest in a Foundry and Machine Shop, now in operation. An experienced Machinist preferred. References given and required. For particulars, address G. O. King, Corry, Pa.

J. N. Cassell, Lincoln, Neb., wants a double Curry Comb manufactured on royalty in Combs.

For Sale—Propeller Steamboat, 19½ feet long, 6 feet 2 in. Beam, by J. A. Spead, South Newmarket, N.H.

Every Metal Worker should have a Universal Hand Planer. For Catalogue, J. E. Suitterlin, Manufacturer, 60 Duane St., New York.

For Sale Cheap—1 Second hand 40 lb. Hotchkiss Air Spring Hammer. D. Frisbie & Co., New Haven, Ct.

For a proper Party having Capital and Facilities for Manufacturing, I offer Partnership in one or all of Three Patented Articles. Cast Iron, Earthenware, Fine Metal Work. Address S. C., P.O. Box 681, Baltimore, Md.

We want a small domestic patent; must be good and cheap, that sells anywhere. Reed & Co., 335 Broadway, New York.

Wanted—To secure a good Patent, small article preferred, to sell by territorial rights. The inventor of a first rate article will be liberally treated with by addressing Needy, Box 2841, Philadelphia P. O.

The Varnishes and Japans of the London M'f'g Co. compare favorably in price with, and are unexcelled in purity, durability, and color by, any first class houses in Europe or America. Hyatt & Co., office 246 Grand St., New York; Factory, Newark, N. J.

Diamonds and Carbon turned and shaped for Scientific purposes; also, Glaziers' Diamonds manufactured and reset by J. Dickinson, 64 Nassau Street, N.Y.

Metallic Pattern Letters and Figures, to put on patterns of castings, all sizes. H. W. Knight, Seneca Falls, N.

Planing Mill Machinery Wanted—Address, price and terms, Hunter & Tilley, Berkley, Norfolk, Va.

For small size Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

Wanted—Official Patent Office Gazette, Volume 1, for which a fair price will be paid. C. O. Thompson, Worcester, Mass.

Inventors of Electrical and Telegraphic arrangements are invited to communicate with the Electro-Magnetic M'f'g Co., 36 Broad St., P. O. Box 1804, New York.

Genuine Concord Axles—Brown, Fisherville, N.H.

Protect Your Houses—Champion Burglar Alarm Co., No. 49 West 18th St., New York. Send for circular.

Wanted, by Manufactory of Steam Engines and Standard Articles, $20,000. Address John, 1802 Olive St., St. Louis, Mo.

Partners Wanted—More working capital needed. Grounds, Shops, Tools, and Machinery, all in good working order. A rare chance for parties desirous of engaging in the manufacturing business. Correspondence solicited. Address D. Whiting, Ashland, Ohio.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass. Send for sample and price list.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrews' Patent, inside page.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Arny, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

For Sale—One "Cottrell & Babcock" Water Wheel Regulator, in good order—by D. Arthur Brown & Co., Fisherville, N. H.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

Pratt's Liquid Paint Dryer and White Japan surpasses the English Patent Dryers and Brown Japan in color, quality, and price. Send for descriptive circular to A. W. Pratt & Co., 53 Fulton Street, New York.

Fairy Electric Engines, with battery complete, $6; without battery, $4. Electro-Magnetic Manufacturing Co., 36 Broad St.—P.O. Box 1804, New York

Cast Iron Sinks, Wash Stands, Drain Pipe, and Sewer traps. Send for Price List. Bailey, Farrell & Co., Pittsburgh, Pa.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street New York.

Brown's Coalyard Quarry and Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

Temples and Oilcans. Draper, Hopedale, Mass.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Peck's Patent Drop Press. For circulars, address Milo, Peck & Co., New Haven, Conn.

Engines and Boilers a Specialty—1st class; new patterns; late patents; reduced prices. Plain and Cut-off Hor'l and Vert'l Engines; Hoisting Engines; the celebrated Ames' Portable Engines; Boilers of all kinds; Climax Turbine; and the best Saw Mill in the market. Large stock always on hand. Hampson, Whitehill & Co., 38 Cortlandt St., New York. Works at Newburgh, N. Y.

Buy Boult's Paneling, Moulding, and Dove-tailing Machine. Send for circular and sample of work. B. C. Mach'y Co., Battle Creek, Mich., Box 227.

Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Sugar from Sorghum.

In reply to a correspondent, who asked for the best process for causing sorghum sirup to crystallize so as to make sugar, we give the following by Stewart: "At the close of the boiling, transfer the cooler to the crystalizing room. Here two modes of treatment are to be pursued to suit the kind of product to be obtained. By the first method, a fair, yellow sugar, of a quality equal to that of the ordinary brown sugar of commerce, is the result. By the second, white sugar, or any grade intervening between it and the crude article, may be obtained. As a pre-requisite to success by either method, the crystallizing and draining rooms should be uniformly heated to a temperature of not less than 80° Fah. To secure this, a close room is needed, opening by a door into another apartment instead of by an outside door. The crystallizing vessels should be roughed along the sides and a stove placed in the center. Crystallization and drainage should be performed in the same vessels, and their form should be such as to conduce to both these ends. 1. Crude sugar of good quality and large grain will uniformly result from well defecated sirup of the proper density, at a temperature of 80° to 90° Fah., by means of slow crystallization and natural drainage. The vessels should be shallow to admit of the speedy downward passage of the molasses through the crystallized mass, and their bottoms should be inclined sufficiently to secure its rapid transmission to a common outlet. They should be of a uniform size, and, in order to secure a large grained crystallization, should be made moderately large. Vessels conforming to these requirements may be of various forms; but for convenience and general efficiency I give the preference to a form of vessel which the experience of nearly a century has not modified for the better. I refer to Dutrone's crystallizing box, thus described by himself: 'Experience has proved to me that the quantity of matter which combines the greatest number of advantages in the crystallization of cane sugar is fifteen or sixteen cubic feet, for which reason the dimensions given to the crystallizing vessels are five feet in length by three feet in breadth. The bottom is formed of two planes, inclined six inches, the intersection of which forms a groove in the middle. If this groove are twelve or fifteen holes of an inch in diameter, to permit the sirup to flow out. The depth is nine inches at the sides and fifteen inches at the center. The vessels should be made of boards one inch thick, and lined with lead' (or better, coated heavily with iron paint). 'Before lining it, the holes should be bored in the groove, and burnt out with a hot iron from the inside, so as to form a small cavity surrounding the hole, in consequence of which not a drop of sirup will remain after draining.' Such vessels combine every possible advantage in crystallizing and purging with the requisite strength. 'The crystallizing vessels rest upon strips of wood two inches thick and three inches broad, which are fastened to and supported by upright posts eight or ten inches high, at the distance, laterally, of ten inches from the middle line. Troughs connecting with a cistern on a lower level receive the molasses as it drips from the sugar.' These vessels, when filled to within 3 inches of the top, will hold about 75 gallons of sirup for granulation, weighing nearly 1,000 lbs., of which one half, or 500 lbs., will be good dry sugar. The depth of the crystallizing mass in the boxes may sometimes be diminished to 3 inches at the sides, where the bottom is most elevated, and 9 inches in the center, when there is reason to apprehend any difficulty of drainage by reason of the presence of an undue amount of grape sugar, or otherwise. After the molasses has all drained out, this depth will be much diminished, and the large surface of sugar exposed permits it to dry speedily. The number of these boxes that will be required will of course depend upon the amount of work to be done, and the length of time that must elapse before they can be refilled and used again. Two weeks is as short a time as can be reckoned upon for the completion of the crystallization and drainage. It will be found that one of these vessels will be required for each 450 or 500 gallons of juice delivered by the mill during that period. Close the openings in the bottom of the box with long, smooth, wooden plugs, abruptly pointed, which may be allowed to project through the holes into the inside of the box two or three inches. Range the boxes in order on the supporting rack, around the side of the room and over the dripping troughs, which are so arranged as to convey the molasses into a pointed wooden or tin gutter, and thence into a cistern. The dripping troughs may be simply short open conductors of the same materials. In twenty-four hours after the thick sirup has been passed into the crystallizing box from the cooler, the formation of crystals of small size will generally have commenced. They may then be seen along the edges of the yet liquid mass, but on the bottom of the box they will be found in the greatest abundance, and may be detached and brought to the surface at the shallow sides of the box, by means of a knife blade or the wooden scraper, which should always be at hand. The last-named implement is simply a long paddle of ash or hickory wood, with a stout handle and thin blade. With this the fine crystals should be loosened from the bottom and sides and stirred into the mass so as to distribute them as equally as possible through it, that they may act as nuclei for the formation of larger crystals. Generally in twenty-four hours after this operation, and often in less time, the crystallization will have pervaded the entire mass. When this is found to be so, then gently withdraw the stoppers and permit the molasses to drain. The sugar will be dry in ten days or less thereafter. It may then be shoveled into boxes or barrels, and the crystallizing boxes refilled."

Notes & Queries

H. C. S. will find directions for molding rubber on p. 283, vol. 29.—E. M. G. will find a recipe for soldering brass on p. 364, vol. 29.—F. W. Z. can find a recipe for a copper dip for iron on p. 90, vol. 31.—C. C. can cement glass to tin by using the preparation described on p. 298, vol. 30.—J. B. can measure the cylinder of his engine by the formula given on p. 16, vol. 29, and by that on p. 54, vol. 30.—R. H. H. can fasten rubber to rubber by using the cement described on p. 203, vol. 30.—J. J. F. will find directions for silvering glass on p. 234, vol. 30.—M. W. H. will find a description of mica on p. 88, vol. 24.—C. E. G. will find directions for stereotyping on p. 363, vol. 30.—N. L. F. can remove paint from window panes by the method described on p. 88, vol. 32.—T. J. C. can blue guns by the process given on p. 123, vol. 31.—F. W. will find directions for molding from living objects on p. 58, vol. 24.

(1) J. E. E. asks: What degree of heat will a diamond bear without injury? Diamonds are said to be destroyed at about 14° Wedgewood or 1,820° Fahrenheit, but they vary in hardness. What would be the effect of a cherry red heat upon a very hard diamond? Would it have a tendency to soften it? What heat will cause a diamond to crack and chip off on the outer surface? A. Heat would not soften a diamond, neither would the stone crystallize at extremely high temperature. Heated intensely, it would burn and be converted into carbonic acid gas, an exceedingly small residue being left behind.

(2) J. J. asks: Will a slit extending from top to bottom in the glass chimney of a lamp be a preventive from breaking by partial rapid expansion or contraction? A. Yes. 2 Do you think a slit would impair combustion? A. No. 3. Does glass require tempering or annealing before leaving the factory? A. Yes.

(3) A. A. F. says: I have tried your recipe for staining wood to a black walnut color, as follows: Water 1 gallon, washing soda ½ oz., chromate of potash ¼ oz. This will not make a stain. It settles at the bottom; and after standing a few moments the water becomes almost clear. A. We have tried this stain and had no difficulty in obtaining a very fine stain, perfectly counterfeiting the color of black walnut. The settling or precipitation of your solution is due probably to impurities in the chemicals or water used. Separate your water into two portions, in one of which dissolve the soda and in the other the bichromate of potash. The solution of soda should be perfectly clear; and when added to the other solution, it should impart a bright yellow color to it. The wood should be steeped in this solution for about one hour, or until the desired shade is obtained. A gentle heat will hasten the process.

(4) M. H. K. asks: What is the kind and character of change that takes place in white of egg when beaten from the shell into a stiff froth? A. The continued beating causes the albumen to become aerated, or mixed with a large quantity of air bubbles.

How can I make a stamp or press, out of other material than wood, to quickly press and shape a lump of butter to fill the table butter dish? A. There is no material, to our knowledge, that will answer the purpose so well as wood.

1. How can I polish a pearl, found in an oyster? A. Try rouge powder. 2. Have such pearls any value compared with others? A. They have no commercial value.

(5) F. W. H. asks: Is rottenstone and linseed oil good for repolishing a piano? A. The rottenstone is used as a polishing powder, the linseed oil to cleanse the surface after having been polished. They are not mixed together.

How can I prepare glue, so as to use without heating? A. Dissolve the best isinglass in the strongest (glacial) acetic acid.

(6) C. R. S. B. says: I curl my hair with a thin gum arabic water. Is it injurious? A. It is of no benefit, and probably of no more injury to the hair than the use of too much water, rendering the hair stiff and dry. 2. What is good to prevent the hair from falling out? A. See p. 333, vol. 31.

(7) E. B. says: I have some elder wine which last summer turned sour, but not sour enough for vinegar. I added ½ pint alcohol to the gallon when made. How can I make vinegar of it, fit for the table? A. Add to it a little yeast, or mother of vinegar, which will hasten fermentation.

(8) W. C. says: I have a lot of molded sandstone, saturated with coal oil. How shall I take the oil out? A. Heating to a moderate temperature might be tried, if practicable. Sometimes chalk and magnesia are used to absorb and extract oil stains.

(9) A. M. F. asks: How can a harmless substance be magnetically polarized, to convey into the human system the positive or negative forces, so as to circulate in the blood and so through every part and atom of the body? A. There is not, to our knowledge, anything that is susceptible of magnetic polarization that may be taken into the system in the way you describe.

(10) E. B. J. asks: 1. What can be added to tobacco that will cause the odor of the smoke to smell sweet? A. Try lavender. 2. Can it be made pleasant by passing the smoke through perfumed water or alcohol? A. No.

(11) B. S. asks: What is the behavior of potassium and sodium, and similar metals, in absolute or nearly absolute (95°) alcohol? A. When sodium or potassium is added gradually to absolute alcohol, a brisk action occurs, the temperature rises rapidly, and the metal is dissolved; while an extrication of pure hydrogen takes place, and a fusible, crystalizable, deliquescent compound is formed, which has received the name of sodium alcohol (or potassium alcohol) or of ethylate of soda (or of potash).

(12) W. E. says: I have tried many recipes for tinning articles made of cast iron, some of which are malleable; the last I tried was: "Cover the articles in a solution of sal ammoniac, then dip them in melted tin," but it would not work. A. The operation only succeeds well when the surface of the metal to be tinned is quite free from oxide, and when during the operation the oxidation of the molten tin is prevented. The former requisite is attained by the use of dilute acids, rubbing and scouring with sand, pumicestone, etc., the latter condition, by the use of either rosin or sal ammoniac, both of which cause the reduction of any oxide that may be formed. The objects intended to be tinned are heated nearly to the melting point of tin; they are then dipped into a vessel containing the molten metal, and rubbed with a piece of hemp over which some sal ammoniac is strewn. Pins, hooks and eyes, small buttons, and similar objects are tinned by being boiled in a tinned boiler filled with water, granulated tin, and some cream of tartar. The tinned objects are dried by being rubbed with sawdust or bran. In the manufacture of tinned sheet iron, technically termed tin plate, the iron must first be thoroughly scoured, so as to present a clean metallic surface, and then immersed in baths of molten tin covered by a layer of molten tallow to prevent the oxidation of the metal. On being removed from the tin bath the sheets are immersed in a bath of molten tallow to remove any excess of tin, wiped with a brush made of hemp, next cleaned with bran, and packed.

(13) S. N. M. says, in reply to O. H., who asks: What is the force of blow of the pile of a pile driver, whose weight is 100 lbs., falling 20 feet? "Force is any cause which moves or tends to move a body. Weight is the measure of the force of gravity. Momentum is the quantity of motion, the impetus, the force with which one body strikes another, and is equal to the weight×velocity." This must be the force of the blow of the pile driver. To find the time of falling, equal to $\frac{1}{4}\sqrt{20 \text{ feet} + 16\frac{1}{12}} = 1{\cdot}115$ seconds. To find the velocity $= 1{\cdot}115 \times 32\frac{1}{2} = 35{\cdot}861$ feet per second. Therefore, $35{\cdot}861 \times 100 = 3586{\cdot}1$ lbs. = the force of the blow. If there be any demonstrable error in the above, I shall be pleased to learn it. I conceive it possible that it may be said that the momentum is not the same as the force of the blow, estimated in pounds. A. The definition of momentum, given above, that it is the force with which one body strikes another, is incorrect; and indeed, this definition is ordinarily given incorrectly, in elementary works on mechanics. The force of the blow of a pile driver, as we understand it, is a certain weight which would produce, by steady pressure, the same effect as the falling body. The amount of the weight can only be ascertained by experiment.

(14) C. J. L. asks: How can I electrotype from an iron solution instead of copper? A. Use the protosulphate or neutral chloride of iron, a single battery cell, and an iron positive pole.

(15) J. C. C. asks: Have dispatches ever been successfully transmitted on the same wire in both directions at the same time? A. Yes. The Western Union Telegraph Company has been successfully using Stearns' method of sending two messages over the same wire at the same time for several years past.

(16) C. A. C. asks: Will you please explain the process of electrotyping, and the kind of metal used? A. An impression of the objects which you desire to reproduce is first taken in gutta percha or wax, which is then covered with plumbago by brushing with a camel hair brush. The impression is then attached by a wire to the zinc pole of a weakly charged Daniell cell, and a copper plate is attached by a wire to the copper pole of a battery. The impression and copper plate are then dipped into a strong solution of sulphate of copper, when the copper of the solution will begin to deposit itself on the impression, first at the black-leaded surface in the vicinity of the connecting wire; then it will gradually creep over the whole conducting surface. It is usual to keep the impression in the solution for about 24 hours, when the copper deposited on it will have formed a tolerably strong plate, which can be easily removed from the wax. On the side of the plate next the matrix, will be found a perfect copy of the original object.

(17) L. W. asks: In a galvanic pile composed of copper and zinc plates, 4 inches square, how many pairs would it take to produce a shock that would be felt? A. One hundred pairs would produce a perceptible shock.

(18) T. J. W. asks: Is it twelve o'clock when the clock strikes the first stroke, or when it strikes the twelfth? A. As a general thing, a clock indicates the hour of twelve at the first stroke.

(19) R. K. asks: What is the objection to driving ferrules in boiler tubes, or to caulking the tubes, when the boiler is full of water? A. It cannot be ordinarily done with safety and convenience.

(20) C. R. asks: Which is the most powerful wheel, the overshot or the turbine? A. The following data may be accepted as generally correct for the average performance of the different kinds of wheels: Percentage of the power of the water that is utilized by the wheels: Overshot and breast wheels from 75 to 80, undershot wheels from 40 to 65, turbines from 60 to 80.

(21) E. E. E. asks: Will cast iron make a safe head on which to put four cutters for a wood molding machine, the heads to be from 2 to 6 inches across and 6 inches square, with 1¼ holes in center for shaft? The shaft is to revolve at the rate of from four to six thousand per minute. A. Possibly, but wrought iron or steel would be preferable.

(22) W. H. F. asks: Can you give me the rule for determining the electromotive force necessary to overcome a given resistance? For instance, on a line of say 100 miles, having a resistance of about 1,500 ohms, how many Daniell's cells would be required to operate it satisfactorily? A. Much depends upon the size of the wire, its insulation, and the delicacy of the receiving instruments used. Assuming the wire to be of No. 8 gage, the insulation of the Kenosha pattern, and the instruments Morse relays of 150 ohms resistance, 50 cells would be sufficient.

(23) J. C. G. asks: What tools and materials would a person need to make small working models of steam engines? A. A lathe, a small planer, and a good vise bench, with hammer, files, chisels, center punch, scribers, etc.

(24) W. P. says: I inclose some indicator cards from the compound engine that I run in a flour mill. What do you think of them? A. They appear to be very fair. We would be glad to receive from you a brief account of the performance of the engine, giving average power exerted, consumption of fuel, water, oil, and any other matters of interest that you can furnish.

(25) S. B. H. says: You recommend heating wire ropes. All the wire rope that I ever saw had a small piece of rope in the middle, for the purpose of making it pliable. as I suppose. Would not the heating of the rope red hot injure the hemp? A. Wire rope is made with either a wire or hemp center, according to the wishes of the purchaser. Our correspondent's question implied that his rope had an iron center.

(26) J. D. asks: Will it add to the power of an engine to increase the length of cylinder from 12 to 16 inches, and proportion all other parts to the increased length of cylinder, the number of revolutions and the pressure of steam remaining the same as it did on the 12 inch cylinder? A. The power will be increased if the alteration is made.

(27) R. M. R. says: On p. 27, vol. 32, I find this question (No. 64): "At what speed would an engine, having 2 inches bore and 4½ inches stroke, drive a boat 18 feet long, 5 feet wide, and drawing 6 inches of water? The engine will have 100 revolutions per minute and 50 lbs. steam." You reply: "The engine would be entirely too small to give a satisfactory result, unless a much higher pressure of steam and greater piston speed were employed." Would not such an engine have at least one man power under the conditions named? If so, the engine ought to be able to do as much work as a boy of fourteen could do: pull such a boat with a pair of oars at about 3 miles an hour. I have often done this when I was about fourteen. If a screw loses so much of the power as to make the engine less powerful than a small boy, why did you not advise F. C. R. to connect a long cylinder with a pair of oars, or construct a machine to work oars? A. As you surmise, one man power applied to the screw of a small boat would be entirely too small, on account of the loss from friction and slip. If you have any plan for a boat with steam oars, which you have proved by experiment to be more economical and satisfactory than the ordinary modes of propulsion, we will be glad to hear from you again.

(28) W. & B. ask: Is tannate of soda safe to use in all cases, for removing scales from boilers? A. Try it.

Is superheating of steam any advantage in economy of fuel, and is it safe? A. This depends upon the manner in which you are using your steam. It is safe, if properly done.

(29) A. F. A. asks: Has the coefficient of expansion of hard rubber been determined? A. We do not remember ever having seen it, and would be glad to hear from any of our readers who may have information on the subject.

(30) J. G. says: I have just set an 8 foot by 34 inches tubular steam boiler for running engine and heating building. The inspector says that it should be run with water within 6 inches of the top (over 3 solid gages) to save the tubes from unequal expansion; while I contend that there should be at least 18 inches steam space, 2½ gages water, to have dry steam and work to the best advantage. Which is right? A. It is common to carry water in such boilers from 2 to 4 inches above the top row of tubes.

(31) C. S. D. asks: Does a column of water flowing to a hydraulic ram through a pipe twenty feet long, inclined at an angle, with a vertical fall of ten feet, give more force than flowing through a ten foot pipe attached to the ram in a vertical position? A. No.

(32) J. H. P. says: A bell has been placed in a church spire, but only a heavy and strong man can ring it. A. says that if the bell be hung higher in the yoke it will ring more easily, and the tongue will strike heavier and louder. B admits the former but maintains that the tongue will strike with less power and consequently emit less sound. Which is correct? A. The question cannot be answered, positively, without more data. If the bell is raised in the yoke, it can be moved more easily, but it will be necessary to swing the yoke through a greater angle in the same time as before to produce the same sound. Hence the ringer will have to work more quickly than before.

What should be the length and width of an iron wedge two inches thick, to be used for splitting wood? If it be too long, it will bend in crooked-grained wood. If too short, it will fly back when driven into frozen wood. If too wide, it will drive hard. If too narrow, it will merely displace the wood without splitting. Should the faces of the wedge be plane surfaces with sharp corners, or oval, like those of an ax with rounded corners? A. It would seem to be better t have different wedges for the several kinds of wood. They are commonly forged, not finished, with sharp corners.

(33) H. A. H. asks: Would a wire, cut or grooved out like the threads of a bolt, cut wood readily? A. Not unless it was tempered and had a cutter at the end, which would change it into a common auger.

(34) K. asks: If steam at 100 lbs. per inch be confined in a certain area and the area be doubled, what will be the pressure in the enlarged area? In other words, what is the elasticity of steam? A. The pressure varies nearly inversely as the volume. You will find precise formulas, which are somewhat complicated, in any good treatise on heat.

(35) T. E. L. says: I notice that you state in your answer to B. L. H. that the pressure is greatest at the bottom of a boiler. This being the case, why is it that an injector will supply a boiler? A. On account of the difference in area of the steam pipe and orifice through which the water is forced, the velocity of the steam is greater than that of the water; so that steam at boiler pressure, moving at a high velocity, can overcome a much greater pressure if the resistance moves at a less velocity. Similar action takes place in the case of a lever where a small weight moving fast raises a large one moving slow. It can also be observed in an ordinary system of ropes and pulleys, and in numerous other instances, which will doubtless occur to you.

(36) W. C. R. asks: If I take a cylinder with an outlet and stopcock to it, and compress air in it to a pressure of 100 lbs. to the square inch, and put it on a small boat, and then open the stopcock, letting the air escape, the air on the outside traveling in the same direction, and at the same speed as that coming out of the cylinder, will it propel the boat? I say it will not, as there is no reaction. A friend of mine claims that it will. Which is right? A. Your friend.

(37) J. A. H. says: 1. T. L. maintains that if you half fill a boiler with cold water, disconnect the pump (if any be attached) and heat up to 130 lbs. pressure, all the water will be turned into steam, in other words, there will be no water in the boiler by the time it reaches 130 lbs. pressure. I say that this is wrong, and that only a small portion of the water will be turned into steam, which steam occupies that portion of the boiler not occupied by the water. Which is right? A. You are. 2. T. L. says that if you take a hollow cylinder or other vessel of sufficient size to contain 1,000 gallons gas in a liquid state (not 1,000 gallons liquid), force gas into it under proper conditions until it is full of liquefied gas, then draw off 500 gallons gas, that the remaining 500 gallons (less the quantity evolved into gas to full space above liquid) in the vessel will not and cannot be in the liquid state. I say it can be in the liquid state under such conditions, and will be in such an instance, provided the exhaustion of 500 gallons of gas has not reduced the pressure below the pressure at which the gas liquefies. Who is right? A. You are. 3. He further maintains that if you take any vessel, half fill it with fluid and raise the internal pressure to 150 lbs. per square inch (either by heat, pumping in air, or the efforts of a liquefied gas to reassume the gaseous condition) you cannot hear such fluid shake and gurgle if you agitate or shake the vessel; in other words that, if there be any fluid in such vessel under such pressure, it will not change position by turning the vessel upside down and other movements. I say he is wrong. Who is right? A. You are.

(38) J. G. P. asks: Is there any invention to facilitate the safety of treasure in case of fire or foundering of a vessel at sea? Could not a large floating preserver be made and placed in the ship with the treasure enclosed, and, when found necessary, be given to the waves with better hopes of recovery than if it went down with the ship? A. The idea is quite practicable, and is, we think, practised. Your turbine device would not work.

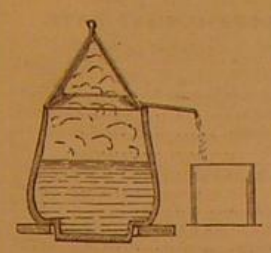
(39) W. A. N. asks: How is linseed oil manufactured? A. By cold pressure in a mill. Sometimes the seed is roasted first to destroy a gummy matter in the outer envelopes. This frees the oil from mucilage, but renders it more acrid and higher in color than the cold process, which, however, should be used in preparing oil for medicinal purposes. The residue (oil cake) is a most valuable food for cattle.

(40) J. S. B. says: The following is a good recipe for welding cast steel: Take copperas 2 ozs., saltpeter 1 oz., common salt 6 ozs., black oxide of manganese 1 oz., prussiate of potash 1 oz.; pulverize and mix with welding sand, 3 lbs. Use it in the ame way as you would sand.

(41) C. F. asks: 1. From what substance is methylic ether made? A. Methylic ether or oxide of methyl is obtained by distilling 1 part of pyroxylic spirit and 4 parts of oil of vitriol; a colored gas (homologous with ethylic ether) is disengaged. It is accompanied with carbonic and sulphurous acids, which may be removed by allowing the gaseous mixture to stand 24 hours in contact with slacked lime. The gas is liquefiable at a temperature of −33°, and boils at −6° (Berthelot). 2. What ether is mostly used in the manufacture of artificial ice? A. Ethylic or vinic ether, sometimes called sulphuric ether.

(42) F. G. H. asks: 1. What is nitroglycerin made of? A. Nitroglycerin is a compound formed by the action of a mixture of highly concentrated nitric and sulphuric acids for a few minutes on glycerin. 2. Can the ingredients be mixed in one or two seconds, so as to be ready for use? A. No; the manufacture requires great care and careful watching.

(43) J. H. asks: How can I make distilled water? A. By boiling water and condensing the steam in a tube or coil of block tin pipe surrounded by cold water. Another way is by using the little device shown in the engraving, in which the steam condenses inside the conical cover, and descends the same, being caught by a projecting gutter and conveyed to the spout. A cloth kept wet with cold water on the top will facilitate the condensation.



(44) W. R. B. says: 1. In your issue of August 28, 1874, I see a description of a new light for photographers, which is produced by passing hydrogen through iodide of ethyl in which zinc has been digested. Will you explain what iodide of ethyl is? A. In order to prepare this ether, 100 parts of alcohol are placed in a retort, and a small amount of iodine is introduced; phosphorus is added in small quantities until the liquid becomes colorless; a fresh portion of iodine is then added, and then a fresh quantity of phosphorus, until about 200 parts of iodine and 2 or 3 parts of phosphorus have been added. The mixture thus obtained must be cooled by immersing the bulb of the retort after each addition in cold water, otherwise a large proportion of the phosphorus will become converted into the red variety, which is not susceptible of being attacked by the iodine at low temperatures. After the reaction has terminated, the liquid is distilled by the heat of a water bath, taking care that the iodine (as shown by its brown color) is in slight excess. The distillate should be washed with water, digested on chloride of calcium, and redistilled. 2. Is metallic zinc meant? A. Yes. 3. Is there anything dangerous about this light in careful hands? A. No.

(45) P. D. asks: Is there any process by which an amethyst can be restored to its original color after being heated? A. Not if the color has been destroyed.

(46) E. B. G. says: In drilling into rock which forms the pavement of coal, I struck a vein of water, which soon turned to a deep red color, and tasted strongly of alum. Is there probably alum in it? A. It was probably colored by suspended oxide of iron, and contained compounds derived from the pyrites, etc., analagous to the sulphate contained in alum.

(47) A. T. asks: How can I take impressions from sunk lines on copper plates? A. Obtain a fine copper plate ink from a reputable maker, dab on the (warm) plate with a rolled flannel, wipe the plate quickly with a soft leather and then with the palm of the hand. The ink should be stiff enough to remain in the engraved lines, although the surface of plate is perfectly cleaned as described. Print by heavy pressure between rollers.

(48) W. J. L. asks: Can carbon gas be liquefied by any known process, and what are the means? A. Carbon gas is rather an indefinite term; carbonic acid gas can be liquefied. Take bicarbonate of soda with water and place it in a strong wrought iron bottle, together with a narrow pot nearly full of sulphuric acid. The bottle is closed by a screw plug, and then agitated so as to shake the acid out of its pot, and bring it in contact with the carbonate. The great pressure produced by the evolving gas condenses the carbonic acid to the liquid form. Carbonic oxide, however, has resisted all efforts for its liquefaction. Marsh gas (CH_4) a combination of carbon and hydrogen, is, next to hydrogen, the lightest of known substances. It has resisted all efforts of cold and pressure to liquefy it. Ethylene (C_2H_4) was condensed to a liquid by Faraday. Coal gas is a mixture of gaseous compounds given off by coals. It consists of, in 100 parts: Hydrogen 45·58 (cannot be liquefied), marsh gas 34·99 (cannot be liquefied), carbonic oxide 6·64 (cannot be liquefied), ethylene 4·08 (can be liquefied), butylene 2·38 (can be liquefied), sulphuretted hydrogen 0·29 (can be liquefied at a pressure of 17 atmospheres), nitrogen 2·46 (cannot be liquefied), carbonic acid 3·67 (can be liquefied). This analysis is of the gas supplied to the city of Manchester, England.

(49) O. L. asks: 1. Is aluminum worked in this country? A. It is not. The metal which comes into this country is mostly manufactured in France. There have been several manufactories in France, namely, at Salyndres and Amfreville, and one in England, at Washington, county Durham. 2. Can you give the process of extracting it from clay? A. The metal has not, as yet, been profitably extracted from ordinary clay (silicate of aluminum); the nearest approach to it has been the process of Professor Rose, of Berlin, who first used cryolite, which is a compound of the double fluorides of aluminum and sodium. This mineral, being treated at a high temperature with sodium, yields aluminum and fluoride of sodium, and the latter, treated with quicklime, yields caustic soda and fluoride of calcium. Aluminum is also obtained from bauxite, native hydrate of alumina, which, having been previously mixed with common salt and coal tar, is next heated in an iron retort with chlorine gas, the result being the formation of carbonic oxide, and the double chloride of aluminum and sodium, which volatilizes, and is condensed in a reservoir lined with glazed tiles. The salt so obtained contained iron, and consequently the aluminum derived from it is alloyed with that metal. The double chloride of aluminum and sodium is converted into metallic aluminum by being heated in a reverberatory furnace with sodium, while the aluminum is set free. A slag is formed, consisting of the doul le salt with excess of chloride of sodium. 3. If aluminum can be readily worked, why is it not in common use? A. Aluminum is now not so much in use; when first introduced, aluminum jewelry was much employed. The metal is at present more usefully employed for small weights, light tubes for optical instruments, and to some extent for surgical instruments. The price, however, of this metal ($1.50 per oz.) is too high to admit of its extended use.

(50) W. G. C. asks: 1. What kind of ink is used for machine ruling? A. Any good fluid ink will do. Dilute with water to the required tint, and add ox gall to prevent the ink running, and to hasten drying. 2. What kind of pens are used? A. They are cut out of very thin brass by a tool constructed for the purpose. 3. Is a blotting roller used after the paper passes from the pens or points? A. No.

(51) P. O. T. asks: What is the nature of manganese? A. Manganese is a combination of oxygen, 36·7 per cent, with metallic manganese, 63·3 per cent. It usually occurs in deposits, being frequently associated with ores of iron. If the ore is good, it is fit for use directly. It is extensively mined in Thuringia, Moravia, and Prussia. It is common in Devonshire, Somersetshire, and Aberdeenshire in Great Britain. It is found in various parts of Vermont, also in Massachusetts, Connecticut, and other parts of the United States, New Brunswick and Nova Scotia. The pure article is sold in New York at from 10 to 15 cents per lb.

(52) A. B. P. asks: How can I prepare paper for cartridges so that the explosion of the cap will ignite the powder without first opening the cartridge? A. Cartridges of this kind are made by enclosing the fulminating powder between disks of hard, stiff paper in the head of the cartridges.

(53) J. H. K. asks: How can mildew, stains etc., be removed from gold lace? A. For this purpose, no alkaline liquors are to be used; for while they clean the gold, they corrode the silk, and change or discharge its color. Soap also alters the shade, and even the species, of certain colors. But spirit of wine may be used without any danger of its injuring either color or quality, and, in many cases, proves as effectual for restoring the luster of the gold as the corrosive detergents. But though the spirit of wine is the most innocent material employed for this purpose, it is not in all cases proper. The golden covering may be in some places worn off, or the base metal, with which it has been alloyed, may be corroded by the air, so as to have the particles of gold disunited, while the silver underneath, tarnished to a yellow hue, may continue of a tolerable color; so it is apparent that the removal of the tarnish would be prejudicial, and make the lace less like gold than it was before.

(54) N. J. P. asks: What is bleaching powder? A. It is commonly called chloride of lime. It is made by passing chlorine gas over moistened lime. It is a moist grayish powder, and is soluble in 10 parts of water, any excess of hydrate of lime remaining undissolved. It deteriorates by keeping; when freshly made, it may contain 30 per cent of chlorine, but often has less than 10 per cent. It is decomposed by acids, yielding chlorine. It consists of hypochlorite of lime and chloride of calcium, with water and excess of lime. It is used for bleaching, and as a disinfectant. We do not understand your other question.

(55) J. G. C. says: I doubt very much if A. W. B. ever kept cider sweet in the way he mentions. If the fermentation is not checked, it will inevitably turn to vinegar. I have been advised to strain the cider through sand, as it comes from the press into the barrel, so as to get it free from as much impurity as possible; put the barrel in a cool place, taking care not to freeze it, leave the bung out a few days till the most violent of the fermentation has taken place, then bung it up tight bore a small gimlet hole near the bung, and put in a spile; watch it closely, and once in three or four days draw the spile, so as to relieve the pressure on the cask, otherwise it may burst. Judgment must be used in the matter, and the time must be lengthened gradually for giving vent; finally leave it to itself; and in the following February, if you wish to bottle it, take a clear, cool day for the operation, use good strong bottles and the best of corks, and drive them in with a wooden mallet, first softening them with a cork squeezer. By putting a moderate sized lump of the best white sugar into each bottle, it will tend to make it more sprightly. The bottled cider must be kept in a cool place. The later in the year that cider is made, the better it will keep.

(56) A. K. says, in reply to J. C. & Co., who ask as to why millers steam their wheat before grinding: There are several good reasons for this. The first reason is that it improves the quality of the flour and increases the yield. It also makes a broader bran, proving what I have already said; for if you can make a broad bran, you will evidently have less of it to contend with in your bolts. In fact, it puts the whole system of milling in a superior condition for manufacturing a choice article of flour. Some millers object to steaming

on the ground that it requires more dressing of stones, and they have ample reason for making this their standpoint. In very dry and cold weather, when there is trouble in keeping up the grade of flour, steaming serves instead of rain or thaw. We can do better milling when the weather is moist and damp.

(57) W. T. B. says, in reply to H. D., who asks how to get rid of red spiders: The minute insect known to florists as red spider is usually of a bright red color, though some are brown and others almost green. They seem to increase most rapidly in a dry, hot atmosphere, and upon plants that are not growing well, or that have been allowed to suffer for lack of water at the roots. They infest the under side of the leaves, and apparently shun the light; but when very numerous, they may be found upon all parts of the leaves and stem. The upper part of the leaf, opposite where the insects are at work, becomes light colored and dusty looking. In greenhouses, they are most troublesome in the warmest part of the house; but I have seen them in a house where the temperature was allowed to fall to 40° at night, and also on plants growing in the garden. I would suggest the following treatment: Syringe the plants freely with water once or twice a day, taking care to wet the under side of the leaves. Keep the air of the room moist, by setting pans of water on the flues, heating pipes, or register; give all the light possible, and ventilate freely whenever the weather will permit. When the soil is dry, give sufficient water to moisten all the soil in the pot; and water no more until the surface is dry again. If plants seem stunted or sickly, re-pot them in fresh, rich soil, or use some other means to induce a healthy growth. The red spider is anything but an aquatic insect, and will yield to the hydropathic treatment, if it is persisted in.

(58) A. H. says: E. S. S. can season his croquet balls after they are turned by brushing them over with linseed oil, then baking them in the oven (slowly at first) to get the oil into the pores of the wood, repeating the oil coating three or four times, and then storing them away for the oil to dry. This will not only keep them from checking, but will make them waterproof and keep them from rotting. Last winter I made some plane handles out of a piece of a plum tree, 5 inches in diameter; those treated with oil stood the sun's rays without the least check; the others, not oiled, checked so as to make them useless.

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

H. D. P.—Having subjected your sample of paper to the usual tests, we failed to discover the presence of arsenic.—J. T.—Your box contained but one specimen, a piece of basaltic rock, the only value of which would be in building.—W. M. L.—It is a fossil coral.—A. B. H.—It is galena, containing 85 per cent of lead and 15 of sulphur.—S. M.—It is quartz grains, yellow mica, black mica, and fragments of augite, which is a silicate of lime, magnesia, iron, and alumina, but is of no value in the arts.—P. B.—It is a superior red oxide of iron. We have known several specimens to contain as high as 70 per cent of iron. It will make red paint and, if in sufficient quantities, will be a valuable ore of iron.—H. P. E.—No. 1 is quartz grains, colored red with oxide of iron, and mixed with small crystals of black mica. No. 2 is the same as No. 1, but with yellowish mica also. No. 3 is quartz rock with yellow mica. No. 4 is the same as No. 2, with more quartz. No. 5 is similar to No. 3.—R. E. M.—It is asphalt. You have already a knowledge of its valuable qualities. It is a highly bituminous asphalt, capable of yielding illuminating gases and oils, and of being used as a paint. You have only to develop the deposit.—E. T. D.—It is garnet in mica schist.—N. S. S.—It is garnet. The crystaline form is the rhombic dodecahedron, and belongs to the variety of garnet called the iron-alumina garnet, which is common.—A. J. R.—It is difficult to determine the value of stones from such small specimens. If you will send us a stone of the proper dimensions (3 inches thick), and finished on one surface, we will give it a practical trial.—H. L. H.—No. 1 is a quartz rock containing scales of yellow mica, of no value. No. 2 is quartz rock with some iron, but too little to be worth working. No. 3 is a crystal of aragonite, which is carbonate of lime.

COMMUNICATIONS RECEIVED.

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

On Canal Towage. By R. B. C., and by W. R. W.
On Filling Teeth. By A. H. B., and by J. G. C.
On Springs as Motors. By M. W. P.
On the Patent Office. By O. P. S.
On Furnaces and Flues. By H. M. S.
On Anointing in Cases of Fever. By R. P.
On a New Lamp. By D. D. N.
On a New Bridge. By J. A. P.
On Spiritualism. By H. M., and by F. S.
On Lacing Belts. By R. G.

Also enquiries and answers from the following:

J. P. W.—N. C. P.—J. H. K.—J. S. B.—W. X. Y.—H. M.—T. F. M.—J. S. E.—T.—W. S. D.—H.—F. G. S.—E. A.—S.—J. E. E.—W. C. B.—S. D.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Who makes steam cracker-making machinery? Who deals in old coins? Who makes sample trunks? Who publishes works on the construction of lights for lighthouses? Where are the best carpenter's tools to be obtained?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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DESIGNS PATENTED.

7,969.—DESK.—W. T. Bromwell, St. Louis, Mo.
7,970 to 7,976.—CARPETS.—R. R. Campbell, Lowell, Mass.
7,977 to 7,981.—CARPETS.—J. M. Christie, Kidderminster, England.
7,982.—SIDE OF CASE.—J. E. Hunter, N. Adams, Mass.
7,983, 7984.—CARPETS.—C. S. Lilley, Lowell, Mass.
7,985.—CARPET.—C. W. Swapp, Lowell, Mass.
7,986.—CARPET.—R. Allan, Yonkers, N. Y.
7,987.—SMOKING PIPE.—I. Demuth, New York city.
7,988.—BOTTLE.—E. R. Durkee, Brooklyn, N. Y.
7,989 to 7,991.—CARPETS.—E. Petit, Paris, France.
7,992.—NURSING BOTTLE.—V. H. Smith, Philadelphia, Pa.

TRADE MARKS REGISTERED.

2,150.—YEAST CAKES.—Amer. Y. Co., FondDuLac, Wis.
2,151.—CIGARS.—Freedman & Co., Detroit, Mich.
2,152.—NECKTIES.—Hellenberg *et al.*, New York city.
2,153.—OIL.—W. E. Jervey, New Orleans, La.
2,154.—TOBACCO POUCHES.—Novelty Co., New York city.
2,155.—CIGARS.—S. Lowenthal & Co., Cincinnati, Ohio.
2,156.—PLAYING CARDS.—V. E. Mauger, New York city
2,157.—FELON CURE.—W. H. Puffer, Athol, Mass.
2,158.—SHIRTS.—Burlock Man. Co., Bridgeport, Conn.

SCHEDULE OF PATENT FEES.

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On appeal to Examiners-in-Chief..... $10
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On application for Design (7 years)..... $15
On application for Design (14 years)..... $30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, JANUARY 7 to JANUARY 8, 1874.

4,217.—H. J. Wattles, Toronto City, Ont. Improvements on a machine for washing vegetables, called "Wattles' Vegetable Washer." Jan. 7, 1875.
4,218.—J. R. Smith, Brockville, Leeds and Grenville counties, Ont. Improvements on clothes wringers, called "The Victor Clothes Wringer." Jan. 7, 1875.
4,219.—C. A. Terrey, Southwark, Surrey county, England. Improvements on setting diamonds in drills and cutting tools, called "Terrey's Diamond Cap." Jan. 7, 1875.
4,220.—J. A. Stockwell, Lynn, Essex county, Mass., U. S. Improvements on boots and shoes, called "Stockwell's Combined Toe Guard and Half Sole for Boots and Shoes." Jan. 7, 1875.
4,221.—J. C. and C. J. Sturgeon, Erie, Erie county, Pa., U. S. Improvements in lawn mowers and harvesters, called "Sturgeon's Improved Lawn Mower and Harvester." Jan. 7, 1875.
4,222.—J. Lennerton, Princeport, Colchester county, Nova Scotia. Machine for making tree nail wedges, called Lennerton's Tree Nail Wedge Machine." Jan. 7, 1875.
4,223.—J. W. Elliott, Toronto City, Ont. Machine for the external application of croton oil, etc., called "Elliott's Counter-Irritant." Jan. 7, 1875.
4,224.—J. Vessot and S. Vessot, Jr., Joliette, Joliette county, P. Q. Améliorations an sémoir et herse combinés, dits "Le sémoir, herse, et rouleau combinés de J. & S. Vessot." Jan. 5, 1875. Improvement in combined harrow and sowing machine.
4,225.—R. B. Anderson and M. Anderson, Sackville, New Brunswick, Canada. Improvement on gentleman's scarf, called "Anderson's Improved Scarf or Necktie Holder." Jan. 7, 1875.
4,226.—G. W. McNeil, Akron, Summit county, Ohio, U. S. Improvements on wheat scourers, called "McNeil's Wheat Scourer." Jan. 7, 1875.
4,227.—R. Cobleigh, Chester, Windsor county, Vt., U. S. Improvements in carriages for children, called "Cobleigh's Improved Children's Carriage." Jan. 7, 1875.
4,228.—J. Telfer, Toronto City, Ont. Improvements on lamp-holding attachment to sewing machines, called "Telfer's Lamp Holding Attachment to Sewing Machines." Jan. 7, 1875.
4,229.—E. Mercier, Springfield, Hampden county, Mass., M. Lanctot, Jersey City, Hudson county, N. J., D. H. Elliott, New York city, U. S. Improvement on railway switch, called "Mercier's Railway Switch." Jan. 7, 1875.
4,230.—Wm. S. Wooton, J. G. Blake, and H. H. Fulton all of Indianapolis, Marion county, Ind., U. S. Improvements on secretaries, called "Wooton's Secretary." Jan. 7, 1875.
4,231.—R. M. Wanzer, Hamilton county, assignee of J. Jamison, same place. Improvements in sewing machines, called "The Wanzer B." Jan. 7, 1870.
4,232.—Wm. Cochrane, La Fayette, Tippecanoe county, Ind., U. S. Improvements on harvesting machines, called "Cochrane's Harvester." Jan. 7, 1875.
4,233.—S. Paling, Woodstock, Oxford county, Ont. 1st extension, No. 598, on "The Ontario Balanced Window Blind." Jan. 7, 1875.
4,234.—S. Paling, Woodstock, Oxford county, Ont. 2d extension, No. 598, on "The Ontario Balanced Window Blind." Jan. 9, 1875.
4,235.—H. A. Dierkes, New York city, N. Y., U. S. Improvements in hanging and operating bells, called "Dierke's Improvements in Hanging and Operating Bells." Jan. 8, 1875.
4,236.—J. M. and C. T. Schramm, Pontoosuc, Hancock county, Ill., U. S. Improvements in the shingling of roofs, called "Schramm & Sons' Improvement in the Shingling of Roofs." Jan. 8, 1875.
4,237.—J. L. Massie, Cowansville, Missisquoi county, P. Q. Improvements in heaters, called "Massie's Improved Heater." Jan. 8, 1875.
4,238.—C. H. Miller, Buffalo, Erie county, N. Y., U. S. Improvements in wooden pavements, called "Miller's Improved Wooden Pavement." Jan. 8, 1875.
4,239.—J. C. Codyé, Windsor, Essex county, Mass., U. S. Improvements in water filters, called "Codyé's Excelsior Water Filter." Jan. 8, 1875.
4,240.—L. A. Powers, Meriden, New Haven county, Conn., U. S. Improvements on rakes, called "Powers' Rake." Jan. 8, 1875.
4,241.—W. S. Von Essen, Hamburgh, Germany. Improvements on apparatus for cleaning boiler tubes by steam, called "W. Von Essen's Steam Boiler Tube Cleaner." Jan. 8, 1875.
4,242.—W. A. Martin, London, England. Improvements on furnaces and furnace doors, called "Martin's Improvements on Furnace and Furnace Doors." Jan. 8 1875.

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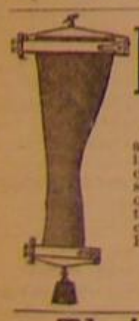

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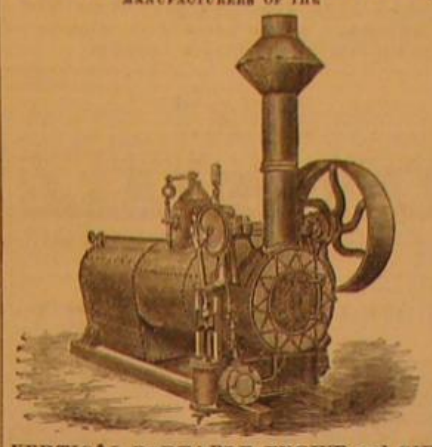

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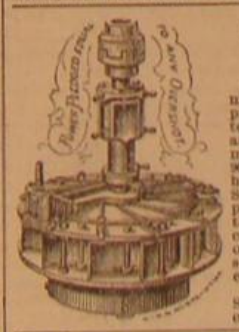

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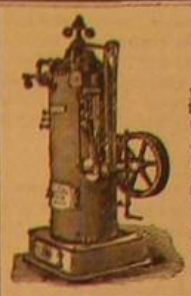

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VALUE OF PATENTS,
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Practical Hints to Inventors.

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

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

To Make an Application for a Patent.

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

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Vol. XXXII.—No. 7. [NEW SERIES.] NEW YORK, FEBRUARY 13, 1875. [$3.20 per Annum, Postage prepaid.

THE EXCELSIOR UNIVERSAL WOOD WORKER.

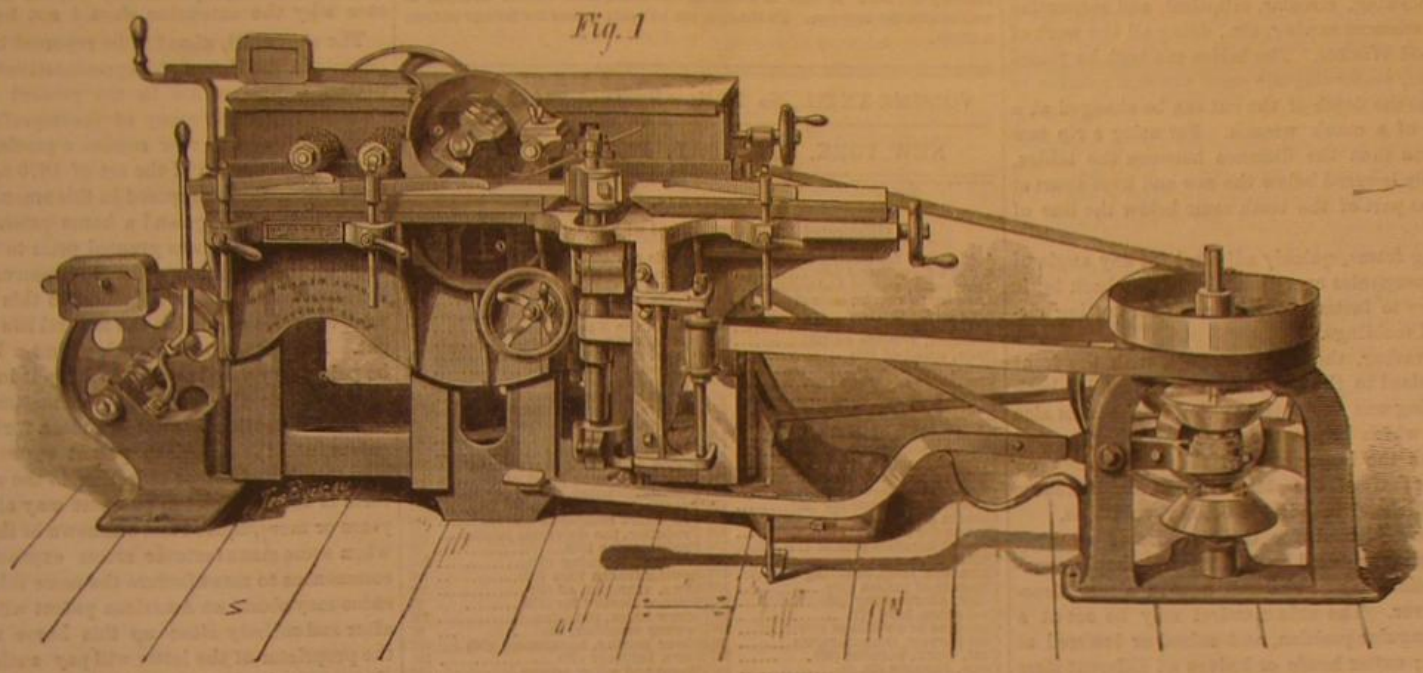
It often happens, in manufacturing establishments, that even in the busy season, many expensive and valuable tools are allowed to stand idle because the peculiar kind of work, for which they may be exclusively adapted, is not for the time required. There is no doubt that large shops economize work by having, for every change of operation, a special tool, but the value of such apparatus is certainly enhanced if its construction be such that it can be devoted to other operations whenever the same may be desirable.

Such a machine is that represented in the annexed illustrations, the distinguishing name of which forms the above heading. Its operation is not new, and therefore not experimental; but the combination of several operations, and the form, shape, and adjustability of the different parts to make them answer one and all the purposes, are decidedly novel and useful. It is built by the well known firm of Bentel, Margedant & Co., manufacturers of woodworking machinery, of Hamilton, Ohio.

The sticker or molding operation is not intended for such heavy work as the large sized Universal Wood Worker, made by the same manufacturers and illustrated some time ago in this paper. The present machine has one sidehead only, but is, nevertheless, very strong, as the whole frame is cast in one piece, without joined or framed parts.

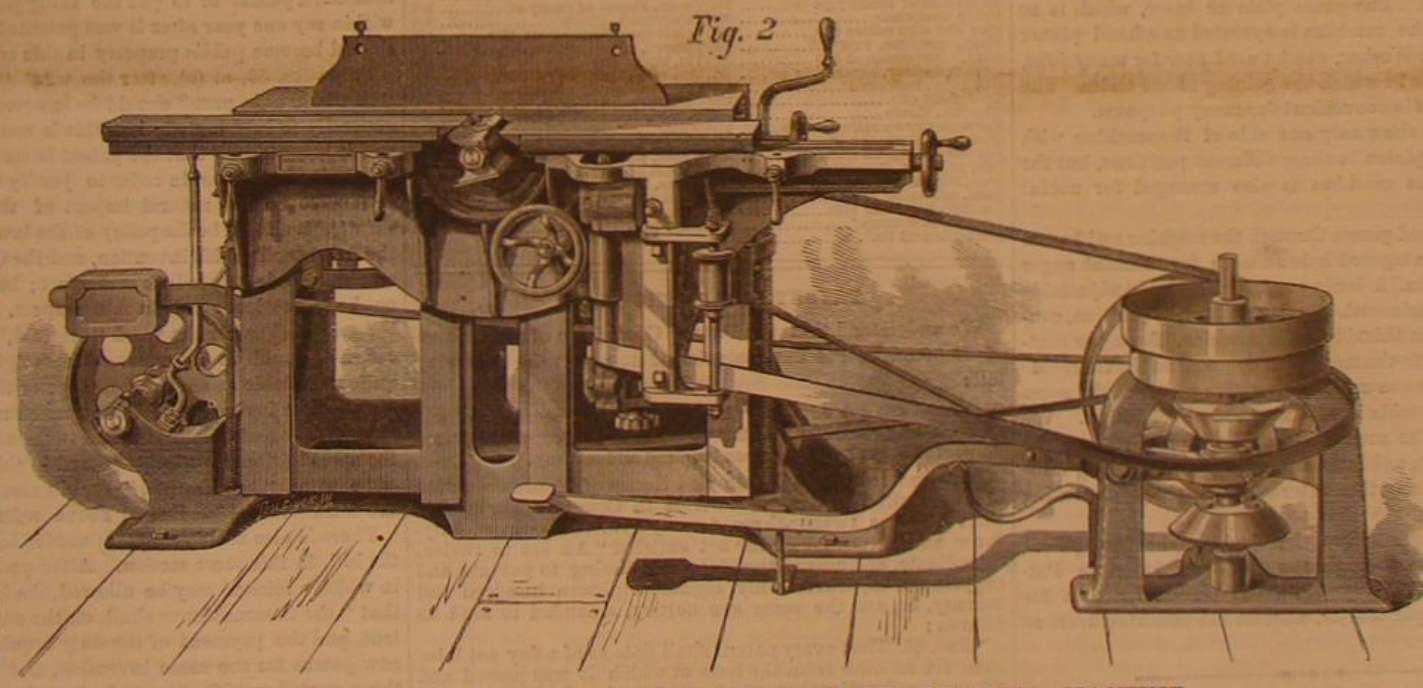
Fig. 1 shows the apparatus arranged for a molding machine. The table or platen consists of a large main support on which a side bracket is raised and lowered independently of any other adjustment of parts; also of two tables independently adjustable in a horizontal plane, all of which can be raised and lowered at either end of the machine, by means of a crank wrench, which engages two screws connected by corresponding gearing. The illustration shows both tops at a common level. The larger one rests partly on the main support and on the side bracket. The smaller table is carried forwards to the projecting sidehead sufficiently to permit the free working of the same. The table may be brought forward, and the opening entirely closed if the sidehead is not needed; the machine will then operate as known under the name of a "single-head molder or sticker." The sidehead can be raised and lowered, moved in or out, set at any angle, and adjusted either way, keeping the angular position given. The upright countershaft of the sidehead, driven by strong friction gearing, enables the operator to start or stop the sidehead at will, while the material is moved forward by the feed rollers, and operated upon by the central cutter head. This gives an important advantage in planing material on the sides only, in the middle, or on one or both ends, substituting, in many cases, machine work for labor hitherto accomplished only by hand.

Fig. 1



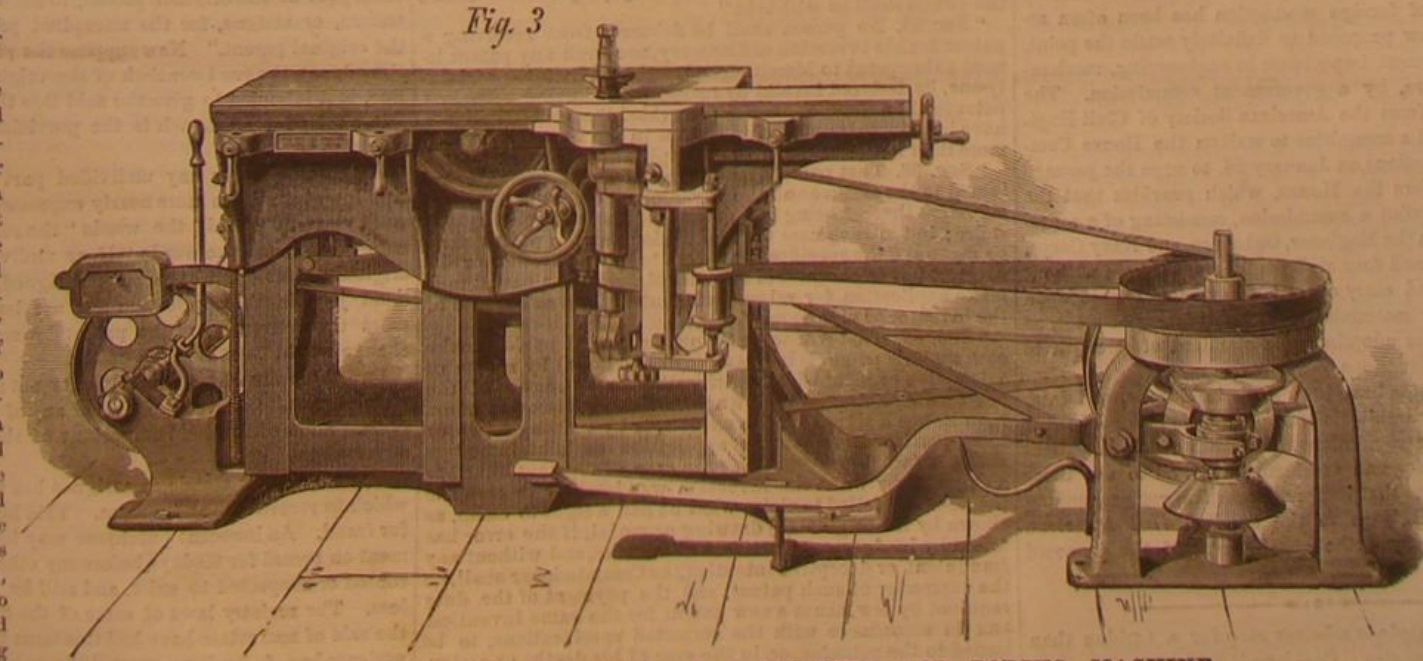
THE EXCELSIOR WOOD WORKER AS A MOLDING MACHINE.

Fig. 2



THE EXCELSIOR WOOD WORKER AS A HAND PLANING MACHINE.

Fig. 3



THE EXCELSIOR WOOD WORKER AS A SHAPING AND BORING MACHINE.

The feed rollers are of a peculiar construction; they remain perfectly parallel at any hight, or rise from the table, are strongly and simply geared and linked, and are so arranged that they press on the whole width of the material with even pressure.

The feed shafts, on which the teethed wheels are held by a nut, rest on strong sleeve sockets with long bearings, in which they can be slid back if not needed. The feed arrangement is held down by adjusting levers and weights. The hand lever on the end of the machine is used for starting or stopping the feed.

The weighted chip bonnet is adjustable to permit the use of long or short projecting molding cutters. The usual springs and spring holders, which are adjustable for their purpose, accompany the outfit. They can be let down on the sides of the tables, and may be advantageously used, at any altitude of the tables, for a large variety of work. The back top of the machine, visible in the engraving, serves in this position of

the machine as a commodious rest for short or long material before or after it is planed.

Fig. 2 shows the apparatus arranged as a hand planing machine, to which it can be changed quickly, and while the central cutter head is running.

The feed roller shafts are returned in their sleeves; the large table is slid back and the small one brought forward close to the cutting line of the cutter head. The main support is raised so that the front top, back of the cutter head, is on a level with the cutting line. The machine is then in position for planing material out of wind, squaring, beveling, cornering, chamfering, or tapering. The small front top may be raised or lowered for any desired thickness of cut. A fence or guide, which is adjustable to any desired angle, rests on the back top. By simple changes of the cutter heads, the adjusting of the tables to a common level with the cutting line of the cutter head, and the raising or lowering, parting or closing, of the front tables, all the different manipulations can be made, such as planing out of wind, beveling, cornering, tapering, mitering, rabbeting, jointing, panel raising on both sides at one operation, hand matching, rolling joints, gaining, plowing, circular, elliptical, and serpentine molding, rip and crosscut sawing, etc., doing all the work of the Universal Wood Worker. The tables can both be raised or lowered together, preserving the same position relative to each other; so that the depth of the cut can be changed at a moment by a turn of a crank wrench. For using a rip saw of larger dimension than the distance between the tables, the same are simply lowered below the saw and kept apart at the middle, so that part of the teeth come below the line of the tables.

A patent gaining frame, quickly adjusted for any angle of gain required, accompanies every machine. The back top is provided with holes to fasten the pattern on for cutting circular and elliptical moldings.

In the third engraving, the main support, with the front tables, is shown raised to the hight of the adjustable back top, thereby forming one large table; the sidehead is also raised to a hight which brings the smaller leather-covered pulley in line with the larger step of the cone pulley on the upright countershaft of the side head. This increases the speed of the sidehead mandrel to 5,000 revolutions.

The speed is now altered for the purpose of running smaller cutters as they are used on friezing and shaping machines, but the motion may be changed now in either direction by the foot lever. The side mandrel may be set at a perpendicular or angular position, and raised or lowered at will while running; cutter heads or knives of different sizes and shapes can be used and will operate in the same manner and for the same purpose as those of the best special friezing or shaping machine. The guide plate or fence, which is so very useful when the machine is operated as a hand planer or Universal Wood Worker, can be used now for many jobs, as well as the groove in which the gaining frame slides. The gaining frame itself is convenient for many purposes.

The illustrations show only one side of the machine with the stickerhead or platen in three different positions, but the opposite side of the machine is also arranged for useful work.

The center mandrel passes through the machine and has on the projecting end a tapered hole suitable for machine auger bits or chuck shanks. A boring and routing table adjustable in perpendicular, horizontal, angular, and rotary position, constitutes the outfit on this side of the machine. Boring or routing may be done while the machine is operated on the front side so that two persons can use the operative power at the same time. The boring table is of a new and novel design. We are informed that the machine is sold with and without the boring arrangement, and is so arranged that the boring table can be put on at any time afterwards by simply fastening a few bolts.

The right to manufacture the device (the last patent on which was taken through the Scientific American Patent Agency, April 7, 1874) within the United States is for sale. For further particulars, address the manufacturers as above.

Comparative Tests of Building Materials.

The superiority of American steels and irons to similar grades of metals of foreign production has been often asserted; and it is now proposed to definitely settle the point, which is of the utmost importance in engineering, mechanics, and agriculture, by a government commission. The suggestion comes from the American Society of Civil Engineers, who deputed a committee to wait on the House Committee on Appropriations, on January 26, to urge the passage of a bill, now before the House, which provides that the President shall appoint a commission, consisting of a representative each from the Engineer, Ordnance, and Navy Corps, the Coast Survey, and four civil engineers, to serve without pay, to institute and carry out such a system of tests upon American building materials, particularly iron and steel, as would result in the adoption of a standard of strength to govern future constructions.

Similar experiments have been made in Europe, and data, for the guidance of architects and for the use of local boards in framing building regulations, have been obtained. Hitherto our scientific men and artificers have had to use these results; but we hope that improved practice, comprehending the well known facts as to the excellence of American metals, will result from the appointment of the proposed commission.

Rock or swamp maple is a better step for a turbine than either *lignum vitæ* or elm. Cast iron is useless.

Scientific American.

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PATENT LAW AMENDMENTS.

We understand that the Patent Committee of the House of Representatives have concluded to report the following bill:

To amend the act entitled "An act to revise, consolidate, and amend the statutes relating to patents and copyrights," approved July eighth, eighteen hundred and seventy.

Be it enacted by the Senate and House of Representatives of the United States of America in Congress assembled, That sections twenty-three, twenty-five, thirty-three, fifty-three, and sixty-four of the act entitled "An act to revise, consolidate, and amend the statutes relating to patents and copyrights," approved July eighth, eighteen hundred and seventy, be, and the same are hereby, amended to read as follows:

"SEC. 23. That every patent shall date as of a day not later than six months from the time at which it was passed and allowed, and notice thereof was sent to the applicant, or his agent; and if the final fee shall not be paid sufficiently within that period to admit of the patent being prepared for issue, the patent shall be withheld."

"SEC. 25. No person shall be debarred from receiving a patent for his invention or discovery, nor shall any patent issued subsequent to March second, eighteen hundred and sixty-one, be declared invalid by reason of its having been first patented in a foreign country; provided the same shall not have been introduced into public use in the United States for more than two years prior to the application."

"SEC. 33. That patents may be granted and issued or reissued to the assignee of the inventor or discoverer, the assignment thereof being first entered of record in the Patent Office; but in such case the application for the patent shall be made and the specification sworn to by the inventor or discoverer, but an assignee of the entire interest in a patent may make application for reissue without the aid or consent of the inventor or discoverer."

"SEC. 53. That whenever the owner of a patent shall make oath that his patent is inoperative or invalid (a) by reason of a defective or insufficient specification, or by reason of the patentee claiming as his own invention or discovery more than he has a right to claim as new, or by reason of two or more parties having made application as joint inventors when, in fact, they were not, or in case of a patent issued to a single party when the invention was joint, or in case the patentee has failed to claim what he had a right to claim, as shown by his original (b) drawing or model, if the error has arisen by inadvertence, accident or mistake, and without any fraudulent or deceptive intention, the Commissioner shall, on the surrender of such patent, and the payment of the duty required by law, cause a new patent for the same invention, and in accordance with the corrected specifications, to be issued to the patentee, or, in the case of his death, or assignment of the whole or any undivided part (c) of the original patent, to his executors, administrators, or assigns, for the unexpired part of the term of the original patent (d), the surrender of which shall take effect upon the issue of the amended patent; and the Commissioner may, in his discretion cause several patents to be issued for distinct and separate parts of the thing patented, upon demand of the applicant, and upon payment of the required fee for a reissue for each of such reissued letters patent. And the specification and claim in every such case shall be subject to revision and restriction in the same manner as original applications are. And the patent so reissued, together with the corrected specification, shall have the effect and operation in law, on the trial of all actions for causes thereafter arising, as though the same had been originally filed in such corrected form; but no new matter shall be introduced in the application, nor, in case of a machine patent, shall the model or drawings be amended, except each by the other."

"SEC. 64. That upon the receipt of such application, and the payment of the duty required by law, the Commissioner shall cause to be published in the Patent Office *Official Gazette*, and in such other papers published in the section of the country most interested adversely to the extension of the patent as he may deem proper, for at least sixty days prior to the day set for hearing the case, a notice of such application, and of the time and place when and where the same will be considered, that any person may appear and show case why the extension should not be granted.'

The above bill, about to be reported by the committee on patents in the House of Representatives, contains several important improvements in the present statute, but falls far short of correcting many of the imperfections of the latter. Some of these will now receive a passing notice.

The 25th section of the act of 1870 needs further amendments than those proposed in this amendatory act. He who holds both a foreign and a home patent is now obliged, if the foreign patent was granted prior to the House patent, to keep up the former in order to preserve the latter.

There would be less objection to this if the home patent were to expire only with the natural life of the foreign patent. But in case of a French patent, a hundred francs must be paid every year in order to keep it in existence. A failure to make this payment—no matter for what reason, or whether intentional or not—causes a forfeiture of the French patent, and the American patent expires with it, as the law now stands. Another objection to the section in its present form is that the foreign patentee may allow it to run for ten years or more, unused and unknown in the United States; and when some manufacturer erects expensive works here and commences to manufacture the same thing, the foreign patentee may obtain an American patent within two years thereafter and entirely close up this home manufactory, unless the proprietor of the latter will pay such an exorbitant royalty as may be demanded of him.

The law should require the holder of a foreign patent to take out a patent or to put the thing patented in use here within say one year after it was patented abroad, or the same should become public property in this country.

In section 53, at (a), after the word "invalid," the words "in whole or in part" should be inserted. The law is now generally so interpreted; but this is sometimes controverted and it is contended that the patent in its original shape must be wholly worthless, in order to justify a reissue: and such seems to be the natural import of the language of the statute. It should be the policy of the law to give an inventor the full benefit of his invention, and the Office usually strains a point in order to produce that effect; but the matter should not be left at loose ends in this respect.

Again, at (b), after the word "original," the word "specification" should be inserted. The original specification is quite as reliable as are the drawings or the model in indicating the true invention, and often much more so. But as the section now reads, both here and in lines 62 and 63 of the bill, the specification is entirely ignored in this connection. The same word "specification" should also be inserted before the word "model" in line 62 above referred to.

There is also some correction needed in or about line 46 of the bill, in this same section. After providing for the cases in which a reissue may be allowed, the bill goes on to state that "the Commissioner shall, on the surrender of such patent, and the payment of the duty required by law, cause a new patent for the same invention, and in accordance with the corrected specification, to be issued to the patentee, or, in case of his death or assignment of the whole *or any undivided part* of the original patent, to his executors, administrators, or assigns, for the unexpired part of the term of the original patent." Now suppose the patentee to have assigned, say the one twentieth of the original patent to John Doe, is it intended to give the said Doe the sole right to obtain a reissue? But such is the provision of the bill as it now stands.

If the words "or any undivided part" were erased, the true intent would be more nearly expressed. But if, after the word "patent" at (d), the words "the surrender of which" were erased, and the words "if an undivided interest in the original patent shall have been assigned, all the assignees must join in the application for a reissue. And in all cases the surrender of the patent" were substituted, the change would be still much better.

But there are some amendments not noticed in the bill which are quite as much needed as any of those which it contains. Some of the most important of these will be briefly adverted to.

As the law now stands, an assignee has ninety days within which to record his assignment. This holds the door open for fraud. An innocent purchaser may have had his assignment on record for 89 days before any other assignment is recorded or suspected to exist, and still he may find it worthless. The registry laws of some of the States in relation to the sale of real estate have had this same provision. But experience has fully demonstrated the superiority of the rule that the first deed on record shall hold the property. It

may work hardship in some cases, but it incites to vigilance, and is, on the whole, vastly preferable. The same would doubtless be the case in relation to the assignment of patents.

But licenses are by the present law not required to be recorded at all. After the most thorough care and vigilance, the purchaser of a patent may find that scores of licences to make, use, and sell the thing patented in every portion of the United States have left the property, for which he has paid his money, comparatively worthless. This ought not to be so. A license should be recorded just the same as an assignment or a deed.

But there is another evil, which, although less in magnitude, is just as palpable and should not be overlooked. The 48th section of the act of 1870 summarily abolishes the appeal from the Commissioner to the courts in interference cases. There is reason to believe that this was the result of accident or mistake. Interference cases above all others should be subject to such appeals. The inquiries involved are just as intricate, and the questions of law and fact call into requisition as high an order of legal acumen, as those which tax to their utmost capacity the most experienced and clearsighted minds that are to be found on the bench of any court in the republic. And yet, by the law as it now stands, these questions are to be decided, without any right of appeal, by a Commissioner who is wholly inexperienced in such matters, who has never read a chapter of Kent or Blackstone, and who is wholly ignorant of the great legal maxims which underlie all sound judgment in matters of that nature. Such an arrangement is outrageously improper, and should be changed at once.

We shall make only one further suggestion in this connection. After a decision by the Board of Examiners-in-Chief, we see no reason why the dissatisfied party should be obliged to appeal in all cases to the Commissioner before he can make his appeal to the Supreme Court of the District, especially in interference cases. If such a case is appealed from the Board of Examiners-in-Chief, it rarely if ever fails to be taken eventually to the court. It would save much trouble and some expense if the dissatisfied party were permitted at his option to appeal directly to the court. A change in section 48, which would make it read as follows, would accomplish the entire purpose above suggested.

"Section 48. *And be it further enacted* that, if such party is dissatisfied with the decision of the Commissioner, he may appeal to the Supreme Court of the District of Columbia sitting in *banco*. Or the dissatisfied party may at his option appeal directly from the decision of the Examiners-in-Chief to the said Supreme Court without first having appealed to the Commissioner of Patents."

CAN ANTS TALK?

No one has studied the habits of "our six-legged rivals" without becoming impressed by their ability to communicate with each other, and the wide range of intelligence which they seem to be able to convey. Information of common danger is quickly spread throughout colonies numbering many thousands, the news being brought by perhaps one or two spies. Hitherto their mode of communication has been a mystery, the most plausible hypothesis being that it was by a sort of fencing with their antennæ. Thus an ant returning from a foraging expedition meets another outward bound. They stop, strike antennæ together a few times, then proceed, No. 1 to the nest, No. 2 setting off on a new course and going straight to the place where No. 1 found her load. It would now appear that the striking of antennæ is merely a sort of salutation, as two neighbors might shake hands, while conversation goes on by other means. At any rate, according to the report of Professor Landois to the Natural History Society of Prussian Rhineland, they are provided with a sounding apparatus resembling that of the sand wasp. To have implies to use; and though its pitch is generally inaudible to human ears, its range of tone may be ample for a fully developed language. We say "generally inaudible," notwithstanding Professor Landois' belief that it is always so, having more than once noticed a faint strident, hissing sound proceeding from columns of large ants when annoyed. The next thing in order is an apparatus for making inaudible sounds audible, as invisible rays are made luminous; then some enterprising student may give us a comparative grammar of formic idioms

THE SEWING MACHINE.

The Committee on Patents of the House of Representatives has recently reported adversely to the application for the extension of the A. B. Wilson sewing machine feed motion patent. As we have previously explained, this patent has been controlled by a coalition of manufacturers, namely, the Wheeler & Wilson, Grover & Baker, Wilcox & Gibbs, Singer, and the two Howe companies, who have made it the means of exacting immense royalties from smaller makers, and thus of distancing all competition, while at the same time of amassing colossal profits from their own large sales. The patent has already been once extended, and this second extension, had it been granted, would have continued the monopoly for a further period of seven years, during which time a score of millions would probably have been added to its already vast wealth. As it is, the invention now becomes public property, and is free to all users. The onerous royalty is thus obviated, the door opened widely for a healthy competition, and the diminution in price of the sewing machine probably to the extent of fifty per cent, will doubtless soon follow.

The history of a successful invention of this kind furnishes a suggestive commentary upon the wisdom of the principles which underlie our system of patent laws. Of these, the ultimate object is, solely and purely, benefit to the community, not the mere securing of a monopoly to the inventor. But as is exemplified in the instance in point, although the proprietors of this valuable right have been allowed to exercise a species of tyranny for several years, and to exact from the public large sums, still the object has been not to afford means for them to get rich, but to induce them to improve and develop the invention. Spurred on by immense gains, those reaping the harvest have accomplished this development. More than that, they have evolved a new and lucrative industry. Ample opportunity has been afforded them for all this; and now Congress, in declining to continue the same privilege, asserts that the benefits to the public will not be so great in so doing as will be secured by removing the restrictions. Certainly the reward obtained during the period of the monopoly by its owners has been enormous, but it is utterly inconsiderable beside the profits which will now accrue to the public.

In brief, for twenty-one years we have submitted to great exactions, but in so doing we were investing sums to secure the prosperity of our descendants. By allowing a few to become wealthy over a couple of decades, we have induced them to develop a great industry which will prove a source of income to millions in years to come.

PROSPECTS FOR 1875.

We are gratified to be able to state that the subscriptions to the SCIENTIFIC AMERICAN, for the new year of 1875, are pouring in from all directions as they have never done before. We are now printing, every week, 50,000 copies of our journal, which is undoubtedly more than the combined circulation of all other papers of its kind published in the world.

We hope our friends who have not yet renewed, and all who are engaged in the formation of clubs, will send along their names as rapidly as possible. To prevent the loss of back numbers by those whose remittances are a little tardy, we electrotype each issue and preserve the plates, whereby we are enabled to print new editions of any numbers that may be required.

We recommend persons to patronize their local periodical dealers, when equally convenient for them, in preference to the mail. By receiving the paper weekly from the counter or by carrier, the objectionable creases in the paper, necessitated by the folding for the mail, are avoided; besides, it is commendable to patronize home enterprizes in every thing.

We have the most gratifying assurances from all parts of the country that, notwithstanding the hard times among some of our industrial classes, the demand for scientific and mechanical information is increasing. Our subscription books, since the new year, demonstrate this fact.

SCIENCE RECORD FOR 1875.

We have much pleasure in announcing the issue of the volume for the current year, which we believe will, on examination, be found fully equal in merit to any of the preceding books of the series. The SCIENCE RECORD for 1875 contains about 600 pages, and such is the wide scope and variety of contents that the index alone fills some ten closely printed pages. The index of references is also extensive, designating nearly one hundred and fifty scientific publications that have been more or less consulted in the compilation of the work.

In the department of Chemistry and Metallurgy, which covers nearly sixty-eight pages, we have accounts of all the leading improvements, discoveries, and suggestions in these important branches, made public during the year just closed. All who are interested in either of these departments of Science, or who desire to be concisely informed as to the latest progress therein, will find the records to be of value.

The department of Technology, occupying nearly one hundred and fifty pages, contains a very large amount of new and useful information, illustrated by a variety of engravings. The new alloys, new recipes, and new processes in the various arts, here collected and condensed, are of great value, and probably not attainable in any other one work. Among the illustrated articles is the latest form of machinery for the artificial manufacture of ice; also the methods and apparatus used in gathering natural ice. Here we find described the many uses of paraffin, new methods for the ornamentation of metals, nickel plating, iron welding, new imitations of silver and other precious metals, directions for the practice of several new and simple arts, photographic improvements, waterproofing of paper, manufacture of carbonic acid, solvents for rubber, protection and ornamenting of iron, preparation of bronzes, uses of mica, production of artificial leather, artificial manufacture of precious stones, tempering of steels, and a multitude of other subjects, all useful, interesting, and desirable for reference.

Under the head of Electricity, Light, Heat, and Sound, covering fifty pages, we have descriptions and engravings of recent telegraphic apparatus, new electric motors, new machines for producing the electric light, several forms of new batteries, an engraving of the apparatus used for the new artificial light called the Bicarbon Light, said to be equal to the oxyhydrogen but cheaper and superior, better also than the electric or magnesium light. An electrical barometer, a simple little instrument, worked by electricity drawn from belts in machine shops, is represented, and a great number of other improvements and new suggestions.

The department of Mechanics and Engineering, occupying nearly one hundred pages, embraces a great variety of articles of special interest to the mechanic and engineer. The latest improvements in ships are here given, with engravings. The Bessemer steamer is illustrated, also the Castalia twin ship. Diagrams of the most recent ordnance are given. There is a chapter on the propulsion of cars and vehicles by springs, with engravings. The latest railway improvements and structures are shown, and among them the new car of Giffard, of injector fame, which moves without oscillation.

The departments of Rural Economy, Botany, Horticulture, Agriculture, etc., are full and interesting. The latest egg hatching machine is illustrated; so are the habits and form of the Colorado potato beetle, etc.

Under Materia Medica, Therapeutics, Hygiene, we have a large amount of new and important information, from the most reliable sources, profitable to every reader.

Pisciculture is an interesting department, containing engravings of the most recent methods for hatching and cultivating fish, with descriptions. The farming of fish is rapidly growing in importance, and there is evidence of more profit, with less labor, to be made from the streams that flow through the land than from the adjoining land itself.

The department of Natural History and Zöology will be found especially interesting, as the amount of new information acquired during the past year, from various expeditions, is large and important.

In the department of Geography, the past year has been prolific of new and interesting information. A series of views of the remarkable cañons of the Colorado is given, which convey an idea of the astonishing natural formations that exist in our West.

Astronomy is full of useful interest; some of the results of the Transit of Venus observations are given, together with a mass of new and valuable matter.

The department of Biography is illustrated with the portraits of several eminent men of science, and will be found unusually interesting.

Taken altogether, the SCIENCE RECORD for 1875 is a book of unrivalled importance and value. All who desire to have before them, in condensed form, the year's progress in Science should possess a copy. Sent by mail, prepaid. Price $2.50. Published by Munn & Co., office of the SCIENTIFIC AMERICAN, New York.

AN ANCIENT METRIC SYSTEM.

The library of Asshurbanipal, King of Assyria, found during Mr. Layard's excavations at Nineveh, shows that Science had made no little progress in Asia twenty-five hundred years ago. This curious library consisted of flat, square tablets of baked clay, having on each side a page of closely written cuneiform cursive letters, which had been impressed on the clay while it was yet moist. The great majority of these tablets are now in the British Museum, and have been found to contain the remains of an immense grammatical encyclopædia. There are also fragments of many mathematical and astronomical treatises, with catalogues of observations, tables, calculations of eclipses of the moon, and observations of solar eclipses, the earliest of which occurred nearly a thousand years before the beginning of the Christian era. There are also fragments of law books and legal records, books of chronology, manuals of history, accounts of Assyrian and other divinities, collections of hymns in the style of the Psalms of David, a geographical encyclopædia, works on natural history containing lists of plants and animals, of timber trees employed in building and furnishing, of stones fit for architecture and sculpture, etc. Perhaps the most interesting of all these lists is a classified catalogue of every species of animals known to the Assyrians, showing a scientific nomenclature similar in principle to that of Linnæus. Opposite the common name of each animal is placed a scientific and ideographic name, composed of two parts, a family name and a characteristic epithet denoting the species.

A still more remarkable indication of the scientific advancement of the ancient Assyrians appears in their system of weights and measures, in which, as in the French system, all the units of surface, capacity, and weight were derived from one typical linear unit. The basis of the system was the cubit (equal to 20·67 inches). This was divided into sixty parts, corresponding with the minutes of the degree. The cubit, multiplied by 360, the number of degrees in the circle, produced the stade, the unit for large distances. The fundamental unit for areas was the square foot, the square of a measure bearing to the cubit the relation of 3 to 5, or 12·4 inches of our measure. The cube of the foot was the metreta, the standard of all measures of capacity; and the weight of a cubic foot of water gave the talent, the fundamental unit of weight; the sexagesimal division of the talent gave, first the mina (=510·83 grains), and second, the drachma (=8·51 grains).

The sexagesimal system was employed throughout their mathematics, the unit being invariably multiplied or divided by sixty, the result again by sixty, and so on to infinity. "This, it is very evident," observes Lenormant, "was the result of a wise combination of a very practical character, intended to combine the advantages of the two systems of dividing unity that have been in dispute at all times and among all nations—the decimal and the duodecimal." We still follow this Chaldæo-Assyrian system in the divisions of the circle and in our divisions of time.

Water glass deserves more extended household usage. Mixed with paint or whitewash it gives increased durability and a fine gloss, it is an excellent fireproof cement, and when dry is also waterproof. It is a good adhesive mucilage for mending china, glass, or wood, and made into a wash is the best coating for brick vaults.

Dr. GUTTCKIT recommends rubbing warts, night and morning, with a moistened piece of muriate of ammonia. They soften and dwindle away, leaving no such white mark as follows their dispersion with lunar caustic.

THE UNDERGROUND RAILWAY, NEW YORK CITY.

NUMBER IX.

Continued from page 68.

THE PASSENGER STATIONS.

With the exception of that in the viaduct, described in our last article, all the stations are beneath the street level. The first of these underground landings occurs in the beam tunnel, midway between 58th and 59th streets. It consists of two waiting rooms and two landings, one of each for each side tunnel, placed immediately beneath one of the rectangular openings of the central tunnel. The platforms are 150 feet long, 12 feet broad, and 3 feet 6 inches above railroad grade. Along its entire length the outside rubble retaining wall of the tunnel is removed and set back 11 feet nearer the house line, its place being supplied by a row of cast iron columns 10 inches in diameter at the base of the shaft, 10 feet 6 inches high, and of ¼ inch metal. They are placed 11 feet 9 inches apart and 3 feet from the inner edge of the platform. About the center of the platform the retaining wall is again interrupted for a distance of 59 feet, and set back 20 feet nearer the house line, thus forming a recess 20 feet by 59 feet, which contains the waiting room, ticket office, water closet and vaults. The waiting room is 36 feet long, 10 feet wide and 11 feet 6 inches high. From the north end of this room rise iron steps which lead to the sidewalk. These steps are 8 feet broad, have iron frames and rises, with wooden treads, and are divided down the center by an iron railing 3 feet high, which also extends from the foot of the stairs to the ticket office, thus separating the flight into two flights, one to be used by passengers ascending from the station to the street, and the other by those descending. At the exit on the sidewalk, these steps are covered by a neat wooden house 8 feet x 12 feet, and lighted by patent lights placed in the roof. The general style of this house is shown in Fig. 6, page 338, volume XXXI

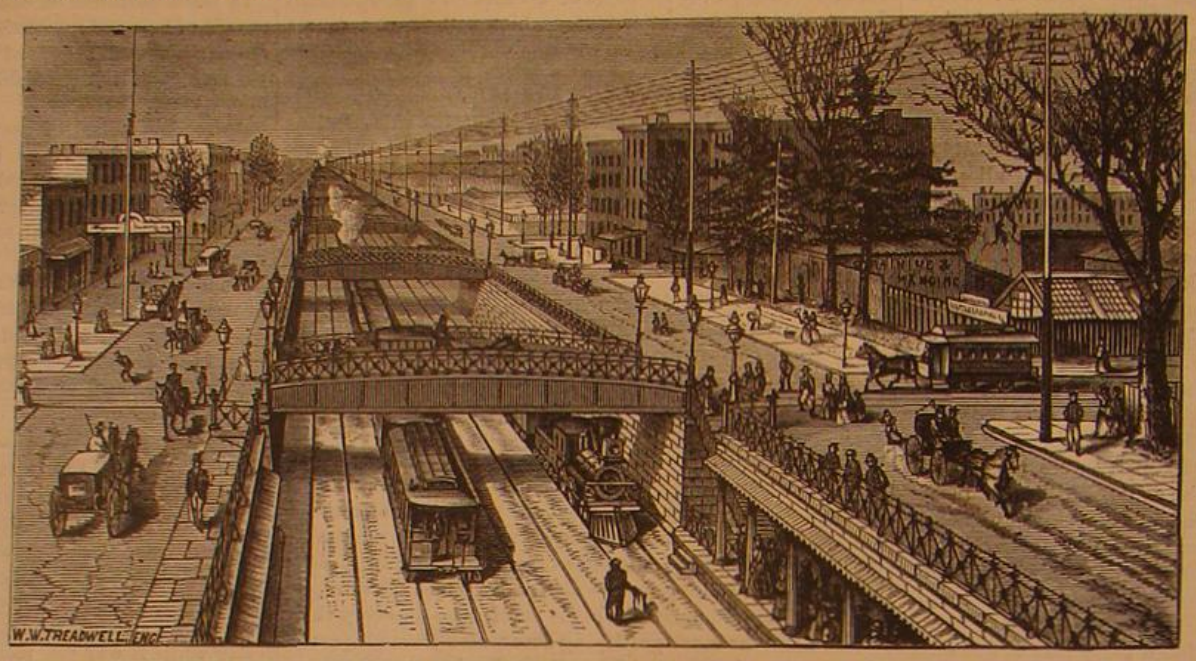


Fig 22.—THE UNDERGROUND RAILWAY, NEW YORK CITY.—PASSENGER STATION AT 125th ST.—THE HARLEM OPEN CUT AND CROSS STREET BRIDGES.

The roof of the station, like that of the tunnel, is composed of H iron beams and turned arches between them. Along the top of the iron columns run the two girders previously described; along the retaining wall which bounds the platform is placed one H beam, and upon the 20 inch brick walls, which form the inner walls of the waiting room and stairway, rest two more girders. Upon these are placed transversely the H beams similar to those used in roofing of the beam tunnel, and between them the brick arches.

The lighting of the station is derived from eleven patent lights, 3 feet in diameter, placed in the sidewalk immediately over the waiting room, from the lights placed in the roof of the house covering the stairs, and from the rectangular opening in the roof of the central tunnel. The ventilation is also largely derived from this latter opening, but also through the ventilators in the side of the house over the stairs.

The station at 72d street is precisely similar to that at 59th street, and needs no description. The station at 86th street is illustrated in elevation in Fig. 23. It differs essentially from those just described. There are two stations, one for each of the two side tunnels; but unlike the 59th street station, they are placed on the inner side of the small tunnel, or the side nearest the central tunnel, and do not have a waiting room. They consist really of a covered platform, 172 feet long, 13 feet 8 inches wide, and 3 feet 10 inches above the railroad bed.

Along the inner side, and separating the side from the center tunnel, runs a rubble wall, 4 feet thick, with vertical faces and lined on the side of the platform with brick. Three feet six inches from the inner edge of the landing is a long row of cast iron columns, 10 inches in diameter at the base, 11 feet 4½ inches high, and of ¾ inch metal. These columns support two 15-inch heavy girders placed side by side, their flanges touching. Upon these rest the roof beams and turned brick arches.

At the south end of these platforms is the ticket office. A flight of four steps leads from the street to the platform on which this ticket office stands; and from this landing go off, to the east and west, two other flights which lead to a platform below the street grade, and from these latter landings a final flight, at right angles to the latter, leads to the platform beside the track.

At the north end of each platform is a small waiting room 35 feet by 8 feet.

The last station on the road is between 125th and 126th streets, in the open cut and upon the west side of the track. Its general appearance is well shown in Fig. 22, which also shows in perspective the open cut through Harlem and the various bridges at the street crossings. In plan, this station consists of a platform, 164 feet in length, 8 feet in width, 2 feet 10 inches above railroad grade and composed of a layer, 12 inches thick, of broken stone covered with 4 inches concrete and 12 inches hard finish. The platform is covered over its entire length by a corrugated iron roof, resting upon 9-inch heavy beams supported upon 15-inch heavy girders, which in turn rest upon cast iron columns, of the same kind as those used in the other stations, placed 12 feet apart and 4 feet from the edge of the platform. These columns rest upon cap stones 8 inches thick and 2 feet square.

At the south or 125th street end of the platform are the waiting room, ticket office, vaults, etc., occupying a recess 53 feet by 10 feet. These rooms are covered by 15-inch heavy beams and 8 inch turned brick arches. The stairs from the platform to the street are also at the south end, are 5 feet wide with yellow pine steps and cast iron risers and strings, supported by 9-inch heavy beams.

Weight and Height of Americans.

According to a recent work of Mr. B. A. Gould, Actuary to the United States Sanitary Commission, in which some very interesting figures relative to soldiers in the last war are given, it appears that the American nation, instead of being degenerate and inferior to the European race in point of physical perfection, is far the reverse. The figures adduced show that "the tallest men were from Michigan, Illinois, and Wisconsin; the next tallest, New England, New York, New Jersey; and the shortest from Scotland, England, Germany." In weight, the men of Kentucky and Tennessee were the heaviest, averaging 150 pounds; England, Scotland, France, Belgium, all between 138 and 139 pounds. The ratio of weight to stature gave in pounds to the inch: Ohio and Western States, 2·185; New England, 2·121; England and Scotland, 2·118; Germany, 2·168.

A Layer of Hydrogen above our Atmosphere.

In a paper read before the Manchester Literary and Philosophical Society, Henry H. Howorth observes: "It is clear that, if under certain conditions hydrogen be an exception to the general law of the diffusion of gases, and follows rather the more general law of gravitation, it will exist in a stratum above the atmosphere and beyond the reach of direct observation. In his experiment upon the occlusion of gases, Mr. Graham examined several aerolites, and found that, under the air pump, they parted with a very large quantity of occluded hydrogen. If, as is probable, the gas was occluded by the aerolites when at a red heat, and this red heat was coincident with their passage through that layer of the upper atmosphere in which the phenomena of shooting stars and of the aurora occur, it seems more than probable that this stream is a layer of hydrogen. This is confirmed by what we know of the spectrum of certain auroras, which resembles those of the zodiacal light and the solar corona. The spectrum of the corona has been the most attentively studied, and Janssen, perhaps the greatest authority on it, speaks most confidently about its distinguishing feature being the hydrogen lines, while a special line, which characterizes both its spectrum and that of aurora, and which is different to that of any terrestrial substance, is considered by Father Secchi to be an abnormal hydrogen line. Dr. Dalton long ago argued, as Mr. Baxendell has reminded Mr. Howorth, that the peculiar features of the aurora could best be explained by the hypothecation of a stratum of some peculiar gas above the atmosphere. A gas of a 'ferruginous nature' is the expression of Dr. Dalton. Now hydrogen, in the higher chemistry, is not only classed among the metals, but Faraday and others have shown that in its relation to magnetism it is nearly allied to iron, so that a stratum of hydrogen above the air would seem to exactly answer Dr. Dalton's postulate. If it should exist, the earth would resemble the sun in one remarkable feature, for we now know that the sun is girdled with an immense layer of hydrogen. Lastly, he would add that the heterogeneous texture of the gaseous nebula, like the great nebula in Orion, seems to argue that the law of the equal diffusion of gases does not prevail there."

Singular Mathematical Fact.

Any number of figures you may wish to multiply by 5 will give the same result if divided by 2—a much quicker operation; but you must remember to annex a cipher to the answer, whenever there is no remainder, and when there is a remainder, whatever it may be, annex a 5 to the answer Multiply 464 by 5 and the answer will be 2,320; dividing the same number by 2 and you have 232, and, as there is no remainder, you add a cipher. Now take 357, and multiply by 5; there is 1,785. Divide the same number by 2, and you have 178 and a remainder; you therefore place a 5 at the end of the line, and the result is again 1,785.

Wicks of Kerosene Lamps.

The unsatisfactory light frequently given by kerosene lamps is often due to the wick. The filtering of several quarts of oil through a wick, which stops every particle of dust in it, must necessarily gradually obstruct the pores of the wick. Consequently although a wick may be long enough to last some time, its conducting power may be so impaired that a good light cannot be obtained.

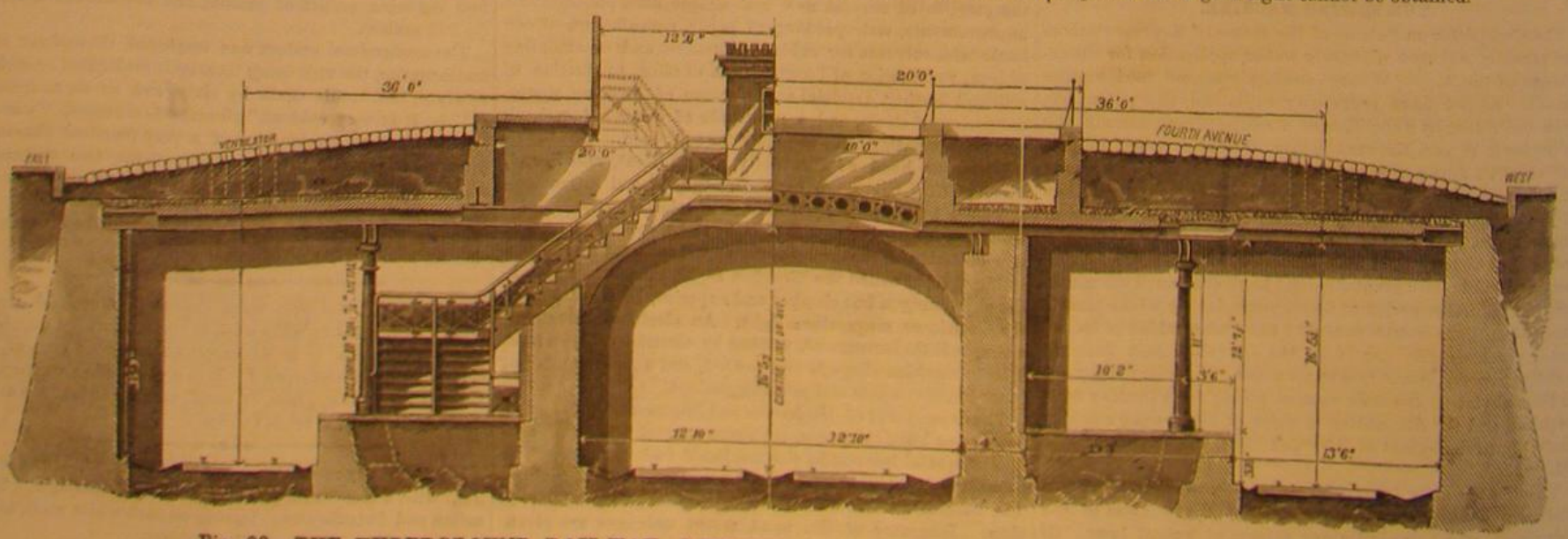


Fig. 23.—THE UNDERGROUND RAILWAY NEW YORK CITY—THE 86th STREET PASSENGER STATION.

BAKER'S IMPROVED BOOTJACK.

The simple and powerful bootjack, represented in the annexed engraving, will doubtless find a ready welcome from all who expect to experience countless struggles with well soaked boots during the wet weather of the next few months. It will be noted that the device takes a firm grasp, not merely of the heel, which is liable suddenly to come off, causing the operator to sit down with more celerity than grace, but of the entire counter, tightly holding the same until the foot is extricated.

The rear portion, Fig. 1, consists of a casting, A, which is

Fig. 1

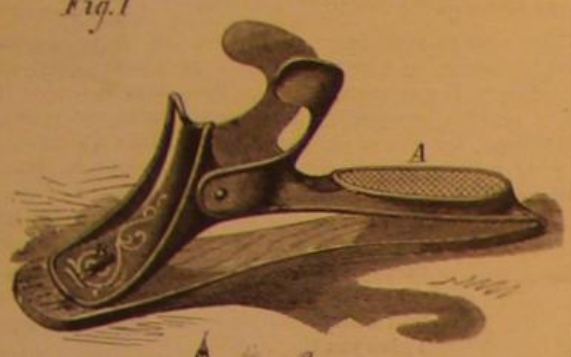


Fig. 2

hinged to the bedplate, and its forward portion is inclined back, and curved, to receive the boot. Pivoted to the front end is a catch plate, which is secured to the bed by a bolt, B, passing through a slot, so that the plate may slide freely in a longitudinal direction. In pulling off the boot, the latter is inserted, as shown in Fig. 2, between the catch plate and the curved part of the rear casting. The other foot is then placed upon the part last mentioned, pressing it down, thereby causing the catch plate to slide outward, so that the boot is clamped tightly between the two portions of the device. While the boot is held, the foot is withdrawn.

Patented through the Scientific American Patent Agency, December 8, 1874, to Mr. Peter H. Baker, of Virginia City, Nevada, who may be addressed for further information.

Private Pisciculture.

Mr. Seth Green, the well known pisciculturist, states that he has invented a new method for transporting and hatching nearly all kinds of fish eggs, by which spawn can be carried for one hundred and thirty days journey, and can be hatched in any room in the house. One million eggs, it is also said, can be hatched by using a pail of water daily.

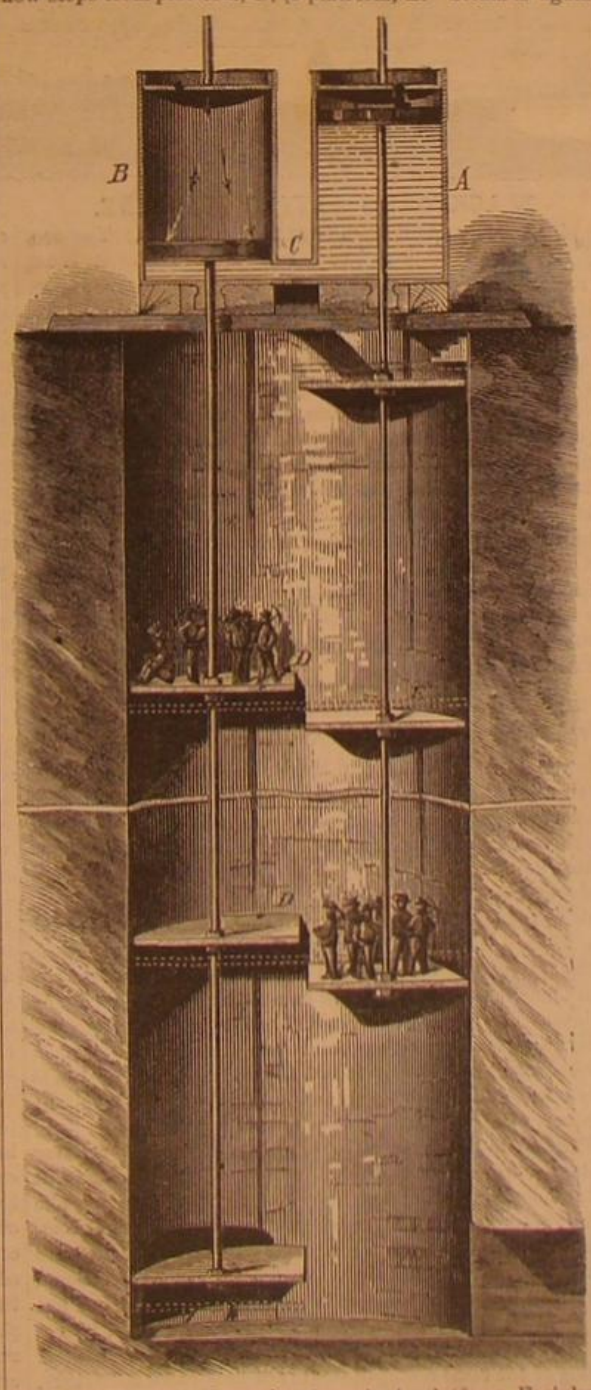
We believe that fish culture by private parties can be rendered a lucrative source of income, provided it is followed with the same care as is exercised in the raising of poultry or any other live stock. Hundreds of farmers have streams and ponds on their lands now of no value save perhaps as watering places for cattle in pasture, and yielding a few worthless perch and catfish, perhaps an occasional trout or pickerel. If Mr. Green has solved the most difficult part of the problem, namely, the successful transportation of the eggs, the mode of stocking of waters and the rearing of the fish are not difficult subjects of which to acquire an adequate knowledge. One species of fish in particular, which is little known, will, we think, prove especially remunerative, and for this reason we commend it to notice. We mean the land-locked salmon, which is a distinct species of the fish, though so closely resembling the ocean salmon as to suggest the idea that, at some remote period, a quantity of the latter fish, being by a convulsion of Nature barred from returning to the sea, had propagated in their land-locked quarters and eventually developed into a separate variety. The habits of the land-locked and ocean salmon are closely similar. The young fry of the former seem to remain in the fast water before going down to their ocean, the deep still water of the pond or lake, about the same time as those of the *salmo salar*. The average size of the fish is about one and a half pounds, though it has been captured weighing as high as eight pounds. It requires running aerated water with access to still pools. As a table fish, the land-locked salmon is said to be superior to its ocean relative; and as game it is reported to be unequaled, rising to the fly from running water even in the hottest summer days.

Steam and Water Power.

According to Mr. Batchelder's book, in 1863, where he quotes Montgomery on cotton, at Lowell or Lawrence, the interest, at six per cent, on the purchase of a mill power, and of land for the mill, will average about $15 per horse power per annum. The rent for water power, also, in cases where the mills are not owners of the water power, would appear to be from $300 to $500 per annum, per mill power of 62½ horses net, showing a rate, per horse power, of $5 to $8.33⅓ only. In Holyoke, the price is about the same. At Manayunk, Philadelphia, the rent of water power and land used to be (1863 about $60 per horse power per annum. I am not aware that the price has been diminished. To these rents should be added a comparatively small expense for labor, oiling, etc., and for repairs. It is obvious that Lowell and Lawrence, and a few places equally well situated, have, after deducting the value of land for the mill, advantages in water power which do not form, however, an average for the United States. I understand that no water companies, with such profitable terms for mills as that of Lowell, are now formed, although, in 1863, it was considered that, such is the superabundance of water power in New England and other parts of the country, it could be obtained in situations favorable for manufacturing for half the cost at Lowell. The reason, or at least one reason, is that the labor required in preparing the water power has increased, as the cost of using steam power has diminished. Another, probably, is that the cost of freight is so much higher, that this and other considerations of a like nature are of more moment, in selecting the site for a mill, than the advantage of water.—*H. Gastrell.*

THE BELGIAN MODE OF LOWERING MINERS IN SHAFTS.

Mr. J. W. Cole, of the Tanite Company, of Stroudsburg, Pa., sends us, from Brussels, Belgium, the following interesting account of his recent visit to the collieries of the *Sociétés des Charbonnages de Mariemont et Bascoup.* These large corporations own an area of some 500 square miles of coal fields, and employ 9,000 men, producing, from fourteen mines, 7,000 tuns per day. The apparatus for lowering and elevating the miners to and from their work is very ingenious, and of especial advantage where a large number of men are to be transported. Its operation will be understood from the annexed engraving, in which A and B are two steam cylinders, connected by the pipe, C, and containing water in the spaces below the pistons. The latter are attached to platforms, D and E. The parts being as shown by the full lines in the engraving, a miner steps upon platform, D. Steam is now admitted above the piston in cylinder, B, forcing said piston down, and hence driving the water into the other cylinder. This of course raises platform, E, and, as is evident, brings the two platforms on a level, when the piston in A is at its highest, and that in B at its lowest point. The miner now steps from platform, D, to platform, E. Steam is again



admitted, this time above the piston in A; platform, E, sinks, and eventually comes on a level with a third platform, D', secured below platform, D. This operation is continued, the workmen entering at the top and stepping from one platform to another until the bottom is reached.

The societies own 14 locomotives and 123 stationary engines; the boilers for the latter are so arranged that no fire door can be opened without closing the flue, thus avoiding the evil effects of a cold air draft.

COMBINED WRENCH AND BOLT CUTTER.

The expensive and cumbersome bolt cutters heretofore provided for blacksmiths and carriage trimmers led Mr. P. Broadbooks, of Batavia, N. Y., to invent a simpler and more effective tool for his own shop; for this he obtained letters patent, dated March 18, 1873. Recent improvements have added to the value of the invention, the moderate cost of which makes it a feature of interest to every mechanic having occasion for its use.

The engraving represents a side view, and shows the manner in which the tool is applied. A and B represent lever handles, pivoted at C. On the lever, B, is found a cam-shaped head, beveled so as to form a cutting edge on the inner side, which operates (with the head, D, of the opposite lever) like a pair of shears. The head, D, is formed with a deep notch or recess, so that it will fit on a nut, and may be used for turning the same like an ordinary wrench. This recess has an offset, E, for turning smaller nuts, and supporting them while the bolt is being cut off by the cam head. The wrench

head is also provided with a half round notch, F, for supporting wires and small rods while being cut off.

The nuts may be turned up and the bolt ends cut off with one operation of the tool. The cut is smoothly made, and an excellent finish is left. The bolt is riveted on top of the nut, as a slight flange is formed, extending a little over the edge of the nut, sufficient to hold the latter from working off. Specimens cut by this tool (one of them a seven sixteenths inch bolt), forwarded to us, fully corroborate the above.

The great power in this bolt cutter is secured by applying, close to its fulcrum, a cam-shaped cutter to a rod or bolt to be cut. The simplicity of the tool (composed of only two pieces, fastened with a rivet or bolt) insures its durability. By screwing the cam lever into a vise, or fastening it into the bench, the other lever can be operated so as to cut bolts, rods, or wires with great ease and rapidity. By removing the handles, as shown in the engraving, the shanks, A and B, form a serviceable pair of large compasses.

This wrench and bolt cutter, and one of the bolt cutters in the Broadbook system of compound tools (already illustrated in the SCIENTIFIC AMERICAN), will enable a person to reach, and cut easily, any bolt in any part of a vehicle, and the two tools together cost less than one of the bolt cutters now in common use.

Arrangements will be made with manufacturers to make this combined wrench and bolt cutter on royalty. For full particulars address Broadbooks & Co., Batavia, N. Y.

THE ANTHRACITE COAL HARVEST OF 1874.—The total quantity of anthracite coal mined in Pennsylvania, in 1874, was twenty-one millions six hundred thousand tuns, or over five hundred and sixty millions of cubic feet. Placed in one mass, this would form a solid wall one hundred feet high, one hundred feet wide, and nearly eleven miles in length.

If a shaft springs in running, the trouble lies probably in either a too small diameter of the shaft for its weight and velocity, a set of unbalanced pulleys, or an unequal strain on either side by the belts.

Correspondence.

Animal Suicides.

To the Editor of the Scientific American:

A few weeks ago I saw in your paper an account of a scorpion stinging himself to death while being burnt with a sun glass. He did not intend to commit suicide; it was a mere accident on his part. I lived in Brazil for several months, and I have seen more than a dozen sting themselves to death. I used to take a straw or small stick, and lay it across their backs and hold them down with considerable force; and they would turn their tails over and feel very carefully for the straw, and then draw back and strike at it; and often the sting would strike the straw and split it, and so enter the body.

I have taken an iron ring, about 4 or 5 inches across, and heated it black hot and put it over them; and when they began to feel uncomfortable, they would strike all around with their tails. But I never knew one to sting himself. At one time I enclosed two of them within a hot ring; and when they began to feel the heat, they went at each other with their stings, and in a short time they were both dead.

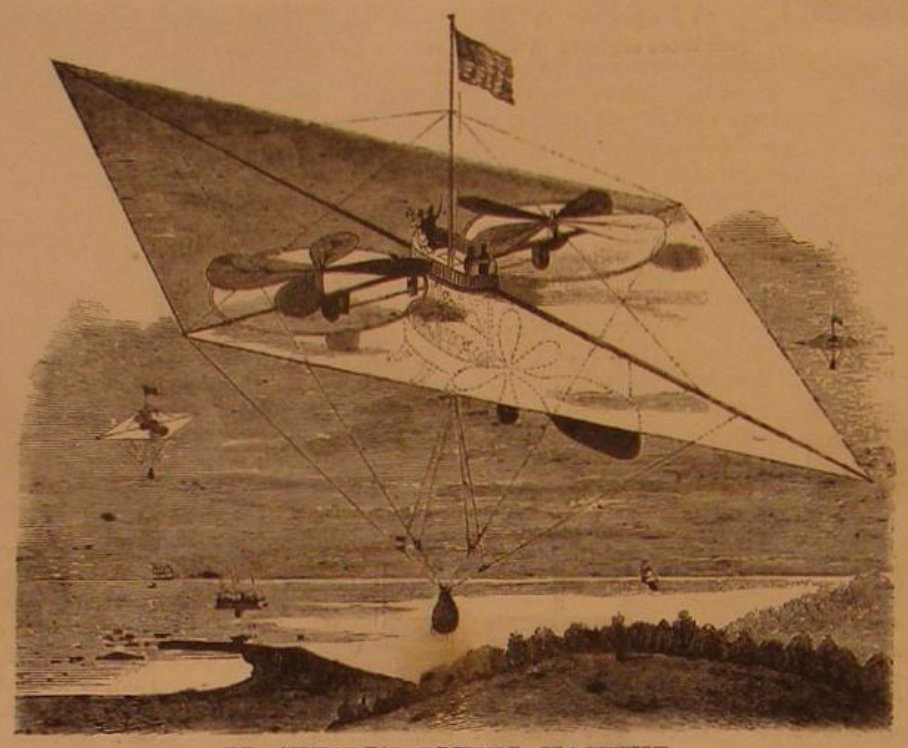
Lynn, Mass. S. A. T.

A New Form of Flying Machine.

To the Editor of the Scientific American:

Screw propulsion is the principle upon which will, probably, be accomplished the great problem of aerial navigation. The plan here proposed is a modification of the device presented by W. D. G., in a recent issue of the SCIENTIFIC AMERICAN. The horizontal driving shaft is attached below the spar, above which the wing propellers revolve in opposite directions. This shaft is rotated by means of cranks actuated by the machinery below, and is connected with the wings by means of bevel gearing. The wing spar is arranged to rotate partially around its own axis, the driving shaft moving with it. The wing propeller shafts may thus be worked vertically, or inclined forward at any angle desired. To rise vertically in the air, the wing propeller shafts are set in a perpendicular position; when a forward motion is required, they are inclined forward. At right angles to the wing spar is a fore and aft spar, and a sail is attached to these after the manner of a kite. Below, about where the string would be attached in the ordinary kite, is suspended a bag of ballast whose position can be shifted at pleasure by means of the lines passing upwards through the bottom of the car. By slackening the forward line and hauling taut the aft line, the inclination of the kite may be increased as circumstances may require. This ballast may be a part of the cargo or the baggage of passengers. When the wings get out of order or need oiling, they may be stopped, and the stern propeller on the car below put in motion. The air ship then sails like a kite when the boy runs with it on a still day.

If great speed is required, all three propellers may be run at the same time, the shafts of the wings being placed horizontally: the ship will then fly onward at a level, or rise or descend, according to the slope given to the kite by means of the ballast lines. Working in a socket joint at the end of the stern propeller shaft is a rudder, the other end of which swings by a cord from the spar above. The steering is effected by ropes, not shown in the illustration, attached to the rudder and passed to the deck of the car through pulleys on the wing spar. On approaching the earth, the bag of ballast touches first; and at this elevation, by keeping its wings in gentle motion, our ship may remain suspended until transfers of passengers and mails are effected, or preparations are made for landing. If an accident should happen to the machinery, the ballast may be instantly adjusted so as to bring the kite to float level, in which position the contrivance becomes a capital parachute. The passengers may then repair to the upper deck and calmly await the result.



BLACKFORD'S FLYING MACHINE.

Increased power and greater security may be obtained by having two propellers on each side of the car, arranged along the wing spar, and so connected that either or both sets may be run. A greater number of fore and aft spars may also be introduced, crossing at the center of the car, like the three sticks of a kite. The rudder might be attached to the rear extremity of the fore and aft spar, in which position it would exercise greater power and render the flight of the ship more steady; it might have a horizontal as well as a vertical wing, and be capable of a vertical as well as a horizontal movement, performing in this way precisely the functions of the tail of a bird.

The great and only obstacle to the successful accomplishment of the problem of aerial navigation is the weight attendant upon motive powers now in use. But even with steam machinery, by using concentrated fuels, the above device would seem practicable. The inclined plane or kite principle is that applied by birds after acquiring momentum by flapping their wings. In this case, the propelling power is continuous, and great velocities might be attained, amply sufficient, no doubt, to dispense entirely with all downward action of the propellers after once starting.

The day cannot be far distant when the inventive genius of the nineteenth century will accomplish a mode of locomotion practised with so much ease by such vast numbers of the animal kingdom. The time may yet come when the present ways of travel will be regarded as we now do the old fashioned 'pike and stage coach; and nations will be brought into such easy, rapid, frequent, and intimate commercial and social connection as to result in a grand unity in language, law, and government on earth. WM. W. BLACKFORD.

New Orleans, La.

The Universal Jointed Propeller.

To the Editor of the Scientific American:

In your issue of November 28, I notice a communication from Lieut. F. M. Barber, U. S. Navy, together with an engraving representing a universal joint in the shaft of a propeller, which he claims as his invention, but states that he has no patent, and perhaps some one may get an idea by seeing it.

Mr. Barber, in his praise of the boat to which he has applied it, is correct, as, from my experience and knowledge of its operation on several vessels, I find it absolutely essential in many respects for the security of sea-going and other vessels, apart from its intrinsic value as a means of rapid manœuvering.

I have taken out patents in the United States, Great Britain, France, Belgium, and Canada.

Washington, D. C. JAMES L. CATHCART.

REMARKS BY THE EDITOR.—Several patents have been granted for different means of making the connection between the driving shaft and the propeller, so that the latter could be used for steering purposes. The idea of connecting the propeller with the driving shaft by means of a Hooke or universal joint is quite old, and was shown in an old English patent, the date of which we have forgotten, but it can be found in Bourne's "Treatise on Propellers."

Burning Chimneys.

To the Editor of the Scientific American:

Probably the most prolific cause of fires in houses, especially in the country, is the burning of chimneys. Of the dozen or so of fires I have witnessed, at least one third are known to have been caused by sparks from burning chimneys falling upon the roof. To prevent the burning of chimneys is an easy matter. The soot in the chimney cannot burn, except as the fire of the stove is communicated to it through the pipe. If the pipe, therefore, be kept clean and free from soot, and the damper in the stove always closed, the chimney will never burn out. To free the pipe of soot, take the stove handle or any convenient implement, and rap the pipe smartly on all sides from top to bottom. The soot will fall into the stove and be harmlessly consumed, or it can be removed in the usual way.

If there be a horizontal pipe, this should be taken down twice a year and thoroughly cleaned. Or if the pipe be only a few feet in length, and the arrangements will admit of it, provide the horizontal pipe with a permanent scraper, as follows: To the end of a stout wire, a few inches longer than the pipe, attach a small segment of a disk of sheet iron, at right angles to the wire. Remove the elbow, and thrust the scraper into the pipe. Pass the other end of the wire through a hole punched in the elbow, loop the end of the wire for a handle, and replace the elbow. After first rapping the pipe, the soot can all be drawn out and let fall into the stove. This arrangement I adopted six years ago, and my chimney has not burned out during that time. I clean my pipe thus, as often as once a fortnight during cold weather.

Franklin, N. Y. J. H. P.

Steam Boiler Explosions.

To the Editor of the Scientific American:

In your issue of January 16, Mr. R. D. Williams attempts to account for the destruction resulting from steam boiler explosions; and although he brings an array of figures to support his theory, I think he is wrong when he assumes that (because a boiler is not torn to pieces when it gives way under a cold water test) it is not the bursting pressure, under steam, which produces the fragments, but that, at the instant of the explosion, a large amount of water heated to a temperature above the natural boiling point is converted into steam, and that alone tears the boiler and causes the destruction which follows. He seems to forget that there is very little elasticity in cold water and a great deal in steam; the former, at the enormous pressure of 15,000 lbs. to the square inch, is only compressed $\frac{1}{20}$ of its volume, while a very large volume of steam can be confined in a very small space.

The opening of a seam or breaking of a rivet relieves water pressure, because, there being so little elasticity, it soon finds its volume; but it is not so with steam. The same rupture would relieve but a comparatively small fraction of the pressure exerted in producing it, and the pressure continues exerting its force upon the broken or fractional part until the whole pressure is relieved and the steam has acquired its full volume. A wooden wedge driven into a cast iron pipe would produce a slight fracture; but a steel spring of the same strength would not only cause a fracture, but would also break it into fragments.

I do not deny, positively, that the conversion of water into steam at the instant of explosion does not lend force, for such a thing is perhaps possible, but I think hardly probable. I do contend, however, that steam of sufficient pressure to rupture a boiler is also sufficient to cause the destruction of life and property which follows explosions.

If Mr. Williams wishes to test the correctness of his theory, let him take an empty boiler that will burst at a pressure of 100 lbs., and connect it by a steam pipe with another boiler, and force dry steam into it until an explosion occurs. In my opinion he will find as many fragments and as much destruction as if the boiler contained the usual amount of water.

I am glad to see the cause of boiler explosions discussed in the columns of the SCIENTIFIC AMERICAN, and are convinced that the interchange of thought on the subject will eventually lead to a solution of this difficult and important problem.

Washington, D. C. C.

Brass vs. Phosphor Bronze for Rolling Mill Uses.

To the Editor of the Scientific American:

I have read in your issue of January 16 an article on phosphor bronze, by a correspondent in this place. Previous to reading it, I was laboring under the impression that it was a superior composition for journal boxes and rolling mill brasses; but on comparing the results of the trials given by your correspondent, with similar work done on brass bearings, my former opinion of phosphor bronze has been changed considerably. The trials made with the bronze brasses were made in a single turn mill, located on the bank of the Monongahela river, a few hundred yards above the mill where some trials were made of which I give you the results.

The water supply of both mills is taken from the same source; and as a matter of course, when the bronze bearings were getting gritty, muddy water, the brass ones were getting the same. The following is the actual work done in the regular way, not by trial bearings. We have no ten inch mill, so I will give you the particulars of a sixteen inch bar mill, for merchant iron. A set of brasses usually run a year in the roughing and finishing, and it is customary to put in new ones every time the mill is stopped to line up and repair, which is done generally in July or August of each year, though the brasses may be but partly worn. This train runs double turns, making over twenty-two millions of revolutions per annum, and turning out in that time about sixty thousand tuns of finished iron. An eight inch train, the driving shaft of which carries two large speed pulleys and a nine foot fly wheel, has journals six inches in diameter and twelve long; it has brass boxes in pillow blocks, the first set of which was put in when the mill was built, and they ran for six years, double turns, equivalent to twelve years of single turns. The second set have now been in some two years or more, and are in good condition. Roughing roll brasses usually run one year as bottom roll brasses, and are then changed to top roll brasses, where they do duty for one year longer. In the finishing rolls (same train) the roller has only had three sets of brasses since the mill has been built (over eight years). These brasses have carried the journals, which revolve over fifty million times in a working year, and turn out about five thousand tuns of finished iron in that time. We also run a thirty-five tun rotary squeezer, cast from the same patterns and fitted by the same parties as the one mentioned by your correspondent. The one under which this most "severe test of all" on a bronze plate was made turns about eleven revolutions per minute, and squeezes puddle balls for nineteen furnaces, single turns. Our squeezer runs sixteen revolutions and does the work for twenty-eight puddling furnaces, double turns, or nearly three times the work, turning out sixty-five tuns of blooms per day of two turns; and under the upright shaft of this squeezer, the builders put a chilled plate of cast iron: and after fifteen months of steady running, as above mentioned, it shows no perceptible wear. I am therefore unable to see where this severe test comes in. The brasses we use are made from ingot copper and pure block tin, in proportion of seven of copper to one of tin. I cannot give its tensile strength, ductility, etc., data which may be very desirable to wire drawers, brass rollers, rivet makers, etc., but which are of no value in determining the value of a composition for journal brasses; but I will guarantee that, if honestly made as above, they will give satisfaction as to durability, and will run smooth and cool, and cost some eight or nine cents per lb. less than bronze. The senior proprietor of this mill, an excellent mechanic, live, progressive, and full of ideas, brought up in a mill, knows the requirements of rolling mill brasses probably as well as any man in this country; and in order to have the best of the kind that could be produced, he has all his brasses made on the premises, for his own use only out of the best materials that can be procured; hence the extraordinary duty performed by the brasses in his mill. He also adopted a plan of preventing the cinder which gets in between the neck of the rolls; and as it is proved to be a good plan for muck mill brasses, I give it for the benefit of your readers: Bore grooves out of the bearings, 1½ inches wide and ½ inch deep and 1½ inches apart, put them at an angle of 45° with the face of the brass, and fill up said grooves with soft Babbitt metal. Then when cinder or iron gets in, it will travel but a short distance before it reaches the soft metal, and the motion of the roll will imbed it therein so that it cannot protrude and score the neck, as it would were it to stick in the brass.

Another useful plan, adopted by him and now coming into general use, is a mode of preventing screws from getting tight in their nuts. The plan is to plane a key wa

or groove in the screw, ¼ inch wide, the full length of the screw and down to the bottom of the threads; and it will act like a tap and scrape all the hard, gummy grease out of the nut and always keep it clean and working free. It is a very simple matter, but saves a great deal of time and vexation.

Pittsburgh, Pa. T. J. B.

To the Editor of the Scientific American:

A letter in your paper of January 16 on phosphor bronze bearings for rolling mill journals, giving the results of three trial bearings, is, I think, fatal to the use of that alloy for the above mentioned purpose, as a much cheaper and more durable bearing can be and is obtained by the use of cast iron lined with Babbitt metal. Under the vertical or central shaft of a rotary squeezers a chilled cast iron plate is used, costing a few cents per pound and giving universal satisfaction, as most mill owners can testify. I am of the opinion that if phosphor bronze were put to a fair test, it would be equal to the best alloy of copper and tin, but for good durable bearings, I think nothing can beat the ones I have mentioned. MACHINIST.

Pittsburgh, Pa.

How to Learn Color Tests for Temper.

Says Mr. J. Richards: "Procure eight piece of cast steel, about 2 inches long by 1 inch wide and ⅛ of an inch thick; heat them to a high red heat, and drop them into a salt bath. Leave one without tempering, to show the white shade of extreme hardness, and grind off and polish one side of each of the remaining seven pieces. Then give them to an experienced tool maker to be drawn to seven various shades of temper, ranging from the white piece to the dark blue color of soft steel. On the backs of these pieces paste labels, describing the technical name of the shades and the general uses to which tools of corresponding hardness are adapted. This will form an interesting collection of specimens, and accustom the eye to the various tints, which will, after some experience, be instantly recognized when seen separately."

PRACTICAL MECHANISM.

NUMBER XVII.

BY JOSHUA ROSE.

MOVEMENT OF THE PISTON AND THE CRANK.

Let us now place upon the valve a maximum of steam lap, and we shall find an entirely new element under consideration. It is that, although steam lap to a certain amount gives us a more free exhaust, beyond that amount it cramps the exhaust by closing the exhaust port of the cylinder. Suppose, for instance, we give the valve, of the engine upon which we have been experimenting, seven eighths of steam lap (instead of three eighths, as formerly). We shall find that, at one part of the stroke, the valve, after having opened the exhaust port full, will commence to close the cylinder exhaust port, so that, while the steam port (being used as an exhaust port) is full open, the exhaust port of the cylinder is as shown in Fig. 54 (the valve seat face at D being left wider

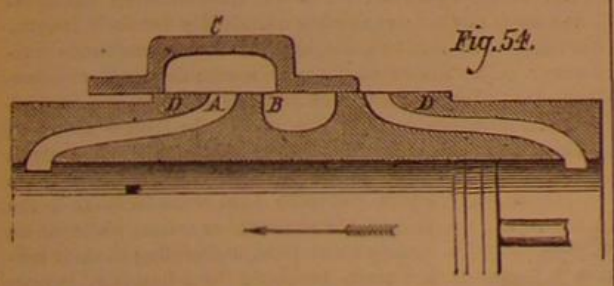


Fig. 54.

than before, to prevent the steam from blowing through to the exhaust port, as it would do if the face, D, were only as wide as the bridge between the steam and exhaust ports, as in our former experiments), A being the steam port operating as an exhaust port and full open; whereas the exhaust port, B, of the cylinder, is closed to such a degree as to cramp the exhaust to the extent of the difference in width of opening between the ports, A and B. We have, however, already decided that the exhaust opening should never be less (during any part of the exhaust) than one half the full width of the steam port; hence it follows that the maximum of steam lap should in all cases be such an amount as will leave an exhaust opening, at all times, at both the ports, A and B, Fig. 54, equal to one half of the full width of the port, A; and it also follows that the limit to which a valve may be made to work expansively is defined or governed by the width of opening which it will leave at B.

We will now place the engine upon which we have experimented under conditions to work to a maximum of expansion, giving to the valve seven eighths inch of steam lap on each side, by increasing the valve travel to three and nine sixteenths inches, and lengthening the eccentric rod one eighth inch (which will be necessary for the increased travel).

Having effected these alterations and moved the engine round a revolution, the first thing to attract our attention is that the front steam port is not left full open by the valve at any part of the stroke, making it appear that the eccentric rod is either too long or that the valve is not properly set; that neither of these defects exists is proved by the fact that the valve lead is equal at each end of the stroke while our valve travel is sufficient to fully open both ports (provided the valve movement were regular); for the width of the steam port, seven eighths, added to the steam lap, seven eighths, amounts to one and three fourths inches, which, multiplied by two, is three and a half; whereas, our travel is three and nine sixteenths inches, or one sixteenth more than would appear to be actually necessary. The valve travels over and beyond the back port to the amount of the deficiency of the opening of the front port added to the one sixteenth inch of increase of travel, and this irregularity of movement is irremediable in all valves having a maximum of steam lap; so that, if the lead be made equal at each end of the stroke, the front port never opens (as a steam port) to its full width. The irregularity is not, however, a very serious defect, since it does not affect the port unfavorably as an exhaust port, and since the port is, of itself, wider than it would require to be if used as a steam port only, and is, therefore, open sufficiently for the admission of the steam. It will naturally occur to the mind that this defect could be remedied by increasing the valve travel; but were recourse had to this expedient, it would cause the valve, when in the position shown in Fig. 54, to leave the opening, at B, still less; and we must, therefore, leave the valve travel as it is, bearing in mind that an increase of valve travel, while advantageous, as we have already shown, to a valve having a small amount of steam lap, is inadmissible, except it be to a very small degree, in one having a maximum of such lap.

The causes which effect partial closure of the front port are those set forth in Fig. 53 and its accompanying explanation. We have given the valve three fourths of an inch more travel than it had in our former experiment; and the effects of this increase are experienced more in one part of the valve travel than in another, as already explained. We have also increased the lap of the valve, and have had, as a natural consequence, to increase the lead of the eccentric so as to get the same amount of lead on the valve as we had in our previous experiment (that is, one sixty-fourth of an inch); for an increase in the amount of the steam lap on a valve necessitates an increased amount of lead of the eccentric (to get an equal amount of lead on the valve) and therefore a greater irregularity in the movement of the valve. The lead of an eccentric (which gives us the lead of the valve) is the amount to which it is set so that its throw line stands in advance (in the direction in which the engine is to run) of a line at right angles to the center line of the crank, as shown in Fig. 55, A A being the center of the line crank; B a line at right angles to A A; C the throw line of the eccentric; and the distance from C to B, at the periphery of the eccentric, the lead of the eccentric, the arrow denoting the direction in which the engine is to run.

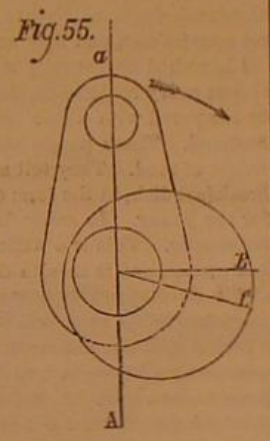


Fig. 55.

In a former experiment, we found that increasing the throw of the eccentric, and hence the travel of the valve, rendered it necessary to diminish the lead of the eccentric, and therefore tended to diminish the irregularity of the valve movement. The reason, in that case, was that no addition had been made to the steam lap of the valve; for if such an addition had been made, the eccentric would have required to have been given increased instead of diminished lead, as shown in Fig. 53.

Proceeding with our maximum increase of steam lap, we find the movements to be as follows:

TABLE NO. 11.—FRONT END.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	5-8	7	1-2
2	3-4	8	5-16
3	13-16	9 1-4	closed, and expansion begins
4	13-16		
5	3-4 full	11 3-8	closed, but expansion ends
6	11-16		
		12	exhaust port open full

TABLE NO. 12.—BACK END.

Piston moved inches	Port open inch	Piston moved inches	Port open inch
1	13-16	6	5-8
2	7-8	7	7-16
3	7-8	8 5-8	closed, and expansion begins
4	7-8		
5	3-4	11	closed, but expansion ends
		12	exhaust port open full

We find here that the steam in the back end commenced to work expansively three quarters of an inch earlier in the stroke than that in the front end of the cylinder, and that it was used expansively during two and five eighths inches of the stroke instead of two and one eighth, as in the front stroke; and furthermore, that the steam in the back end commenced to exhaust when the piston had moved eleven and one eighth inches of its stroke, leaving it to travel the other seven eighths of an inch without any pressure behind it; while the steam in the front end commenced to exhaust when the piston had moved eleven and three eighths inches of the stroke, leaving it to travel the other five eighths without any steam pressure behind it.

Such are the irregularities due to the employment of a maximum of steam lap and its accompanying lead of eccentric, the greatest defect of them all being that the exhaust port opens too early in the stroke, and thus the engine loses a large part of the effectiveness of the steam. It is the variation of the exhaust port opening after the piston has commenced its return stroke (which does not, therefore, appear in the previous tables) that prevents us (as before stated) from adding any more steam lap to the valve, as is shown in the following tables of the exhaust openings:

TABLE NO. 13.—EXHAUST AT THE FRONT END.

Piston moved inches	Port A, Fig. 54, open inch	Port B, Fig. 54, open inch
11 3-4	3-8	1 3-4
12	7-8	1 3-8
Return stroke		
1	7-8	5-8
2	7-8	1-2
3	7-8	1-2
4	7-8	9-16
5	7-8	11-16
6	7-8	7-8
7	7-8	1
8	7-8	1 5-16
9	3-4	1 5-8
10	3-8	1 3-4
11	closed	

TABLE NO. 14.—EXHAUST AT THE BACK END.

Piston moved inches	Port A, Fig 54, open inch	Port B, Fig. 54, open inch
11 3-4	7-16	1 3-4
12	7-8	1 7-16
1	7-8	7-8 barely
2	7-8	11-16
3	7-8	5-8 full
4	7-8	11-16
5	7-8	3-4
6	7-8	13-16
7	7-8	15-16
8	7-8	1 1-8
9	7-8	1 3-8
10	5-8	1 11-16
11	3-16 full	1 3-4
11 1-4	closed	

We here find that the exhaust opening, during the early part of the stroke, that is, from the first to the fifth inch of piston movement, was less at B than it was at A, in Fig. 54, and was, at one part of each stroke, but little more than one half the full width of A, and therefore as small as is compatible with an exhaust sufficiently free for a fast running engine. We have, in point of fact, by the partial closure of B, filched from the exhaust opening to enable us to use the steam more expansively; and in the case of a very fast running engine, we have rather lost than gained by the operation. In locomotives (the piston travel being very fast) sufficient steam lap is employed to leave the opening at B equal, at all parts of the stroke, to the full width of the steam ports.

It has been already remarked that lap on the exhaust side of the valve is sometimes employed to prevent the steam from exhausting too early in the stroke; and that, whatever the amount of such lap, it cramps to a like amount the exhaust opening. How then, it will naturally be asked, can exhaust lap be employed at all, since the opening at B is already as small as admissible, and such lap would make it still less? This leads us to the consideration of the width of the exhaust port of the cylinder, that is to say, of the port, E, in Fig. 47. We have in all our previous experiments made this port twice the width of the steam port, which is the proportion generally employed; and which proportion is ample, providing that the amount of steam lap is not more than three quarters that of the width of the steam port; because, up to that amount, the exhaust opening at B, in Fig. 54, will, at all parts of the stroke, be equal to that at A, in Fig. 54, while beyond that amount it will be, as shown, less than at A.

The width of the cylinder exhaust port may be, if the valve have little or no steam lap, even less than twice the width of the steam port; for instance, the port, E (Fig. 47), has been in all our experiments one and three fourths of an inch wide, the steam ports being seven eighths of an inch wide; but the valve having no steam lap, the port, E, may be made one and one half inches wide only, in which case (the bridges and steam ports remaining unaltered in width) the valve would require to have a narrower exhaust port, and would hence be to that amount narrower in its total width, thus reducing the area of its back face, upon which the steam acts to press it to its seat, and hence reducing the friction upon its face and the power required to move it.

Finishing Microscopic Slides.

The object and a moderate quantity of balsam are covered with thin glass in the usual way, and, if the object is small, held down with a spring clip to prevent displacement. The slide is then boiled either over a spirit lamp or, better still, over an ordinary microscopic lamp. Vapor of turpentine is freely given off, which, as the slide cools, contracts, drawing under the superfluous balsam, which should be kept round the glass cover with a needle. When cool, the balsam may be chipped off with a knife, and the slide finished in the usual way. The cover can never be displaced, as is too often the case where the slide is not boiled. A little practice will tell when the boiling has gone far enough, as, if continued too long, the bubbles formed during the process will not disappear, and the slide will be spoiled.

In the article on balloons, page 64, current volume, in 1st example: For 5,026·5 pounds, substitute 5,026·5 feet. Section (*e*) of the rule: For buoyant effect, substitute square of the buoyant effect. Formula at end of article:

$$z=\frac{2a}{b}-\left[\frac{8a^3}{b^3}, \text{ etc., should read } \quad z=\frac{2a}{b}+\left[\frac{8a^3}{b^3}, \text{ etc.}\right.\right.$$

IMPROVED CAMP LOUNGE.

Parties intending to camp out during next summer, hunters, lumbermen, and, in brief, all who, either for pleasure or necessity, sleep in the open air, will find in the device herewith illustrated a light, compact, and comfortable couch. It is composed of but few parts, which may be taken apart and folded into very small space, so as to be carried in a small valise, or in the hand, or even in a deep overcoat pocket. The invention is simply a piece of canvas which, when stretched on a frame, presents the appearance represented in the engraving. There are two side sticks, A, which are jointed in the middle so as to be folded in smaller space, and two girths, B and C, which form the transverse portions of the frame. Girth, B, forming the head, is straight, and into its extremities the shanks of the double ferrules are screwed with right and left hand threads. The inner pair of ferrules receive the ends of the side sticks. The shanks of the ferrules of girth, C, are arched so as to raise the hip of the person reclining a short distance above the ground. Said shanks are also provided with right and left hand screws, so that, by turning both girths, the width of the frame may be expanded at pleasure.

In putting the couch together, the side sticks are inserted through the side hems, and the head girth through an additional head piece. The foot girth rests upon the ground. The girths are then turned to proper width and the canvas stretched tightly. In order to support the couch at a suitable incline, two sticks are inserted in the outer ferrules of the double ferrules on girth, B, said ferrules being formed at right angles to those in which the side sticks are inserted. The holes shown in the girths are for the insertion of sticks in case levers are needed for turning the girths. A loose piece of canvas is provided, secured to the main portion, and which rests upon the ground beneath the lower portion of the body and feet of the occupant. The small compass and convenient shape into which the device can be folded, is shown on the left of the illustration .It is not absolutely necessary to carry any of the wooden portions of the couch, except the girths, B and C, as the side and supporting sticks may easily be cut from the forest when needed.

The device is a substitute for the india rubber, woolen, and other blankets usually carried to spread upon the ground. It may also be pitched upon uneven ground, securing a comfortable resting place; any desirable elevation of the head may be obtained by driving the sticks more or less into the soil. It, besides, furnishes a softer bed, and raises the body of the occupant above the surface, an advantage of great sanitary importance.

Patented through the Scientific American Patent Agency, January 12, 1875. For further particulars address The Camp Lounge Company, Troy, N. Y., who will forward one to any address for $4.

A NEW CAMP LOUNGE.

IMPROVED GRATE BAR.

We illustrate a novel grate bar, by Mr. C. Toope, of this city, and patented to him January 12, 1875. The inventor has had many years' experience as a practical engineer and iron molder. In the present device he has utilized his experience to produce a bar which, while having the greatest amount of air surface, will still retain the necessary strength. The invention, it is claimed, cannot be injured by contraction or expansion. The lock on the sides, in the center of each bar, holds it securely in its place, and prevents it from falling in case the ends should be burned off. The lugs on its sides are about two inches apart, and intersect each other. These, together with the crossbars between the flanges, on the lower side, prevent the bar from warping or twisting, and the flanges from widening or contracting. The bar is further claimed to be light, durable, and to give a large area of air surface, and, from its peculiar construction, to save from 25 to 40 per cent in weight, according to size, as compared with other bars now in use.

The inventor is extensively engaged in the foundery business, with ample facilities for manufacturing, and proposes to furnish these bars either by the pound or square foot, at the ordinary price of castings, and much below the price usually charged by middlemen.

The engravings represent, respectively, the upper side, Fig. 1, and the lower side, Fig. 2. For further particulars address Charles Toope & Co., Lexington Iron Foundery, 88th street, near Fourth avenue, New York city.

Fig. 1

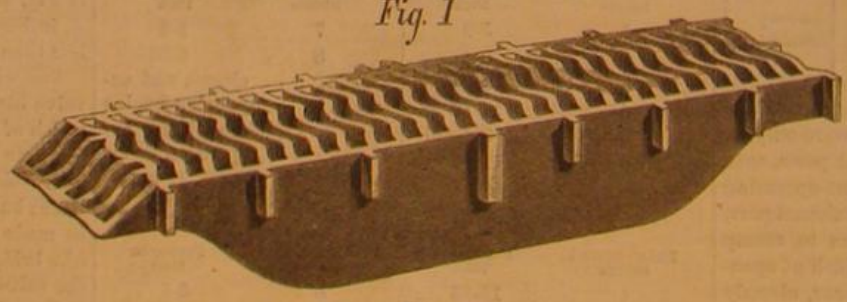
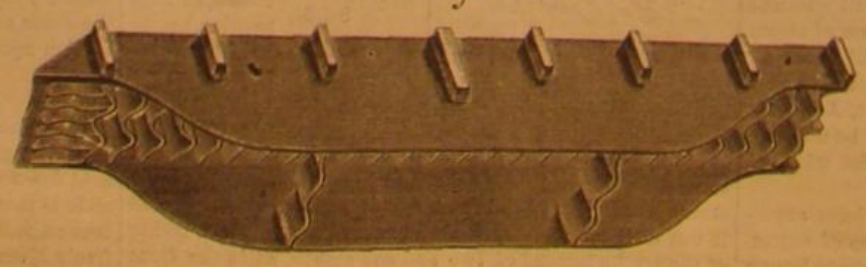


Fig. 2



TOOPE'S IMPROVED GRATE BAR.

Causes of the Decay of Teeth.

In a paper read before the American Dental Society of Europe, Dr. George W. Field says: "By analysis, healthy blood is found to contain a small percentage of inorganic matter, and we can but infer that it is there for a purpose, and that purpose the building up and supporting a perfect osseous system, and that it is from this source alone that the teeth can derive the materials essential to the proper development of their different parts. The blood, acting as medium to supply these materials, cannot manufacture them, but must be supplied most generously, and the food taken into the system must be the base for supplies. Then it follows that the food richest in phosphates is what we need. In the preparation of wheat flour the most valuable part is rejected—that which contains the very nutriment for the want of which we are losing our teeth. The animals fare better than we. The Scotch oatmeal is still richer in phosphates than wheat, be the latter ever so properly prepared; therefore, to substitute this for the fine wheat flour is what is essential if we wish to have such teeth as Nature designed we should. These are my convictions, and they are strengthened daily.

I have had opportunity to examine the mouths of people of almost every nationality, and I have found none that could be compared with those from the north of Ireland and of Scotland. These people make use of oatmeal as a principal article of food. They tell me that it is an almost universal breakfast dish, in the form of porridge, with milk, especially for the young. In many families it is served in cake form for supper. This is a national dish. All partake of it, old and young; and it is with the latter, during the period when all the developmental forces are active, that the system thus nourished is the most benefited. These people not only have a good dental development, but they are strong and healthy, possessing a strength and vigor of constitution almost unknown elsewhere. Acknowledge that Nature must find in the food the material out of which to build up a strong and vigorous constitution: how can we expect to have teeth other than of the delicate, fragile sort, easily acted upon by the deleterious agents present in the mouth, if we persist in withholding the very elements required for their proper nourishment and development?

We all know that, during the period of growth and development, if there is an unusual deficiency of the bone-producing elements, if, because of a severe illness, there is a suspension or a weakening of the assimilative power of the system, this temporary arrest of the developing process in growth leaves its ineffaceable mark, and nowhere so conspicuously as upon the teeth. This being the case, is it unreasonable to suppose that, given the ordinarily good health and activity of the developmental forces of children, and a generous supply of the proper bone food, we will have as a result a good dental development?"

Finny Musicians.

M. Dufossé has recently published a series of admirable researches, in which acoustic phenomena and fishes have been fully systematized and classified, certainly with very curious and striking results. He recognizes the fact that, out of 3,000 species of fishes, 52 are capable of producing sounds. Dr. Galton, in commenting upon the subject, adds that "there is every reason to believe that the majority of the sounds produced by fishes are not casual utterances, but are truly voluntary;" and he further states that, among such, "there is a most remarkable development of the organs of hearing, in all essential particulars correlative with the degree of perfection of the instrument."

M. Dufossé divides the phenomena into two classes. Under the first he places certain sounds which fishes emit when taken off the hook and pitched into a receptacle. These are evidently involuntary, and perhaps convulsive; and among them may be mentioned a croaking noise made by the tench, carp, loach, and other thick-lipped fish, when compelled suddenly to open the mouth. The sea horse also makes a peculiar, sharp sound, by means of a little bone loosely articulated to the gill covering.

The second class includes expressive noises; and it is in this category that the novel and interesting portions of the discoveries are met. Subdividing his subject, M. Dufossé first refers to expressive sounds of a stridulous or harsh nature. These are caused by friction of the pharyngeal bones in a species of mackerel. The noise is rough, short, and piercing; and both males and females are equally sonorous, especially in the hottest part of summer. A somewhat similar sound, though more resembling a grinding of the teeth, is made by the sun fish, and is due to friction of hard prominences in the jaws, playing the part of intermaxillary teeth.

Blowing sounds are included in the second subdivision, and are peculiar to the carp tribe. It appears that the fish has an air bladder, provided with a duct communicating with the gullet. Little valves in this duct can be opened or closed by the animal at pleasure, so as to control the escape of gases from the bladder, through which the blowing sound is produced.

The most important portion of the investigation is found in the second division of the second class, namely musical sounds. Their *timbre* is more or less sweet and soft, and never excites such sensations as are caused by grinding the teeth. They are subject also to an extraordinary degree of change, and their vibrations after being analyzed can be measured by appropriate instruments. They are generated by the air bladder, together with its muscles, the action of the latter being aided and intensified by the rest of the organs. The quality of the sounds is modified by the contraction of other muscles. The *maigre*, a fish found in shoals off the French coast, is cited as the most striking instance. The sounds emitted are notable principally for their length, having a mean of 24 seconds, and for their monotonous uniformity. The *timbre* varies very much, the most common being that of an ordinary reed organ or the reed of a clarionet. Another *timbre* resembles that of the largest string of a violoncello, sometimes passing to that of a *bourdon* organ pipe. Some sounds, are, however, less sweet, and may have some likeness to the tone of a hurdygurdy or rattle; while others are clear and pure, resembling in their *timbre* those produced by a hautboy, harmonica, or accordeon. They have generally, however, a tendency to degenerate into a humming sound, either from an excess or from a want of intensity. M. Dufossé suggests that the song of the fabled sirens had its origin in the utterances of a shoal of *maigres*.

In his review of these investigations, which we find in the *Popular Science Review*, Dr. Galton mentions numerous other instances of musical fishes. In the harbor of Bombay there is a fish, resembling the ordinary perch, which makes long drawn musical notes like the dying cadence of an æolian harp; and in Ceylon two mollusks are found, called "creeping shells," which evolve similar sounds. The magoora, a fish found in the lake at Colombo, makes a grunt when disturbed under water, and Darwin mentions a kind of *silurus*, met with in the Panama river, which also produces a grating noise, distinctly audible when the fish is submerged.

Dr. Galton says, in concluding, that "as the sounds generally excel in frequency and intensity at the breeding season, it will not be unreasonable to regard them—granting, as we do, that the chirp of the cricket and the croak of the frog is each in its way an alluring serenade—as nuptial hymns, or, to use language ascribed to Plutarch, as "deafening epithalamia."

In plugging screw holes in finished work, glue only the edge of the plug; put no glue in the hole. Pass a sponge of hot water over brad holes, and, when dry, sandpaper and paint. The putty in the latter case, after the wood is swelled, will not meet the brad head.

REMARKABLE BIRDS.

Our latest English advices report that many additions of interest and importance have recently been made to the Zöological Society's collection in Regent's Park, London. Among these are some specimens of a bustard, which is common in the Cape settlement, South Africa, and is known scientifically as the *eupodotus kori;* and we publish herewith an engraving of two of them, selected from the pages of *The Field*.

Burchell, in his "Travels in the Interior of South Africa," gives an account of this bustard, which he found on the borders of the Orange River. He says it is there known as the *wilde paauw*, or peacock, and is much esteemed for food, sometimes growing enormously fat, and increasing to a weight which a man can only carry with difficulty. In the Sichuana language, he tells us, the bird is called *kori*, from which its present scientific appellation has been derived.

In the Cape Colony, where it is migratory, arriving from the interior in greater or lesser numbers according to the drought, it is called the *gom paauw*, and is pretty generally distributed in the open plains dotted with mimosa jungle in the northern and eastern parts of the colony. It is a noble bird, and, when seen stalking about in its proper haunts, says Mr. E. L. Layard, "affords a sight to a hunter's eye never to be forgotten."

Andersson states that the kori bustard is found throughout the year in Damaraland and Great Namaqua Land, and is common as far as Ondonga; but is partially migratory. He never saw one weighing more than thirty pounds; but was assured on good authority that, in some parts of the Free States and the Transvaal districts, individuals are sometimes shot weighing from sixty to seventy pounds. This statement, however, must be accepted with reservation. The spread of wings is 8 feet 4 inches. Its flight is heavy, but nevertheless rapid, and at night, says Anderson, when changing its feeding ground, it may be seen flying at a great hight. It feeds on insects and berries, and is very partial to the sweet gummy exudations of the low mimosa thorn, so abundant in Damaraland. This, no doubt, is the origin of its Cape name, "gom paauw," although Andersson, who refers to this propensity, does not give the local name for the bird; while Mr. Layard, who mentions the name in his "Birds of South Africa," says nothing about the bird feeding on gum. He states, however, that it is never found far from the mimosa jungle that skirts the rivers.

In addition to the food above mentioned, the kori will eat reptiles, and can swallow a lizard or snake of considerable size. A female bird of this species, which was shot by Mr. Layard and a friend, disgorged the largest chamelecn they had ever seen, and the crop contained in addition a mass of small snakes and locusts.

The three smaller figures in the background, in the act of "showing off," are Australian bustards, of which remarkable species we published illustrations and descriptions on page 162, volume XXVIII. Mr. Bartlett, the superintendent of the Zöological Gardens, has reason to believe that this curious display, which takes place in the pairing season, is different with each species.

Diphtheria.

Dr. George Johnson, senior physician to King's College Hospital, England, gives an interesting paper in the London *Lancet* on this subject, from which we derive the following:

"I propose in the present communication to discuss some important practical questions relating to the etiology, the pathology, and the treatment of diphtheria.

There are practitioners who, believing that diphtheria is a specific contagious disease, maintain that defective drainage and filth have little or no influence in its causation, while others, denying its contagiousness, assert that its origin and spread may always be explained by its insanitary conditions. I believe that both classes of negationists are in error. I have no doubt that the disease, though not highly contagious, is communicable from the sick to the healthy, and I have as little doubt that it is often caused by filthy emanations from sewers and cesspools, and this, too, when it is in the highest degree improbable that any specific poison can have been introduced from without into the decomposing stuff that has excited the disease. In proof of the contagiousness of diphtheria, the following, amongst a multitude of similar cases, may be set forth:

M. Valleix, a colleague of Trousseau, while examining the throat of a patient, received into his mouth a small quantity of saliva spurted out by the patient in coughing. Next day, on one of his tonsils there was a pellicular deposit, and some hours later both tonsils of the uvula were covered by false membrane; the disease made rapid progress, and in forty-eight hours he died. Another of Trousseau's provincial colleagues was performing tracheotomy in a case of diphtheritic croup, when he applied his mouth to the wound to suck blood from the trachea. He thus inoculated himself, and died in forty-eight hours. [Several other similar examples are then cited, also cases where the disease was apparently communicated to persons visiting or living in the apartments of the diphtheria patient.]

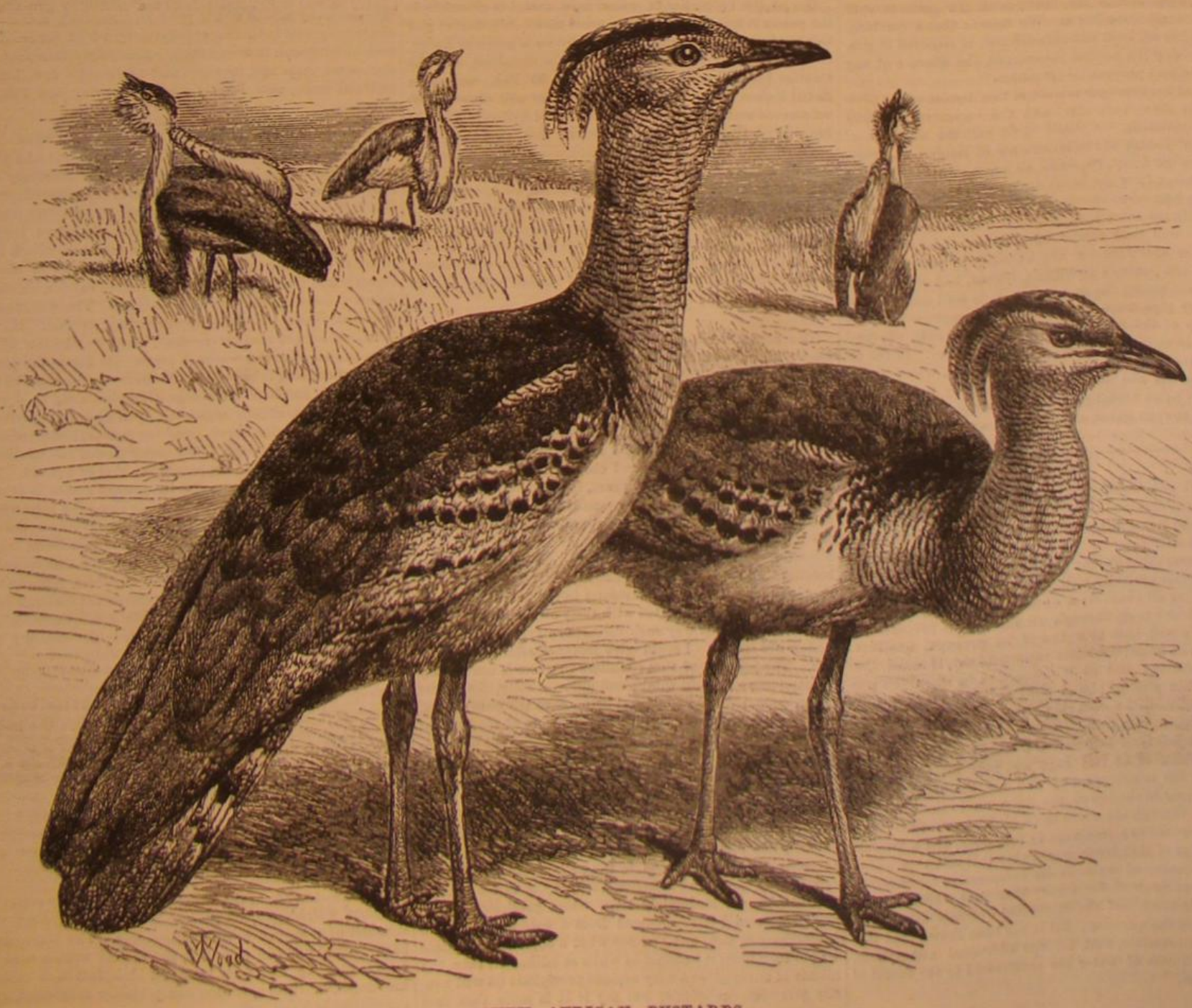
I believe that all the cases which I have cited are examples of the diphtheritic infection being conveyed either through the air or more directly by the actual contact of the morbid secretions with the tissues of the recipient. To oppose to positive evidence of this kind such negative statements as that, in numberless instances, medical attendants and nurses have come into close contact with diphtheritic patients, without taking the disease, appears to me a vain and frivolous objection. Diphtheria is not a highly contagious disease. In the scale of infectiousness it stands far below scarlet fever, for instance, and there is reason to believe that the susceptibility to disease differs almost infinitely in different persons; but a medical attendant who entirely ignores the contagiousness of the malady is likely to neglect reasonable and necessary precautions to protect himself and others from the risk of infection.

When a case of diphtheria occurs in a house without evidence of importation from without, still more when several cases occur together or in quick succession, there will be good reason to suspect that sewers, cesspools, or contaminated water may be the source of the disease. My belief is that, in a very large proportion of cases, there is as close a relation between diphtheria and insanitary conditions as exists between typhoid fever and similar insanitary conditions; and I scarcely need say that, if this be so, the general recognition of the fact is of the greatest importance with reference to the adoption of preventive measures. There is reason to believe that much more harm would result from ignorance of the filth origin of diphtheria than from practically ignoring its infectiousness.

Many instances have come to my knowledge in which fetid fæcal emanations have appeared to be the direct cause of diphtheria.

One case was of a family consisting of a lady, her husband, four children, and three servants. The house is drained into a cesspool about twenty yards distant. The accumulation of many months was emptied one day while the wind was blowing towards the house from the cesspool, and a very offensive smell reached the house. Three days afterwards all the four children became feverish and complained of sore throat; the tonsils were seen to be inflamed and covered with yellowish white patches. In a few days two of the servants were attacked, one rather severely, and, lastly, the lady. Her tonsils were inflamed and covered by false membrane. The only member of the family who escaped was the husband, who was away from home all day, and one servant.'

In another case the family consisted of the father and mother, seven children, and three servants. 'On going up the garden to the house, my nose was assailed by a horrible stink, and, seeing some men at work close to the house, I stopped to see what they were doing. I found that they had ripped open a drain running in front of the house within ten



SOUTH AFRICAN BUSTARDS.

yards of it, and they had opened a cesspool into which the drain flowed. I found the mother, five of the children, and two of the servants suffering from sore throat.' Mr. Bateman says:—'I am at the present time (January, 1874) attending at another house where a young lady and the parlor maid are suffering from severe sore throat with the usual patches. A cesspool had been opened a few days before quite close to the house. I feel quite certain that all these cases were caused by the sewage filth, and in particular by that portion of it which, floating in the atmosphere, was respired by the persons affected Many other cases were cited.

It appears to me to be a matter of almost absolute certainty that the foul cesspool was the primary source of all these cases.

My friend Mr. Salter, of Tolleshunt D'Arcy, in Essex, who has had a large experience of diphtheria, writes to me that he has 'had unquestionably a great many cases of diphtheria whose origin can be distinctly traced to sewage poison, either gaseous or liquid,' and he gives me some particulars of an outbreak in one family, four children and a nurse having been attacked in quick succession, which he attributes to the percolation of sewage into the well which supplied the family with water.

I look upon the occurrence of an indigenous case of diphtheria in a house as an indication of the necessity for a most rigid inquiry into the condition of the drainage and the water supply. At the beginning of the present year, a gentleman living in one of the best houses in Queen's Gate asked me to see his butler, whom I found suffering from a severe attack of diphtheria. The basement of the house looked the perfection of cleanliness, but I advised that a sanitary engineer should be called in to inspect the premises. The result was the discovery of an untrapped sink pipe near the butler's sleeping room.

It is notorious that, in the houses of some of the most exalted and wealthy, and in open country districts, the sanitary defects which originate such diseases as diphtheria and typhoid fever are almost as common as in the meanest cottages and in the most crowded cities; but it is obvious that overcrowding in the small rooms and cottages inhabited by the lower classes must greatly increase the danger arising from other insanitary conditions.

In opposition to the doctrine which I am now advocating, it is sometimes stated with perfect truth that diphtheria never visits some houses which are dirty within and without, and which are surrounded by every form of abominable filth. The reply to this is that no one believes that any and every kind of foul emanation from decomposing organic matter will suffice to cause diphtheria. As every black powder containing charcoal is not the explosive compound which we call gunpowder, so every fetid gas escaping from a drain or a cesssool is not laden with the perilous stuff which will excite diphtheria. We believe that a combination of conditions, local and atmospheric, is required to generate or develop the morbid poison, and the absence of any one of these may prevent its formation."

In view of the great prevalence of this disease at the present time in New York city, and the extensive mortality therefrom resulting, we would again call the attention of our Board of Health to the importance of issuing an order, without further delay, requiring all house owners to make a pipe connection from the house drain to the kitchen chimney. As we have heretofore shown, by this simple expedient, costing probably not more than ten dollars for each house, the sewage gas will then escape up chimney, and not find its way into the apartments of the building, to poison the atmosphere, and generate diphtheria, typhus, and other malignent diseases among the occupants. It is well known that the ordinary pipe traps do not prevent, except in part, the backing up of the foul sewage gases. The only effectual remedy is an open escape pipe into the chimney. If the escape pipe connects with the kitchen chimney, which is all the time, winter and summer, kept warm by a fire, there will always be an attending column of air to assist in carrying off the sewage gases, and, to some extent, render them innocuous.

Water.

The sixth and concluding lecture of the course on chemistry by Dr. Frankland, F.R.S., to working men in connection with the Royal School of Mines, was delivered lately. Subject: Water.

The lecturer said: People usually imagine that they know all about water perfectly well, but, in truth, we are very far from knowing all about it; a whole course of lectures would not be sufficient to go through all the known properties of water. We will look at a few of its principal qualities: First, as to its color; doubtless you would say, if asked, that water is colorless, and so it appears to be when you look only at a thin stratum; but looked at in a stratum of sufficient depth, it will be seen that water has its own peculiar color—a bluish green tint. This we show by passing a ray of white light from the electrical lamp through a horizontal tube, which is 15 feet long and half filled with pure water from the laboratory, and you see the light, passing through the air in the top of the tube on to the screen, is white; that through the water has a bluish green tint. This layer corresponds to a reservoir 7½ feet deep, and a stratum of pure water of that depth would give this color.

Another quality of water is its comparative incompressibility; it was doubted for a very long time whether it was compressible at all, and the celebrated Florence experiment did not settle the question; but it has been shown that it is slightly compressible, that, for one additional atmosphere, 1,000,000 volumes of water are compressed to the extent of 51·3 volumes.

Again, the specific heat of water is greater than that of any other substance we know; that is to say, a certain weight of water contains more heat than an equal weight of any other substance; and this greatly influences the climate of islands and countries lying near the sea. Thus, in the hot summer months, when the land gets strongly heated, the water absorbs the rays of the sun, but its temperature rises much more slowly, and thus it moderates the heat of the land; whereas in winter the reverse takes place: the land parts with its heat readily and becomes cold, while the water gives out a much greater quantity of heat in falling through a similar number of degrees. For this reason the climates of islands are more uniform, and subject to less extremes than those of inland countries. The heat given out by 1 lb. of water in cooling 1° would raise 1 lb. of air 4°; or 1 cubic inch of water in losing 1° of heat warms 3,076 cubic inches of air 4°. On this account, too, our east winds, blowing over large surfaces of land which has but low specific heat, are so much colder than our west winds which come to us over water. Water, too, has a high latent heat, and this, too, has an important bearing in the condition of water as it exists in Nature. Thus, 3 cubic feet of water at the temperature of 32° Fah. gives out, when it becomes converted into ice, a quantity of heat equal to that given out by the burning of a bushel of coal.

Further, water expands on freezing, and the coating of ice thus formed on the surface has a tendency to prevent large masses of water from being entirely frozen. Sometimes we hear of ground ice, or ice formed on the beds of rivers; and the lecturer, who was in Switzerland last winter, noticed that in all the rivers there this ground ice was formed. It admitted of a very simple explanation. Owing to the curious property of this maximum density of water, in still water the ice will be formed on the surface, as before explained; but in these Alpine streams the whole mass of water is kept agitated and mixed up, and consequently keeps throughout of a uniform temperature. Thus we may have the whole body of water uniformly cooled down to 32° Fah., and ice will then form as readily at the bottom as at the top; in fact, more readily, for it is easily proved that ice forms (and the same is the case with other liquids as well as water, in crystalizing) most readily in contact with rough surfaces, and therefore forms first in contact with the stones on the bed of the river; and when once formed there it goes on increasing. If water be perfectly still, it may be cooled down several degrees below 32° Fah. without freezing; and people have sometimes been surprised to find the water in the jugs in their rooms in a morning, which was quite liquid when they took up the jug, freeze as they attempted to pour it out. Being perfectly quiescent, it had cooled below 32° without freezing, but froze as soon as it was moved.

One of the properties of water most useful to chemists is the power it has of dissolving a great many substances; and this is of great commercial value, since such gases as hydrochloric acid gas and ammonia gas can be dissolved, and the solution become marketable articles. At 59° Fah., and under 29·921 inches pressure, 1 volume of water will dissolve 780 volumes of ammonia gas, or 450 volumes of hydrochloric acid gas. With regard to solids, it is found that, as a rule, they are more soluble in hot than in cold water (common salt is equally soluble at all temperatures). Hence, if water at a high temperature be saturated with them, as it cools they will be deposited, and it is found that they assume in deposition definite geometrical forms; these are called crystals. (Beautiful crystalization effects were then shown on the screen by means of the electric lamp and solar microscope, the crystalization of red prussiate of potash being exceedingly beautiful and interesting.)

LONDON WATER.

The above remarks apply to pure water, but we never meet with pure water in Nature: all natural waters contain more or less dissolved matter; the difference is only one of degree. We may divide the water we meet with around us into (1) drinkable or potable water; (2) mineral water; (3) polluted water, so fouled, by the drainage of towns or the refuse of manufactories, that it is no longer fit for domestic use. As the result of researches and observations carried on during the last fifteen or twenty years, it has been asserted that water is one of the most ready means of transmission of germs of epidemic diseases, for example, water contaminated with the excrementitious matter of persons infected with those diseases. Many people will not believe the thing to be true, because the idea is so horrible; but it is nevertheless the case. People in large towns are constantly in the habit of drinking water which is contaminated with their own excrementitious matters, and in this way such diseases as typhoid fever and cholera are spread. I could give instance after instance of this. The presence of these matters in water is not so easy to detect as you might think; and unfortunately, the waters so contaminated taste somewhat better than the pure waters, and people often prefer them, being unaware of the cause of their preference There are means for testing the purity or impurity of your water I will mention one or two simple ones: Get a solution of nitrate of silver or lunar caustic (buy the crystals at the chemist's, and dissolve them in distilled or rain water). Here are three specimens of water, to each of which I will add a few drops of this solution of nitrate of silver The first is distilled water, and you see it remains perfectly clear. The second is the ordinary Thames water, supplied by the Grand Junction Company to this building; here we have a moderately large white precipitate. The third specimen I have obtained from a notorious pump in Bloomsbury square, and you see what a copious precipitate we get from that; it becomes as white as milk. If, then, the nitrate of silver gives a very copious precipitate (it will usually give some precipitate; but say if it is more than that Thames water gave) beware of drinking the water. It may be fit to drink, but the probability is that it is contaminated with those noxious matters. There is no wonder that our third specimen gave such a precipitate (and all the shallow wells of London are as bad), for the water in them is nothing more than the soakage from the cesspools and similar places in the neighborhood. And yet people in the neighborhood constantly drink it, and often prefer it to that supplied by the companies, especially in summer, when it is cooler than the vapid warm water from the taps. Some parts of London are supplied with water from deep wells sunk into the chalk. Now, if you subject that water to the next test I will mention, you will see its superiority. Take a tumblerful of water, let a beam of sunlight from a slit in a shutter pass through it, and observe the path of the light in the water. Here we have two specimens of water; the first from the pipes of this building, that is, Thames water, the other the deep well water. On sending a beam from the electric lamp through both of them, we see at once that the path of the beam in the first reveals itself as a broad and very marked band of light, while in the second the path of the beam is almost invisible. That is to say, there is nothing like so much suspended matter in the latter specimen as in the former, although the Thames water is as clear as sand filters can filter it; but there is no filter so efficient as the soaking through several hundred feet of chalk.

Henry Highton.

Rev. Henry Highton, a gentleman long and well known in scientific, telegraphic, and scholastic circles, died recently in England. As a scientific man he is associated with various discoveries in connection with electrical telegraphy, for which he more than once received a medal from the Society of Arts. He took out his first patent as early as July, 1844, for a telegraph worked by static electricity and a chemical recorder. In 1846 he invented his well known gold leaf telegraph, which, however, was never practically used. A small strip of gold leaf inserted in a glass tube was made to form part of the line circuit, and it was placed between the poles of a large permanent magnet. Whenever the line currents passed through the gold leaf, it was instantly moved to the right or left, according to the direction of the current. Its delicacy is so great that efforts have been recently made to introduce it upon our long cable circuits. In 1848 he took out a patent, with his brother Edward, for a new form of needle telegraph, and various other modifications; and in 1850 the British Electric Telegraph Company was formed for the express purpose of working and bringing into more general use the inventions of Messrs. H. and E. Highton. He recently (1872–3) introduced a new form of battery, and has been engaged in perfecting a mode of working long submarine cables by means of his gold leaf receiver, and a new electromagnetic induction apparatus, by which the sensitiveness of telegraph instruments is considerably increased. He also, some years ago, invented and perfected a new kind of artificial stone, now largely used for paving and building purposes.

Stoppage of Carriers in Pneumatic Tubes.

Although this accident is exceedingly rare, yet the possibility of its happening at all necessitates the discovery of a ready means for localizing the position of the arrested carrier. The method hitherto employed has not given good results. It is to apply to the mouth of the pneumatic tube a receptacle full of compressed air of a known pressure, which is allowed to enter the tube. The resultant pressure in the receptacle and the tube, as far as the arrested carrier, furnishes datum to estimate the carrier's distance. The distances so measured have not been approximately correct. M. Ch. Bontemps adopts another method, based on the law of the propagation of sound waves in pipes. He fits to the mouth of the pneumatic tube a kind of drum, an instrument furnished with an elastic membrane whose inflations or depressions are automatically registered upon a revolving cylinder A diapason likewise traces, upon the same cylinder, seconds and fractions of a second. The under part of the membrane is set in motion by an explosion, say that of a pistol. The blow raises the membrane, and its upward motion is at once registered. The wave speeds onwards along the tube with a speed of 363 yards a second, and strikes against the obstacle; thence it is reflected back to the membrane, and a second motion is registered. It now only remains to calculate the exact time between the two registers, representing twice the time the wave takes to traverse the distance from the tube's mouth to the obstacle. This arrangement is said to be so exact that the possible error does not exceed 2 meters, or 6½ feet.

Cheap Telegraphy.

Competition is the life of business; and where that business is conducted by people of experience and ability, the public are the gainers.

The Atlantic and Pacific Telegraph Company now loom up as competitors with the Western Union Telegraph Company. General Eckert, an experienced telegrapher and manager, long connected with the Western Union, has taken the presidency of the Atlantic and Pacific. A lively competition is expected, and telegraphing, in some directions at least, is likely to be done at reduced prices.

DR. DEMARQUAY, of the Hospice Dubois, recently removed a lipoma weighing 3,200 grammes, about 7 lbs., from the shoulder of a woman aged seventy-three. The tumor had been twenty years in existence, and the old woman used to wear it in a bag, and carry it on her shoulders as a soldier his knapsack. The operation was perfectly successful, and the patient is doing well.

DECISIONS OF THE COURTS.

United States Circuit Court.---Eastern District of Michigan.

RUBBER DENTAL PLATE PATENT.—THE GOODYEAR DENTAL VULCANITE COMPANY *et al. vs.* GEORGE WILLIS.

This was a bill in equity filed against the defendant, a dentist, for infringement of reissued letters patent No. 1,904, granted to The Dental Vulcanite Company, assignee of John A. Cummings, for "Improvement in Artificial Gums and Palates." The claim in the patent is for "the plate of hard rubber or vulcanite, or its equivalent, for holding artificial teeth, or teeth and gums, substantially as described."

Cummings filed his caveat May 14, 1852. Applied for a patent April 12, 1855. This application was rejected May 19, 1855, and again rejected August 14, 1855, and again rejected by the Commissioner of Patents February 6, 1856. In 1859 a motion was made before the Commissioner for a rehearing, or for an appeal to the Board of Examiners, which motion was denied. On March 30, 1864, a renewed application was filed. On April 7, 1863, the Patent Office wrote to Cummings acknowledging that injustice had been done in the former rejection, and the patent was thereupon allowed, and was issued on June 7, 1864. There was evidence that tended to show poverty on the part of the inventor and efforts by him to raise money to prosecute his application during these periods. The invention went into public use about 1859.

EMMONS, J.:

In ordinary circumstances the condition of judicial opinion in reference to all the points involved in the record would render unnecessary their discussion upon principle; and in a case where such rulings have been so numerous, and directly upon the points, and so elaborate in argument, it is unusual to do more than refer to them generally, as settling the points in issue. Such, however, is the exceptional feeling and excitement existing in the minds of the numerous defendants in suits brought on this patent in this and adjoining districts, resulting, we believe, from the want of knowledge on their part of the real history of previous litigations, and the character and number of opinions which have been already pronounced, that it is deemed a duty by my brethren and myself to reproduce that which we are well aware is already familiar to the bench and bar. * We think the learned counsel for the defendant much underrated the effect which it is our duty to give to judgments pronounced by co-ordinate courts, where precisely the same points are brought in litigation before us. *

The following decisions, noticed, we think, in the order in which they were made, every one of them upon records precisely like that before us, or less favorable to the complainants, decide (most of them with much fullness of argument) every point necessary to authorize a decree for complainants. In 3 Fisher, 87, Dental Vulcanite Company *vs.* Wetherbee, before Justice Clifford, in 1868, the bill was filed to restrain an infringement of the patent now before us. The defendant there, as here, insisted that the patent was invalid because it did not embrace that which was the subject of a patent. That if it did, it was void for want of novelty, and that Cummings was not the inventor. That if he invented he abandoned it. That there was a forfeiture of his rights, if any he had, under the statute, because he suffered it to go into use more than two years before he applied for his patent. That the reissue was void, because not warranted by the original patent. The cause was argued by counsel as eminent as any in the nation. Justice Clifford, after taking much time for deliberation, in a painstaking judgment, overruled every objection taken by the defense. Goodyear Dental Vulcanite Company *vs.* Gardner was a similar case before the learned Justice, in 1868, and the same defense, among others, was substantially taken. The application for a preliminary injunction was argued by B. F. Curtis and Causten Browne, for complainants, and B. F. Thurston and S. D. Law and John A. Foster for defendants. It is seldom that more professional ability is brought to the discussion of a similar application. Justice Clifford again, in his judgment, sustained the patent and overruled all the objections to it. (See pamph. rep. of case.) This case was subsequently brought to final hearing on pleadings and proofs, and in 4 Fisher, 224, will be found the opinion of Justice Clifford rendered in favor of complainants after much deliberation, leave having been expressly given the respondents to reargue the questions of law and fact presented in the Wetherbee case. We will note, in connection with this case in the Supreme Court, the imputations cast upon it by the defense, observing here only that there is no accusation of impropriety in the case, before or at the time of the motion for interlocutory injunction. In 5 Patent Office *Gazette*, p. 585, Goodyear Dental Vulcanite Company *vs.* Smith, the same defenses were in evidence as in the case now before us, the records being identical, with the exception of a small amount of additional testimony on the part of the defense in this case, of so little importance that it was not noticed at the bar by either side.

The cause was argued at great length by able counsel before Judge Shepley, who rendered an elaborate judgment in favor of complainants. In 6 Patent Office *Gazette*, p. 154, Goodyear Dental Vulcanite Company *vs.* Root, the same questions were presented to Justice Hunt, sitting in the northern district of New York, who, after argument, again sustained the patent. Subsequently, in suits by the same complainants against Charles S. Stockton and Frank A. Cummings, argument was had by the same counsel on the same record as in the Smith case, before Judge Nixon, in the district of New Jersey, who again sustained the patent at September term, 1874. A decree in favor of complainants against William H. Gates was granted at October term, 1874, on the same record as in the Smith case, before Judges McKennan and Cadwalader, in the eastern district of Pennsylvania.

The case of Goodyear Dental Vulcanite Company *vs.* Gardner, *ante*, was appealed to the Supreme Court, and every ruling necessary for the support of the judgment in the court below affirmed by that tribunal. The effect of this judgment, as an authority here, is earnestly assailed, because the court, before the opinion was actually delivered, although judgment had been rendered, dismissed the appeal. We do not see, in the reasons for this dismissal, anything which decreases the obligation on our part to follow the rule of law necessarily involved in the judgment. *

This series of decisions, without one in conflict with them, presents conditions in which it is our undoubted duty to apply the principle which makes the judgments of co-ordinate courts obligatory where they have been upon the same points and the same subject matter.

As we have already intimated, ordinarily we should terminate our consideration of this case here. A matter so often and so authoritatively decided would not be discussed, upon principle, did we not believe that a brief reference to the reasons upon which these adjudications rest would be locally beneficial. *

Various reasons are then set forth concluding as follows:

To negative the idea that Cummings, by his delay in the prosecution of his claim, intended to abandon it the complainants have put into the record voluminous proofs showing a continuous and persistent assertion of his right and intention to maintain it. The testimony shows numerous and fruitless attempts to procure assistance to defray the expenses of his application by offering shares of the patent, if obtained, and otherwise, and in the latter periods of his delay such a degree of ill health, poverty, and general depression on his part, as shows good reason why he did not prosecute more vigorously his application. The facts do not warrant, nor was the argument pressed, that there was fatal delay prior to 1859. At that time, Cummings had become insolvent, and his health seriously impaired by chronic diseases, which ultimately terminated his life. The testimony leaves no room for doubt that after this period he wholly ceased to furnish any considerable part of the support of his family. His wife's small separate property was first mortgaged and then sold, to procure what is proved to be the small and sometimes too scanty expenditure upon which they lived. The praiseworthy efforts of his wife as the keeper of a boarding house, the pawning of her few personal ornaments, and her general care and support of a diseased and dispirited husband, present a picture as affecting as it is demonstrative of Cumming's inability, from sheer poverty, to prosecute his application. The only diligence of which, in his physical and pecuniary condition, he was capable, he manifested by such a constant reiteration of his rights as showed that the idea, in the words of some of the witnesses, "had taken complete possession of his mind," and incapacitated him for all other business. His offer of portions of the future patent were frequently repeated during the whole period till 1854, when, after its partial use by the profession had demonstrated its utility, for the first time his proposition was accepted, the means obtained, and the patent procured. His history and condition during this entire time exclude the idea that he intended to abandon his claim. The *prima facie* evidence of a contrary intention, springing from the fact that he did make the last application, is not overcome by the evidence *aliunde*, but is proven to be consonant with the real intention of the inventor.

There is one most remarkable feature in several of the discussions of this subject before other tribunals, and which with great emphasis presented itself to this. We do not refer to it to censure counsel in the present cause, as those of equal eminence have elsewhere, in the presence of excited defendants, made similar denunciations. That Goodyear should have a patent for vulcanite, and compel dentists to pay a royalty for using it, and that Cummings should procure a patent for a dental plate made of that same substance, and compel them also to pay a tribute for its use, is treated as an astounding novelty and an atrocious fraud. The accident that subsequent transfers have lodged the present patent in the same hands which held that of Goodyear, presents to the unprofessional mind, unacquainted with the wholly distinct character of the two rights, plausible grounds for this unfounded criticism. A large share of the strong feeling and the strong conviction that injustice has been done the dental profession has sprung from what seems to us a wholly unjustifiable perversion of the most familiar truisms in patent law. It is but the simple—the every day recurring—case where one patentee employs the invention of a prior one. In such instances, it must be true that he who uses the manufacture or article which involves both must pay a royalty to each inventor. Cummings' invention neither authorized him nor any one else to use the invention of Goodyear, nor could the latter make these dental plates with his material without the consent of Cummings or his grantees. When Goodyear's patent expired he and his associates had just as much right to become the assignees of Cummings as any other citizen. The accidental circumstance that the same man issued licenses first under one patent and then under the other is unimportant and even trivial. Such instances in this department of business are very frequent, and the union of such interests, instead of being injurious, is beneficial to the public, not only from the economy, but the convenience of procuring licenses. Self-evident as all this is to the legal profession and to those dealing in this species of property, an impolitic and much-to-be-regretted impression has been created, in the minds of the dental profession, that they have been wronged and actually oppressed by what has been termed "the mercenary marriage or illicit connection of these two rights." It would seem too evident to require additional illustration that the rights under this patent, and the obligations of those who use it, are in no way changed in the slightest degree by the immaterial fact that Goodyear once had a patent for vulcanite that has now expired. *Its* use is free alike to the dentists and these complainants. The one charges and the other pays neither more nor less than if vulcanite was a natural substance common as ordinary clay. It is the real value of Cummings' invention alone which is sold, and which they purchase or not, as they please, being free to use *vulcanite* without any royalty whatever, for any purpose not involving his invention.

Our purpose in thus referring to a few of the reasons which induce us to decide this case in favor of the complainants upon principle, irrespective of the prior adjudications, has been to suggest to the numerous other defendants having like cases pending what we believe to be the uselessness of additional argument before subordinate tribunals. If this patent is to be held invalid after so many judgments sustaining its validity, we are clearly of the opinion that it should be done by the court of last resort. The interests of the numerous defendants now litigating in the circuits would be far better promoted by an early appeal to the Supreme Court than in wasting so much time and money by the creation of numerous similar records, and paying for repeated arguments before co-ordinate courts. We do not think they can be effective there without a violation of the well-established and necessary principle to which we referred in the outset, which renders authoritative upon us the long list of adjudications elsewhere rendered.

Decree for complainants.

An appeal from this decision has been taken to the Supreme Court of the United States.

[*Benjamin F. Lee*, for complainants.
John F. Follett and Calvin C. Burt, for defendant.

Recent American and Foreign Patents.

Improved Violin.

Josiah H. Payne, Garner, Miss.—This is a violin provided with string-fastening devices at the base of the neck and openings corresponding therewith through the top and bottom of the rim, for the passage of the strings. By this arrangement, the tail piece or apron, to which the ends of the strings have heretofore been attached, is dispensed with, and the tone of the instrument is greatly improved.

Improved Device for Protecting Horses' Tails.

Franklin E. Howard, Geneseo, N. Y.—This invention consists in a bag formed of leather, cloth, or other material impervious to mud, the same being slitted to form lapping edges, and adapt it to be readily applied or removed from the tail, a useful device at this season of the year. It saves much time to the coachman, and preserves the hair of the tail.

Improved Boiler Tube Expander.

William S. Sharpneck, Onawa City, Iowa.—This invention consists in an expander adapted to all sized tubes made in longitudinal sections, the outer surface of which is turned to various diameters distinct from each other, each gradation being provided with a collar for forming the bead inside the head of the boiler.

Improved Stove Pipe Elbow.

Samuel Smith, Brooklyn, E. D., N. Y.—This invention consists in holding the connected parts of an elbow pipe together by straps, forming a part of and extending from one and riveted to the other.

Improved Plow.

Thomas Canty, Kaufman, Tex.—Several deep notches are cut in the upper edge of the share, and to tongues thus formed curved parallel and flat strips are attached. Thus said plates form continuations of the share, over which the soil glides with a minimum amount of friction. The means of supporting the rear ends of the strips is a brace having arms. Thus all the mold board strips are supported and held rigidly in position, so as to resist lateral and downward pressure.

Improved Railway Switch.

John D. Murchison and William T. Haney, Taylorsville, Ga.—This invention consists of pivoted switch rails, which are set by a longitudinal crank rod connected therewith, and by pivoted lever rods and elbow levers, operated by curved upright levers at both sides, and at suitable distances from each end of the switch rails, to be struck by a laterally adjustable bar at the head block of the locomotive.

Improved Locomotives and Cars.

Henry Handyside, London, England.—This invention relates to certain peculiar construction and arrangements of locomotive engines and apparatus to be applied thereto, and to the carriages or wagons of a train, whereby the safe and easy ascent of trains up steep inclines is accomplished, and their passage round sharp curves is facilitated. The locomotive engine is coupled to the train or other load to be hauled up an incline, by a rope or chain, which is wound on a drum mounted in the framing of the engine. The axis or shaft of this works horizontally in bearings in the main framing, and is driven or rotated direct or by gearing, as found most convenient, from a separate pair of cylinders, distinct from the usual cylinders which drive the locomotive in ordinary cases. These separate cylinders may be secured to any convenient part of the locomotive and they transmit a rotary motion to the shaft of the hauling drum by connecting rods coupled to cranks secured to the ends of the hauling drum shaft, or coupled to the shaft of separate or intermediate gearing. The drum or windlass barrel is loose upon its shaft, and is coupled therewith, when required for hauling purposes, by means of a sliding clutch, provided with projections or teeth, by preference inclined or beveled off at the back, which teeth engage into corresponding holes or recesses in the end of the drum. A clutch lever is provided for throwing the hauling drum into or out of action, as required. On arriving at the foot of a steep incline, the engineer will release the hauling drum on the engine, and will, without stopping the engine, run it up the grade to any desired distance. On stopping the engine, struts immediately come into action and maintain the engine firmly in its place. The hauling drum is now started by throwing the clutch into gear therewith (the rope or chain having been paid out as the engine ascended), and the entire train, or any part of the train, is hauled up by the sole power of the cylinders which work the winding drum. The struts on the train act to prevent any retrograde motion thereof, when required, or in case of an accident to the hauling apparatus; they also allow the engine to start again without the train to take another length of the incline, and so on until the complete ascent of the incline has been effected, the train being hauled up by the engine by the aid of the winding drum. On level sections, or on comparatively light grades, the locomotive acts precisely as an ordinary locomotive engine.

Improved Butter Worker.

Jonas Lindbeck, Andrew J. Lindbeck, and John E. Lindbeck, Bishop Hill, Ill., assignors to themselves and Andrew Jacobson, same place.—To the inner surface of a cylinder are secured rows of teeth, which are made diamond-shaped in their cross section, and are placed in an inclined position. To a shaft, rotated within the cylinder, are attached teeth, which are also made diamond-shaped in their cross section, but are inclined in the opposite direction, and are arranged spirally upon the shaft. In the top of the cylinder is placed a hopper for the convenient insertion of the butter. As the butter is fed into the hopper, it is thoroughly worked and mixed by the teeth, and at the same time carried forward to the other end of the box, and is forced out through a hole in said end. As the butter escapes from the hole, it passes over two or more rollers pivoted to a chamber, the lower side of which inclines back, and projects beneath the end of the box to serve as a channel to conduct the brine into a spout.

Improved Clothes Washer.

Ezra Crowell, Belfast, N. Y.—This invention is an improvement in the class of washing machines or devices consisting, chiefly, of a hollow sheet metal cylinder and a plunger reciprocating therein. The improvement relates to constructing the cylinder with vents on the side near the top, and connecting them, by means of an exterior tube, hood, or casing, to allow escape of air and water past the side of the piston.

Improved Device for Lifting and Moving Railroad Cars.

Benjamin F. Phelps, Kansas City, Mo.—The object of this invention is to provide means for conveniently lifting and moving railroad cars and other heavy bodies; and it consists of a lever, to which is attached a movable fulcrum, and also a roller and push bar. The push bar is forked to go over the end of the lever, and has an adjustable dog on its end, by means of which it is attached to the angle of a car. By means of a self-adjusting fulcrum pawl, the lever may be applied by either lifting or bearing down, as may be desired.

Improved Hanger for Plant Shelves.

William Higgs, Washington Mills, N. Y.—This invention consists in a shelf hanger, made of a single piece of wire, bent into the general form of a right-angled triangle, with a prong formed of its end or ends at the lower end of its perpendicular, and a loop formed at the upper end of its perpendicular.

Improved Scissors for Use with Sewing Machines.

Sarah L. Fawcett, New York city.—This invention comprises a pair of scissors with a sharp cutting hook to free the cotton from the rotating hook of a sewing machine, and a pulling hook for drawing the cotton from under the needle. The contrivance is particularly adapted for the Willcox & Gibbs sewing machine, and all machines which use the rotating hook.

Improved Combined Cultivator and Seeder.

Matthew Green, Walker Station, Mo.—The pinion of the seed-dropping device is thrown in and out of gear with the wheel, and applied to a shaft which passes into the seed receptacle along the bottom thereof, and is provided with a screw thread inside of the box or receptacle. A slide has a perforation with a flexible spring surrounding the same, being of a diameter corresponding to that of the screw end of the shaft, so that the latter feeds, by the rotation imparted by the gear wheel, the seed taken up by the spiral flange of the screw to the seed-conveying tube.

Improved Steam Rock Drill.

Joseph C. Githens, New York city.—The essential features of this invention consist in mechanism which causes the piston to turn as it moves upward, and allow it to move downward without turning. Other devices force said piston and disk together and apart by steam, for holding and releasing the guide rod as the piston moves up and down.

Improved Fruit Dryer.

William S. Plummer, San Francisco, Cal.—This invention relates to a fruit dryer in which the racks for holding the fruit pans or plates are made to revolve and carry the fruit around a horizontal course through a heated chamber and back to the place of starting, when the dried fruit is replaced by green, making a continuous process. The invention consists of a peculiar construction of the circular chamber, partly of stationary walls and partly of revolving walls, also of contrivances for heating the chamber economically by hot air and steam.

Improved Horse Power Well Boring Machine.

Matthew Steward, Napoleon, Ohio.—This is a horizontal master wheel, which gears internally with a vertical countershaft that drives the horizontal windlass to hoist the auger. The shaft also gears with a hollow horizontal wheel for turning the auger, and is connected with it by two friction rollers on the wall of the eye of the wheel, against which vertical bars parallel to the shaft and attached to it by arms bear, so as to allow the auger to descend freely, and with but little friction, at the same time that it is revolving. The platform for the attendant of the auger is built over the master wheel, and the whole machine is contained within the compass of the sweep to which the horse is attached.

Improved Machine for Barking Wood.

Orson W. Clark, Appleton, Wis.—The cutter has a roller guide on each side of it, one being to gage the wood for the depth it is required to be cut, while the latter is merely to assist the former by acting on the dressed portion of the wood after it passes from the former, and to hold it altogether after the end escapes. These gage rollers are each mounted in the end of a rocking support, and can be shifted toward and from the axis of the cutter. The nut for feeding the frame along is made in two parts, which are pivoted together and connected by a rocking link, so that when one of the parts of the nut is pressed on the screw, the other part will also be closed on the screw by the same means, through the medium of the said rocking link. When the handle is let go, the spring throws open both jaws and disconnects the frame from the screw, so that it can be instantly shoved back to the place of beginning, after each piece is barked.

Improved Soda Water Cock.

Henry Fraser, Pictou, Canada.—Upon the top of the cock is a deep ring flange, having a screw thread cut in its inner surface to receive a screw formed upon the upper part of the cock. In the lower end of the screw are circular recesses to receive the ends of the plug, the handle of which passes out through the flange. By this construction, the upper part will always be held squarely in place, and thus will not be exposed to any unequal pressure.

Improved Biscuit Board.

Aaron P. Forman, Canton, Miss., assignor to William B. Stinson, same place.—In using the machine, the dough is placed in the central compartment of a hopper, and is drawn through between rollers by their revolution. The dough falls from the rollers. It falls upon a bottom board, from which it is removed and again placed in the hopper, and the operation is continued until the dough has been sufficiently worked.

Improved Folding Table.

Nicholas S. Tiemann, New York city, assignor to John A. Tiemann, of same place.—The invention consists of a combination of jointed braces and connecting bars, jointed legs, and a jointed table top, in such a manner that the legs are caused to fold and unfold, and assume their proper position in each condition by the top when it is folded and unfolded, thus affording a simple folding table.

Improved Machine for Making Fence Pickets.

Isaac Levy, Ellaville, Fla.—The invention is an improvement in the class of machines wherein revolving and vertically adjustable cutter heads are employed for dressing the heads of the pickets. The improvement relates particularly to the construction of the sliding or reciprocating table and an attachment thereof, for supporting and clamping pickets of different lengths. A bar is adjustable up and down the carriage, toward and from the cutters, by slotted side pieces and clamping bolts.

Improved Weather Strip.

William O. Chamberlain, Battle Ground, Ind.—The invention consists in a weather strip for doors, formed of two zinc strips, having their adjacent edges rolled to interlock with and turn upon each other. The free edge of the zinc is secured to a strip of wood. A spiral spring is attached to a stationary wooden strip, and its other end is secured to the wooden strip above mentioned. The elasticity of the spring, when the strip is free, raises the same and supports it, so that it will pass over the threshold without touching, when the door is swinging open and shut. A small wheel is pivoted to the side post in such a position that, when the door is swinging shut, the face of the said wheel will strike the wooden strip and force its free edge downward, so as, when the door is closed, to be in close contact with the sill.

Improved Lubricator.

Morris Evans, Erie, Pa.—The lubricator is connected by a separate pipe with the steam space of boiler, and is so arranged that the lubricator therein is thereby thrown in a continuous stream into the steam chest and cylinder, and the quantity of the stream easily controlled by the regulating steam cock.

Improved Plow.

Hugh D. Smith, Richmond, Va.—By suitable construction, the beam may be moved up or down upon its standard, a cleat keeping it always parallel with its former position.

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Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Notes & Queries

W. F. M. will find directions for making cement for mending rubber garments on p. 203, vol. 30.—L. F. P. will find a recipe for lard oil on p. 283, vol. 30. Furniture polish is described on p. 315, vol. 30. Cutting glass is detailed on p. 331, vol. 30.—C. W. will find a recipe for wood filling on p. 347, vol. 31.—J. W. will find recipes for black and red ink on pp. 203, vol. 29, and 200, vol. 30.—S. S. can make a polishing starch by the recipe given on p. 203, vol. 31.—T. H. D. S. can make a T square by following the directions on p. 165, vol. 30.

(1) J. A. McI. asks: How can I make Britannia metal? A. Melt together 8 ozs. shruff or dross brass, 2 lbs. regulus of antimony, and 10 lbs. tin.

(2) C. A. D. asks: What is wire-drawn steam? A. Steam which has its pressure reduced by the resistance of passages.

(3) D. W. G. asks: What can I use to coat the inside of a small brass tube with, that will effectually resist the action of vinegar and spirituous liquors? A. We have seen it recommended in similar cases to use tannate of gelatin.

(4) N. H. V. asks: Does the volatile fluid sulphide of carbon contain carbon in solution? A. From 1 oz. bisulphide of carbon, 404·21 grains sulphur and 75·79 grains carbon may be obtained; yet the carbon cannot be said to be in solution, but in chemical combination with the sulphur. So also with all the compounds containing carbon. Carbon, in its free state, is insoluble in acids or alkalies.

(5) S. E. A. asks: 1. At what temperature does platinum fuse? A. Experiments made by Dr. Deville give the fusing point of platinum to be between 2600° Fah. and 2696° Fah. 2. At what temperature will a compound of silver with one third platinum fuse? A. Direct experiment is your only resource to find the melting point of your alloy.

(6) J. H. A. asks: 1. Will oil in which steel is hardened lose its hardening property? A. Yes. It must be kept up by a supply of melted resin stirred into the oil when warm. 2. Which is the best oil for steel? A. Pure Straits whale or sperm oil. Be sure that it is free from any mixture of mineral oils.—J. E. E., of Pa.

(7) W. W. says: I separated some fine powder from hard coal ashes which are wasted. Is it useful for anything? A. Such ashes have been used for cleaning tin ware for a long time with satisfaction, still it is doubtful whether ashes could be used in this way at present with pecuniary profit as a commercial undertaking.

(8) C. E. P. asks: What process does carbon undergo in order to form it into crucibles? A. Black lead crucibles are made of two parts of graphite and one of fire clay, mixed with water into a paste, pressed in molds, and well dried. Graphite or plumbago is an allotropic form of carbon. It is also used in the manufacture of lead pencils.

(9) A. E. S. asks: 1. How can I fix lard so that it will remain in a soft or liquid state in cold weather? A. Try mixing the lard with a small quantity of kerosene oil, which may be deodorized by digesting for a short time on chloride of lime. 2. Would it be safe to mix it with alcohol for burning in a lamp? A. We would not recommend alcohol as a solvent in this case.

(10) F. F. V. says: On p. 304, vol. 31, is a paragraph on the crystallization of tin. Could this be so arranged as to do away with the platinum capsule? A. Any metallic vessel not attacked by the solution, or one made of carbon, will answer the purpose as well.

What impurities does sheet zinc commonly contain, and how may they be removed, so as to leave it comparatively pure? A. Commercial zinc contains a small quantity of lead, iron, and of a peculiar carbonaceous matter, besides (occasionally) traces of arsenic and of copper. The best method of obtaining the metal in a state of purity consists in transmitting sulphuretted hydrogen gas through a slightly acidulated solution of sulphate of zinc, filtering from any precipitate that may be found, (and after boiling the solution, in order to expel the sulphuretted hydrogen) precipitating the zinc in the form of carbonate by the addition of carbonate of soda. The carbonate when ignited is converted into the oxide of zinc, which must be distilled in a porcelain retort with charcoal prepared from loaf sugar.

What is block tin, and how may it be reduced to pure tin? A. Block tin is a name given to the metal to distinguish it from tin plate (sheet iron superficially covered with tin). The tin which is imported from Banca and several other places is almost chemically pure. English tin usually contains small quantities of arsenic, iron, copper, and lead, and often traces of gold. When required in a state of perfect purity, the metal may be obtained by means of voltaic action. For this purpose a concentrated solution of tin in hydrochloric acid is placed in a beaker, and water is cautiously poured in without disturbing the dense solution below. If a bar of tin be plunged into the liquid, beautiful prismatic crystals of pure tin are gradually deposited upon the bar, at the point of junction between the metallic solution and the water.

(11) H. K. G. asks: I have on hand 15 or 20 barrels cider, which I wish to make vinegar of. It is nearly 3 years old, but will not become sour, though it is no longer sweet. How can I make this sour? A. Try the following plan: Put some of the cider in a clean cask and add to it some vinegar containing abundance of mother of vinegar; after some days, if the acetic fermentation has taken place and the souring is going on, add another portion of the cider, and at similar intervals a third and a fourth. When the whole has become vinegar, take out as much as is equal to the vinegar first put in, and replace by fresh cider, and so proceed. The casks should never be but partly full; good exposure to air is necessary, and the temperature should be kept up to 86° Fah.

(12) B. says: I have made a glass prism, to contain bisulphide of carbon. What kind of cement will do for the joints, that will not injure the transparency of the fluid? A. Obtain a quantity of pure white shellac, which dissolve in alcohol. Evaporate until of the consistence of a thick paste. Moderately heat the ends of the glass plates to be joined, and immediately apply the shellac paste, and allow to set until perfectly hard. By this means a joint is obtained, which perfectly resists the action of the liquid, and, if ordinary care be taken of it, will remain perfectly tight for a very long time. This recipe is kindly furnished by Wale & Co., instrument makers to the Stevens Institute.

(13) A. B. C. asks: 1. There has been a controversy between us as to whether the use of bituminous coal as fuel in dwelling houses is attended with any injurious effects to the interior decorations, gilded work, etc. Is this so? A. When the coals contain sulphur compounds, the liberation of sulphurous gases has a still more injurious effect than the deposit of soot mentioned below. But it must be remembered that these pernicious consequences are dependent upon the escape of the products of combustion; and if bituminous coals are used, this escape should be properly guarded against. 2. What relation does English cannel coal bear to the bituminous coals of this country? A. The striking difference between the cannel and the bituminous coal is that the former contains a very much larger amount of volatile combustible matter. The English cannel coal has 66 per cent of this volatile matter, the Breckenridge from 56 to 72 per cent, the Pittsburgh bituminous has but 33 per cent. In burning there is a corresponding formation of thick sooty flame, and a likelihood, in cases where this combustion of the gases and soot is not perfect, of a deposit of soot.

(14) A. J. H. asks: 1. Will cast iron stills do for distilling spirits? A, Such stills have not been used for this purpose. Some more heat would be required for a cast iron than a copper still, and the iron would rust to some extent. But it would be safe to try such a still. 2. Will a lead worm do? A. It would be better to use a tin-lined lead pipe for the worm, since liquids running through lead pipes sometimes form lead salts which are poisonous. In fact worms of block tin are used in chemical laboratories, where it is desired to distil with the greatest freedom from impurities. There would be a tendency in the tin-lined lead pipe worm to sag with the heat, on account of the metal not being as stiff as copper; but this can be prevented by properly supporting the different parts of the worm.

(15) G. McI. asks: How is chlorate of potash made? A. Chlorate of potash may be economically obtained by exposing to a current of chlorine gas a mixture, in a slightly damp state, of 69 parts carbonate of potash, and 168 parts of caustic lime, previously reduced to the state of hydrate; chlorate of potash, carbonate of lime, and chloride of calcium are formed; boiling water dissolves both the chloride of calcium and chlorate of potash. The two salts are easily separated by crystallization, as the chlorate requires 16 parts of cold water for its solution, and the chloride is soluble to almost any extent. We would not recommend one, destitute of experience in such matters, to undertake its manufacture.

1. In making the calcium light, what kind of lime is used? A. The best results may be obtained with quicklime, freshly burned, free from sand, and perfectly dry. 2. How often can the same piece of lime be used, the piece being 2 inches by ¾ of an inch thick? A. It cannot be used for more than a few hours, for the reason that, from the intense heat that it is subjected to, it becomes disintegrated and partially vaporized.

(16) J. S. S. asks: 1. Is there any mode of constructing a bearing so as to dispense with brasses, when the journal or pivot has a travel back and forth of about 90°, the work or pressure being constant, and from 1,000 to 3,000 lbs., according to the size of machine? A. You can use such a box as you suggest, if you make it with ample bearing surface, and provide it with sufficient means of lubrication. Secure the thimble in position. 2. Are friction and wear greater where the journal makes an entire turn than where the travel is back and forth? A. The power required to overcome friction is ordinarily greater in the latter case, on account of the constant stopping and starting incident to the reciprocating motion. 3. I want to use a toggle lever attached to the connecting rod of an engine (revolutions 200 per minute). There is a journal or pivot at each end of toggle lever, and brasses will not work well. Can I, for 3,000 lbs. pressure, use a 2 inch steel pivot working in a case-hardened iron thimble fitted in each end of toggle lever? Should the thimble be free in its hole in end of lever, or should it be shrunk in while the lever is hot?

(17) C. S. M. asks: I want to raise water by a hydraulic ram from the foot of the hill, on which my house stands, to the cistern in the attic, a vertical distance of 90 feet. I have a steady but small spring with a fall of 20 feet. How many gallons must be discharged from the spring through the best approved ram to raise one gallon into the cistern? A. See article on hydraulic rams, p. 259, vol. 31.

(18) G. W. S. asks: What is the difference between the Griffiths and the Hirsch propellers? A. The blades of the two screws are differently shaped, and in the Hirsch propeller the pitch expands from hub to periphery as well as in the direction of the axis.

(19) C. W. S. asks: We have a cross cut saw hanging up in the shop. On some days the strokes of the hammer will create a greater effect upon the saw than usual. It sounds as if some person had struck it a light blow with a mallet, the sound being clear and distinct. The quicker the strokes while driving a nail, the greater the effect. Has the purity of the atmosphere anything to do with this? A. We think not.

(20) F. C. S. says: 1. We are somewhat bothered in sawing frozen pine logs with a 56 inch circular saw. She will run all right in any other kind of wood. What is the reason of this? A. What is known as sapling pine, when frozen, is about as difficult timber to saw as can be found. The extreme points of the teeth must be wider than the plate of the saw, and very sharp, with the under side wider than the upper part of the tooth, so as to present a very sharp cutting edge to the timber. 2. Does it take a different kind of saw for sawing frozen pine? A. When timber is frozen, it generally requires less set in the saw than when it is not frozen.

(21) T. C. W. says: I melted 1 lb. each resin and pitch together in an iron vessel; then, while hot, I poured the contents of the vessel into a wooden mold in the shape of a brick; but I found, after the mixture got cold and hard, that I could not get it out of the mold; it adhered to the wood. Please to tell me how to construct a mold so that the substance will readily come out when cold. A. Try covering the surface of the mold with a thick coating of plumbago.

(22) A. V. P. says: There was in December, for some days, a very bright star visible in the east just before sunrise, very nearly over the sun, I think, rising a few minutes after six, or about one hour and twenty minutes before the sun, and visible until a few minutes after the sun rose to the naked eye. This morning it looked four times as large as a star of the first magnitude, owing possibly to the fine condition of the air. What star is it? A. Venus. 2. About two weeks ago we were astonished at the unusual brightness of a star rising in the E., or a little S. of E., just before 9 P. M. It rivalled Venus at her brightest, and its light flashed in our field glass, fairly lighting it up. After getting up into the heavens, it lost much of its brightness, and since then it has not been half so conspicuous. What is it? A. Sirius.

(23) C. N. G. asks: 1. What is the size of the largest telescopic lens now in use? A. There are now completed two similar Clark equatorials, 26½ inches clear aperture, and 26 feet focus. The crown lens is double convex, of equal curvature on each side, 13 feet radius. The flint lens is 12 feet 8 inches radius on the concave side, nearly flat on the other. 2. What is its value? A. $50,000. 3. Can lenses be made any size? A. The largest disks now obtainable are 30 inches in diameter, price $10,000 per pair. Two 30 inch achromatics and a silvered glass reflector of 6 feet 6 inches aperture are now being made in Europe. 4. Can large ones be made as rapidly in proportion to their size as small ones? A. No.

(24) J. C. says: 1. We learn that the moon by her attraction produces the tides, and that attraction is in inverse proportion to distance (less distance, more force). When the tide is 72 feet high, moon's attraction is increased and earth's attraction decreased. Why does not the water continue to rise and go to the moon? A. Because the earth is nearest. 2. Why does the earth turn on its axis? A. Because the primeval nebula rotated as it condensed.

(25) C. M. asks: 1. In your issue of November 7, in answer to A. H., who asks how to prepare the glass for a camera, you say that lead-faced chucks are cast of the proper curvature, and the lever is held upon the chuck by a wooden handle attached with pitch, while sand and water are applied. Would not hard-tempered steel answer the same purpose as lead chucks? A. No; brass or iron grinders follow the roughing out. 2. Are microscopic objectives ground in the same manner, that is, with lead-faced chucks? A. Microscope lenses are roughed out on a lathe with a steel tool dipped in turpentine, or a diamond pinched into a copper rod, then ground in one of a pair of brass chucks alternately with the chuck of opposite curvature.

(26) W. P. & Co. ask: Is it practicable to discharge water from a centrifugal pump eight feet below the surface of the water? The discharge pipe is 22 inches diameter, the pump making 220 revolutions per minute. The lift of the suction pipe is from 4 to 6 feet, and the pipe is 22 inches in diameter also. A. It can readily be done with a good pump.

(27) J. W. asks: What boiler, engine, and wheel are required to propel, at 12 miles per hour, a boat of 36 feet keel, 10 feet beam, 3 feet draft, and sharp bows? She was built for sails. A. Cylinder 7x9 inches, boiler 4 feet diameter, 6 feet high; propeller from 32 to 36 inches diameter with 4 feet pitch.

(28) G. H. B. asks: What would be the effect on the cables of the new Brooklyn bridge (when completed) of a fire under that part of it extending over the tops of buildings? A. It

would depend so much upon the attendant circumstances that we could not give a general answer, except to say that, if our fire department were to act as efficiently as it usually does, the cable would probably not be injured.

A course for a boat race is three miles long, measured on the shore of a river. At slack water a rower can row the distance in 20 minutes. How long would it take him to row over the same course with the current of 4½ miles an hour, and how long also against the same? A. See p. 202, vol. 31.

(29) G. E. M. says: 1. How many horse power would it take to run a dummy on a 30 inch gage railway, not over 30 feet grade to the mile, hauling weight 8,000 lbs. at a rate of not over 10 miles per hour? A. It would probably require 2 or 3 effective horse power. 2. What style of engine would be best? A. A pair of vertical engines would answer very well.

(30) J. C. W. asks: 1. What kind of stove is best adapted to the use of coke, and could the same be economically used in the place of anthracite coal at about half the price per tun? A. A stove with open grate would be the best. We scarcely think there would be any great economy in this arrangement; but if it proved efficient, you would have a very cheerful and healthy fire. 2. Would it do to mix coke and coal for use in an ordinary coal stove, a self-feeder? A. It seems to us that the action would be somewhat the same as if wood were mixed with the coal. We have never tried the experiment, however, which is the only way to settle the matter.

(31) O. W. R. says. I have an engine of 1 inch bore x 3 inches stroke. It makes 500 revolutions per minute, and cuts of at ¾ stroke. Flywheel is 1 foot in diameter and 1 inch wide, weighing 10 lbs. What power could I get by running it at a pressure of 50 lbs. per square inch? A. You might realize about ½ of a horse power. 2. What kind of a boiler should I use? A. A cylinder boiler would answer very well.

(32) R. H. S. says: I dissolved a three cent nickel coin in nitric acid; after filtering, I poured in a solution of soda of commerce, then added spirits of ammonia, and precipitation commenced. I washed with pure water, and had a green mass. What is it? A. You first formed a solution of nitrate of nickel and nitrate of copper. On adding the soda, you neutralized the nitric acid in excess of what was needed to convert the metals into nitrates. On adding ammonia (in case you added it in proper quantities) you threw down a greenish blue precipitate of a copper salt, together with a little hydrated oxide of nickel. If you had used potash, you could have effected the precipitation more perfectly. This residue cannot be used for plating.

(33) C. H. asks: What is the cheapest way of obtaining 1,000 cubic feet of oxygen? Perfect purity is not required. A. Oxygen may be obtained on a small scale very readily by simply heating in a close retort a mixture of 4 parts chlorate of potash and 1 part black oxide of manganese. If large quantities are desired, the continuous process of T. du Motay may be employed. The principle of this process resides in the fact that the manganates and permanganates of potash, soda, and baryta, the ferrates and chromates of the same bases, and in general all metallic oxides and acids which will form, with potassa, soda, or baryta, binary compounds capable of superoxidising, possess the property of yielding their oxygen, at a more or less elevated temperature, when they are submitted to the action of a current of steam. These bodies, thus deoxidized, also possess the property of reoxidizing themselves when they are exposed to a temperature more or less great. The atmosphere is therefore the constant source from which the oxygen is derived. The mode of operation is the following: One of the binary compounds just enumerated is placed in a distilling vessel, whether at the maximum or minimum state of oxidation. If the compound is in the latter condition, it is oxidized by means of a current of air mechanically drawn over it; if at the former stage, it is deoxidized by means of a current of steam. The oxygen and steam, on issuing from the mouth of the retort, pass together into a condenser, where the steam is separated by condensation, while the oxygen passes over into a gas holder, and is there collected. When all the utilizable oxygen has been disengaged by the steaming process, the action of superoxidation by means of the air current is recommenced. By this alternate process the oxygen is generated as long as may be required.

(34) J. A. H. says: We have heard lately considerable difference of opinion about the distance boilers should be set from the grates. Some parties claim that 6 feet is better than less; others say 3 or 4 feet. I am satisfied that there is economy in having plenty of space. Can you tell what would be the most economical distance to set a 60 inch shell, tubular boiler with 4 inch flues, 16 feet long? A. If by "from" you mean "above," we should say that for burning coal, with natural draft, it would probably be well to set the boiler not more than 30 inches above the grate, which would make 5 feet from center of boiler to surface of grate.

(35) R. K. asks: What is the best mode of setting steam boiler furnaces? Some claim that it is best to have a space of from 3 to 6 feet between the grates and boiler, and the same space for fire bed along the length of the boiler. A few of this class claim that it is not best to have a bridge wall, as they want the above space for the whole length of the fire bed. Others claim that from 12 to 18 inches space between boiler and grate is enough, with a bridge wall at back of grates. A. We do not believe that any authoritative rule can be given that will apply to all cases. From our observations, we should judge that both parties have good reasons for their opinions, since we have seen boilers set in both ways that did well. A bridge wall is generally convenient in working the fire. The most common practice in setting boilers is to place them from 1¼ to 2½ feet above the grates.

(36) C. H. asks: I have several times noticed the chimneys of my kerosene lamps break without apparent cause. Sometimes they were being carried, at others they were on the table in a warm room. Can you tell me the reason for such constant breakage? A. We must class these occurrences with the unexplainable one of the vase that went into a thousand pieces just before the maid of all work was going to dust it.

(37) J. H. S. asks: What advantage is derived by running a main belt at 3,368 feet a minute, when the driven belt only requires 527 feet in the same time? What law governs it? A. The greater the speed of a belt, the less tension it requires to transmit the same power.

What is the expansion of steam pipe, when heated, per foot? A. Its length is about $\frac{1}{8\frac{1}{4}\frac{1}{8}}$ greater at 212° Fah. than at 32°.

(38) J. & H. ask: Does the use of coke in ordinary stoves, with cast iron or brick-lined fire pots, injure the stoves? A. Not unless you allow the iron to become unduly heated.

(39) H. C. W. asks: 1. Is the air in the air chamber of a hydraulic ram or force pump absorbed and carried off by the water? A. It is absorbed by the water to some extent. 2. If cast iron is used for such chambers, can it be rendered impervious to air by japanning or glazing, or any other means? A. An ordinary cast iron air chamber will answer well enough for most cases.

(40) I. F. asks: Is there any way by which printing ink may be removed from paper without materially injuring the same? The paper in question is heavy writing paper, and could bear a good deal of rubbing without tearing. A. We know of no better method than that of acting upon it with some solvent, such as turpentine or benzine.

(41) D. J. asks: What colors can I mix to make pearl gray paint? A. Any white pigment with a little blue black.

How can I separate gold from silver? A. The silver and gold may be parted by treating the alloy with very pure aquafortis. In order that this process should succeed, it is necessary that the silver should be as two or three to one of gold; also that the acid should be pure.

Is there any work on mixing of pig iron to produce the different grades of bar iron? A. Read Bauermann's "Treatise on the Metallurgy of Iron," or "The Practical Metal Worker," by O. Byrne.

(42) J. J. T. asks: Does a revolving body, such as the fly wheel of an engine or two weights revolving on arms, weigh as much when at rest as when in motion? A. Yes.

(43) J. W. asks: Can you tell me anything about the Keely motor of Philadelphia? I have seen scientific men, who have seen the power generated and run off, who say it is a fact and can be utilized. Have you seen it? Do you believe in it? Do you know anybody connected with it? Tell me all you know or think of it. A. The Keely humbug was shown up in our paper last year.

(44) W. P. asks: What is the best means of polishing leather? A. After the usual process of currying, the hide or skin, being rendered flexible and uniform, is conveyed to the shed or drying house, where the greasy substances are applied, which is called dubbing (daubing) or stuffing. The oil used for this purpose is prepared by boiling sheep or doe skins in cod oil. Before waxing, the leather is commonly colored by rubbing it with a brush dipped into a composition of oil and lampblack on the flesh side, till it is thoroughly black; it is then black sized with a brush or sponge, dried, tallowed with the proper cloth, and "slicked" upon the flesh side with a broad, smooth lump of glass, sized again with a sponge, and dried.

(45) P. R. S. asks: 1. What is the correct chemical formula of the double sulphate of nickel and ammonia? A. Ni $(NH^4)^2(SO^4)^2$. $6H^2O$, in the new system, or NiO,SO_3+NH^4O,SO_3+6HO in the old system. 2. Can I use cast zinc cylinders for Bunsen batteries, and how should I prepare them? A. Yes. First dip them in dilute sulphuric acid, and then rub them with mercury by means of a piece of flannel. You should experience no other trouble, if your connections are properly made. 3. Which are the right proportions of water and sulphuric acid for a Bunsen battery? A. One of acid to ten of water. 4. How can I obtain the nickel in a metallic state out of a mixture of it with nitric and sulphuric acids, most of it being sulphuric acid? A. On a small scale, the method of electrolysis will probably answer your purpose best.

(46) B. C. asks: How is cider made to effervesce? A. By bottling while the fermentation is still going on. In this case the carbonic acid gas generated in the process of fermentation is imprisoned in the liquid in the bottle, and escapes violently when, on drawing the cork, the pressure is removed. 2. What gives it the biting taste? A. It is due to the vegetable acids present—malic and acetic acids.

(47) P. I. says: I want a cheap vessel of 100 gallons capacity to boil a mixture, in containing 4 per cent of sulphuric acid, over an open fire. Is there anything cheaper than a copper tank? Will lead or nickel-plated iron do? A. For this purpose lead is out of the question, as it is a poor conductor of heat, and would speedily be burnt through. As to nickel, we have tried the experiment in the following manner and with results as stated below: First, a suitable vessel was coated on the interior with an even coating of nickel by galvanic action, filled with a solution containing 4 per cent of sulphuric acid, and gradually brought to the boiling point; in about half an hour (the solution being kept at about the same density by the addition of water from time to time) the nickel was found to be entirely dissolved. For your purpose we can recommend large porcelain-lined iron pots, which may readily be obtained, and at a much smaller cost than either of the above.

(48) A. F. O. says: 1. Is bichromatized glue insoluble in water? A. It is insoluble in water only after being exposed in thin films to the action of light. 2. Is it also as insoluble, in alcohol, as it was before the bichromate was added? A. Yes. 3. What proportions of glue and bichromate are used to produce the best result, and how should they be treated? A. Make a strong solution of isinglass in pure distilled water; for this purpose the water should be hot. Add to this as much bichromate of potash as it will dissolve; allow to stand. When cold, decant from the crystallized salt.

(49) J. McL. asks: How can I make ink for writing on zinc labels? A. Dissolve muriate of ammonia and crude sal ammoniac in strong vinegar.

(50) C. A. L. asks: How can I burnish silver plating? A. Use a tool of hardened cast steel or bloodstone.

(51) H. W. S. says: To find the radius when the length of chord and hight of arc are given: Let x = distance from center of circle to chord; then, by well known properties of right angled triangles, the value of x can be found, and x + hight of arch = radius. But I give a simpler rule. To the square of half the chord, add the square of the hight and divide the sum by twice the hight. This will give the radius, or $\frac{(\frac{1}{2}\text{ chord})^2+h^2}{2h}=r$.

(52) R. L. DuB. says, in answer to several correspondents who ask as to burning sawdust: I erected a saw mill in New Jersey. The boiler was a return tubular, 14 feet 6 inches long and 54 inches in diameter, with 64 three inch tubes, and brick firebox 48x56x27 inches high; bridge wall was 7 inches at center, rounded to the sides of boiler. I had to use coal for a few weeks and lined the firebox down to ⅔ the above size. After making sufficient sawdust, I endeavored to run with that and slabs, and I found it hard to keep up steam enough to run an hour steadily. I experimented until I reached the following result: I made the firebox the original size, lowered the bridge wall 13 inches (keeping the same circle as before), lowered the paving in rear of firebox to a level with the grate bars, and obtained a barrel of furnace slag from 3 to 7 or 8 inches in size and 1 or 1½ inches thick, which I placed on the grate bars, about half covering them. I fired with wood; and when the slag got heated, I threw in the sawdust, which burned very well but smoked fearfully (clouds would arise from the smoke stack). I then introduced a 2 inch pipe, with about fifty ¼ inch holes, directly behind the bridge wall, leaving both ends of pipe open; after which, I never had a particle of trouble either in keeping up steam or in burning up the smoke. Not even in firing up did I ever see any smoke come out of the stack, which was 30 feet high and 32 inches square, enlarged near top and to the top to 36 inches inside measurement. I forgot to state that I covered the top of boiler with sheet iron, then laid brick on it, covering the interstices with sand. The sheet iron was to prevent the sand from wedging off the wall when the boiler expanded.

(53) V. M. J. says, in reply to J. C. W., who has small success in burning slack or fine soft coal: "From personal knowledge, I can say that neither unusually strong drafts, nor close bars, are necessary. We have a boiler 15 feet long by 4 feet 3 inches diameter with 51 four inch flues, connected with a stack 101 feet high, with a round 3 feet flue hole in it. Originally the boiler had common cast iron grate bars under it. Length of bars was about 4 feet, and the grate was 4 feet 8 inches wide. With this arrangement, ordinary lump coal was used; but owing to the quality of coal and the amount of steam required for power, it was very difficult to fire for 5 hours and keep clinkers off the bars; and at noon and night, it required hard and hot work to get the bars in good order. Three or four years ago, a change was made in the grate bars, substituting those now in, which are the same width as formerly, but 8 feet long, being more than half the length of boiler. The bars are made in short pieces, half the length in width, and supported by cross bars. The openings in bars are about ⅝ x 2½ inches, and the ribs of bars about ⅜ inches wide. Immediately inside of furnace doors, at end of boiler, is a shelf of fire brick, on line with grate bars, on which the fuel may be thrown. Also, at side of boiler and back end of grate bars are doors and similar arrangements, as at front of boiler. The doors are provided with dampers for regulating draft, both for furnace and ash pit. Damper in breech just at entrance to chimney, and boiler about 23 inches above the grate, complete the general arrangement. With this arrangement, common slack is used successfully, requiring less in quantity than coal formerly used, being much easier to fire, and with the great advantage of having the bars free from clinkers, from the draft not being so intense. Good judgment and experience in firing with this arrangement will insure the almost complete combustion of the smoke. The same kind of bars were put under a boiler which had a stack 65 feet high, with satisfactory results. The bars have been furnished in other cases, and wherever used will soon repay the expense of the change from the old style, on account of better combustion, and being able to use a cheap kind of coal.

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

J. E. C.—It consists of silica, which, under the microscope, appears as extremely small transparent grains. It may be used for polishing, or as a detergent (alone or along with rouge or saponaceous substances), or as a base for siliceous paints, or in soluble glass, or in glassware, glazes, etc.—T. S. C.—The specimen sent was found to consist of silica, silicate of alumina, carbonate of lime, carbonate of magnesia, oxide of iron, and sulphate of lime. It is a very poor conductor of heat, and would largely prevent the heat from passing to the water, and thus the iron would be overheated.—G. A. F.—A most careful analysis of this specimen was made, and revealed not a trace of nickel. Why did you form the opinion that it was an ore of iron and nickel?

(17) D. J. C. asks: Supposing a man is pulling a boat in smooth water in a dead calm, at the rate of a mile in 10 minutes, and to accomplish this he is compelled to pull thirty strokes per minute with a pulling force of 50 lbs. to each stroke. The oars are ten feet in length, weigh 10 lbs. each, the weight of the oar being equally distributed along its full length, so that you can balance it horizontally by holding it on your finger in the center of its length. The oars extend outside the rowlocks 7½ feet; the oarsman has to make the recover in ⅓ the time it takes to pull the stroke. What percentage of the pulling power is required to make the recover?—J. E. B. asks: How can pearl be dyed of various colors, using aniline?—H. P. asks: How can I imitate twist on a gun barrel?—E. B. L. asks: How can I make blacking for boot sole edges?—F. S. V. asks: How can I make soap for blowing bubbles that will last?—D. D. F. asks: Can any one give me some information as to the raising of hops, the distance apart, manner of cultivation, when to pick them, etc.?

COMMUNICATIONS RECEIVED.

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

On Rapid Transit in New York City. By G. R. N.
On the Motions of the Heavenly Bodies. By W. I. L.
On the Sun's Orbit. By J. H.
On the Epimethean Gods. By G. H.
On Oscillating Saloons on Steamers. By A. de B.
On Theories of Spiritualism. By S. C. F.
On the Highest Lakes. By C. R.
On Small Steam Engines. By G. F. S.
On Hollow Bolts. By J. B.
On Ornamenting Locomotives. By H. W. G.
On Diphtheria. By S. D. F.
On High Lakes. By H. R. S.
On Weights and Measures. By S. P. L.

Also enquiries and answers from the following:

N. B.—T. B. B.—W. W.—J. B. S.—W. J. B.—C. R. S. B.—W. C.—J. D. C.—M.—M. McC.—J. R. B.—H. P.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Who makes machines for preparing peat for fuel? Who makes machines for shaping ax and broom handles? Who makes machinery for working flax fiber? Who sells plane guides? Who sells decalcomaine pictures? Who makes domestic gas machines? Whose is the best covering for steam pipes? What is the best preventive of boiler incrustation?" All such personal enquries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

INDEX OF INVENTIONS

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Granted in the Week ending

January 12, 1875,

AND EACH BEARING THAT DATE.

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DESIGNS PATENTED.

7,993.—TYPE.—D. W. Bruce, New York city.
7,994, 7,995.—TYPE.—J. Herriet, New York city.
7,996.—COOK RANGE.—N. S. Vedder, Troy, N. Y., *et al.*
7,997 to 7,999.—STOVE.—N. S. Vedder, *et al.*, Troy, N. Y.
8,000.—MEDAL.—H. G. Brace, N. Y. city.
8,001.—CARPETS.—H. F. Goetze, Boston, Mass.
8,002.—ORGAN CASES.—J. P. Lomas, New Haven, Conn.
8,003.—CARPETS.—T. J. Stearns, Boston, Mass.
8,004.—COOK STOVES.—N. S. Vedder *et al.*, Troy, N. Y.
8,005, 8,006.—STOVES.—N. S. Vedder *et al.*, Troy, N. Y.
8,007.—CASSIMERE.—F. S. Bosworth, Providence, R. I.

TRADE MARKS REGISTERED.

2,159.—COOKING STOVES.—Bonnet & Co., Quincy, Ill.
2,160.—BAKING POWDER.—Hamilton & Co., Ft Wayne, Ind.
2,161.—CIGARS.—S. Lowenthal & Co., Cincinnati, Ohio.
2,162, 2,163.—PIANOFORTES.—Arion Co., New York city.
2,164.—NURSING BOTTLES.—M. S. Burr & Co., Boston, Mass.
2,165, 2,166.—SILK TWIST.—Copcutt & Co., Yonkers, N. Y.
2,167.—MEDICINES.—D. Dick & Co., New York city.
2,168.—COOK STOVES.—Fuller & Co., Troy, N. Y.
2,169.—VARNISHES.—A. E. Hoppock & Co., Newark, N. J.
2,170.—SOAP.—D. F. Packer, Mystic River, Conn.

SCHEDULE OF PATENT FEES.

On each Caveat	$10
On each Trade mark	$25
On filing each application for a Patent (17 years)	$15
On issuing each original Patent	$20
On appeal to Examiners-in-Chief	$10
On appeal to Commissioner of Patents	$20
On application for Reissue	$30
On filing a Disclaimer	$10
On an application for Design (3½ years)	$10
On application for Design (7 years)	$15
On application for Design (14 years)	$30

CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, JANUARY 8 to JANUARY 18, 1874.

4,243.—J. G. Muller and W. Muller, Dayton, Montgomery county, Ohio, U. S. Improvements on apparatus for manufacturing illuminating gas, called "Muller's Gas Machine." Jan. 8, 1875.

4,244.—M. Bray, Boston, Suffolk county, Mass., U. S. A new rivet, called "Bray's Rivet." Jan. 8, 1875.

4,245.—J. Boyle, Toronto City, Ont. Improvements on machinery for molding iron, called "Boyle's Iron Molding Machine." Jan. 8, 1875.

4,246.—C. A. Shaw, Boston City, assignee of H. Halverson, Cambridge, Middlesex county, Mass., U. S. Improvements on lamp wicks, called "Halverson's Carbonized Lamp Wick." Jan. 9, 1875.

4,247.—L. Letourneau, Montreal, Canada. Améliorations aux apparells de securité des navires à vapeur et à voiles contre la mauvaise mer, pour les empecher de sombrer. "Ceinture Baudé, dite de Sauvetage des Navires." Jan. 9, 1875. Improvements in safety apparatus for ships and sailing vessels, to prevent sinking.

4,248.—J. L. Thomson and F. N. Davis, Beloit, Rock county, Wis., U. S. Improvements in the manufacture of paper barrels, called "Thomson's Paper Barrel." Jan. 9, 1875.

4,249.—E. Bussey, Troy, Rensselaer county, N. Y., U. S. Improvements in base burning stoves, called "Bussey's Base Burning Stove." Jan. 9, 1875.

4,250.—G. Williams, Toronto City, Ont. Improvements in friction pulley blocks for carrying wire rope, etc., called "Williams' Improved Semaphore Wire Rope Pulley." Jan. 9, 1875.

4,251.—E. W. Scoville and W. L. Scoville, Manlius, Onondaga county, N. Y., U. S. Improvements in door hangers, called "Scoville's Improved Door Hanger." Jan. 9, 1875.

4,252.—W. I. Jebb and L. F. Harvey, Buffalo, Erie county, N. Y., U. S. Improvements in station tickets, called "Harvey's Improved Station Ticket." Jan. 9, 1875.

4,253.—E. Caswell, L. Whitlock, and S. Scott, Lyons, Wayne county, N. Y., U. S. Improvements on machine for boring hubs, called "Caswell's Hub-Boring Machine." Jan. 14, 1875.

4,254.—S. T. Norman, Toronto City, Ont., assignee of H D'Ary, same place. Mode of making galvanic electric body wear, consisting of insoles and belts and bands of different forms, called "D'Ary's Curative Galvanic Insoles, Belts, and Bands." Jan. 14, 1875.

4,255.—W. W. Wickes, Brooklyn, Kings county, N. Y., U. S., assignee of J. J. Bate, same place. Improvements on refrigerators, called "Bate's Improved Refrigerator." Jan. 14, 1875.

4,256.—J. L. Thomson and F. N. Davis, Beloit, Rock county, Wis., U. S. Improvements in paper barrels, called "Thomson's Paper Barrel." Jan. 14, 1875.

4,257.—W. M. Comey, Norfolk, Norfolk county, Mass., U. S. Improvements on games, called "Comey's Game of Conquete." Jan. 14, 1875.

4,258.—R. Patton, Montreal, P. Q., assignee of J. M. Maharg, Montreal. Improvements on steam traps, called "Patton's Steam Trap." Jan. 14, 1875.

4,259.—G. M. Bright and F. Barron, London, Eng., assignees of J. H. Banks, of 11 Lavender Road, Battersea, Surrey county, Eng. Improvements on the production of printing surfaces and of engraved metal surfaces applicable for other purposes, called "Banks' Improvements on the Production of Printing Surfaces and of Engraved Metal Surfaces, applicable for other purposes." Jan. 14, 1875.

4,260.—P. Burke, Toronto City, Ont. Improvements on gas carburetters, called "Burke's Improved Gas Carburetter." Jan. 14, 1875.

4,261.—P. B. Myers and S. Rough, Buchanan, Berrien county, Mich., U. S. Improvements on carpet stretchers, called "The Eureka Carpet Stretcher." Jan. 14, 1875.

4,262.—G. C. Thomas, New York city, N. Y., U. S. Improvements on retaining washers for lock nuts, called "Thomas' Lock Nut Washer." Jan. 14, 1875.

4,263.—E. N. Porter, Morrisville, Lamville county, Vt., U. S., assignee of E. E. Foster and M. B. Eaton, same place. Improvements on milk coolers, called "The Morrisville Milk Pan and Cooler." Jan. 14, 1875.

4,264.—A. B. Daniels, Franklin, Norfolk county, Mass., U. S. Improvements on games, called "Daniels' Game of Tourette." Jan. 14, 1875.

4,265.—W. A. Clarke, York Township, York county, Ont. Instrument for wrapping wire or cord on broken vehicle shafts or whiffletrees, fork handles, or any such like articles, called "Clarke's Wire and Cord Wrapper." Jan. 15, 1875.

4,266.—N. A. Menaur, Buffalo, Erie county, N. Y., U. S. Improvements on tea kettles, called "Menaur Tea Kettle." Jan. 15, 1875.

4,267.—F. B. A. Royer de la Bastie, Vilette, Department of Aisne, France. Process and furnace or apparatus for tempering and hardening flat and shaped glass, called "Royer de la Bastie's Process and Apparatus for Tempering Glass." Jan. 15, 1875.

4,268.—C. F. Lalonde, Montreal. Améliorations aux machines à separer les clous, viz., troquettes, rivets, crochets, etc., au sorter du bain d'etainage, "Machine a separer les vis, clous, broquettes, rivets, crochets, etc., au sorter du bain d'etainage." Improvements in machines for separating nails, screws, tacks, rivets, hooks, etc., when taken out of tin baths. Jan. 15, 1875.

4,269.—J. E. Townshend, Montreal, P. Q. Improvements in the cleansing, disinfecting, and preserving feathers, hair, wool, flocks, fiber, and all materials used for beds and upholstery, called "Townshend's Process." Jan. 15, 1875.

4,270.—J. E. Thompson, Stambridge, Missisquoi, P. Q. Improvements on steamers, called "Thompson's Perfected Steam Cooker." Jan. 15, 1875.

4,271.—Wm. West and T. West, Toronto City, Ont. Improvements on bedsteads, called "West's Combined Bookcase and Wardrobe Bedstead." Jan. 15, 1875.

4,272.—Jas. Goodwin, Lennoxville, Sherbrooke county, P. Q. Reissue of No. 3,377, on "Goodwin's Invalid Bedstead." Jan. 15, 1875.

4,273.—R. Whiting and J. Kyser, Cleveland, Ohio, U. S. Improvements on brace fasteners, called "Whiting's Brace Fastener." Jan. 15, 1875.

4,274.—J. Baker, Trenton, Hastings county, Ont. Extension of No. 223 on "Baker's Combined Hand Flour Scoop and Sifter." Jan. 15, 1875.

4,275.—L. J. Hewitt, Toronto City, Ont. Improvements in railroad car wheels, called "Hewitt's Improved Car Wheel." Jan. 15, 1875.

4,276.—G. D. Booth, Ottawa, Carleton county, Ont. Improvement on breech loading shot guns, called "Booth's Shot Gun Rifler, Adjustable and Convertible." Jan. 15, 1875.

4,277.—G. W. Otis, Lynn, Essex county, Mass. Improvements on lightning conductors. Attachments of head and ground plate for "Otis' Solid Cable Fluted Lightning Rod." Jan. 15, 1875.

4,278.—C. P. Crossman, West Warren, Worcester county, Mass., U. S., and E. J. Brown, Worcester, Worcester county. Improvements on salt boxes or casters, called "Crossman's Salt Box or Caster." Jan. 15, 1875.

4,279.—W. L. Phillips, New York city, N. Y., U. S. Improvements in stoves for heating and ventilating purposes, called "Phillips' Fire on the Hearth." Jan. 15, 1875.

4,280.—D. Conboy, Uxbridge, Ontario county, Ont. Improvements in vehicles for the conveyance of passengers, called "Conboy's Turn-Down Seat." Jan. 15, 1875.

4,281.—I. M. Rhodes, Hancock, Houghton county, Mich., U. S. Improvements on a fracture bed and apparatus, called "Rhodes' Fracture Bed and Apparatus." Jan. 18, 1875.

Advertisements.

Back Page - - - - - - $1.00 a line.
Inside Page - - - - - - 75 cents a line.

Engravings may head advertisements at the same rate per line, by measurement, as the letter press. Advertisements must be received at publication office as early as Friday morning to appear in next issue.

THE FRANZ & POPE
Knitting Machine Co.,

Having become the proprietors of patents for Knitting Machines, granted to WILLIAM FRANZ and WILLIAM POPE, and secured by Letters Patent of the dates and numbers following, to wit: No. 88,027, bearing date the 23rd day of March, A. D., 1869; also No. 99,425, bearing date the 1st day of February, A. D., 1870; also No. 99,426, bearing date the 1st day of February, A. D., 1870; also No. 102,529, bearing date the 3rd day of May, A. D., 1870; also No. 105,187, bearing date the 12th day of July, A. D., 1870; also No. 123,987, bearing date the 13th day of February, A. D., 1872, do hereby caution and warn all persons in general, and manufacturers in particular, against buying, selling, or using, or causing to be bought, sold, or used, any Knitting Machine having the improvements covered by the above mentioned Letters Patent. The Knitting Machines offered under the name of *Dana Bickford, Family Favorite,* and *Branson,* are infringements on our Patents; and it is our intention to prosecute all infringements coming under our notice.

FRANZ & POPE KNITTING MACHINE CO.
BUCYRUS, Ohio, February 1st, 1875.

MODELS FOR THE PATENT OFFICE,
All kinds of light work in Brass or Iron made and repaired at low prices. LADD & WILLIAMS, 34 Dey street, City.

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FOR SALE ON ROYALTY.
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Tempering Edge Tools
BY STEAM.
A patented process by which a ton of tools can infallibly be drawn to the same degree at one operation, by an unskilled workman. Address, for circular,
J. JENKINS, No. 267 N. Ninth St., Philadelphia, Pa.

26 PEMBERTON SQ., Boston, Mass.
New Variety Moulding Machine,
Containing all the Excellences of the old Gear Machine and new and valuable improvements,
At Prices that Defy Competition.
Send for Prices and Descriptive Circular.

Important Notice to
Manufacturers and Users of
CIRCULAR SAW MILLS.

THE SUITS FOR INFRINGEMENT OF the LANE SAW MILL PATENTS, brought against *F. C. Candee & Co.*, New York, (selling agents of Belknap, Ely & Co., Northfield, Vt.,) against *Luke Buzzell*, St. Johnsbury, Vt., and others, have been terminated in favor of the plaintiffs, and decrees have been issued by the United States Courts declaring the validity of the Lane patents, and perpetually enjoining the defendants from further use of the following devices, viz.:

An independent outset or tapering device;

A frost dog—sliding on a post, and binding in the eye;

Dog rests, or holders, on the set beam of saw-mill carriages;

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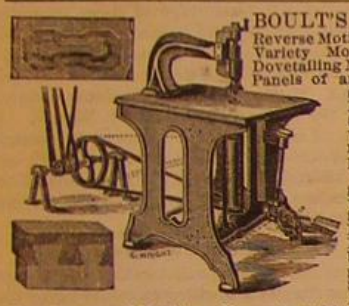

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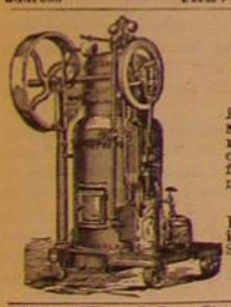

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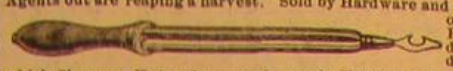

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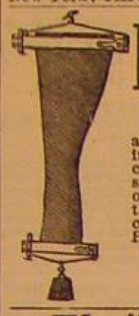

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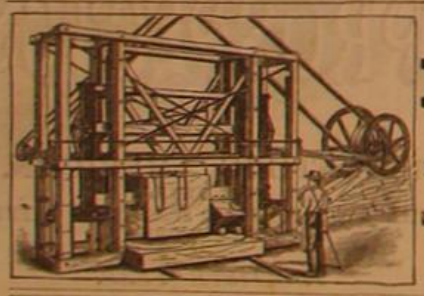
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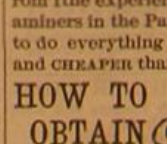
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SCIENTIFIC AMERICAN

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

Vol. XXXII.—No. 8. [NEW SERIES.] NEW YORK, FEBRUARY 20, 1875. [$3.20 per Annum, Postage prepaid.

THE PROPOSED NIAGARA BRIDGE AT LEWISTON, N. Y.

In a recent issue we printed a letter from a correspondent, C. A. H., in which the possibility of erecting a permanent bridge across the Niagara River, at Lewiston, N. Y., was suggested, and the opinions of engineers on the subject asked. Our correspondent pointed out briefly the high importance of such a work, and offered, in event of its completion within twenty years, a subscription of $500, and also a further and similar amount to go toward the creation of a trust fund of $100,000 for the engineer whose skill may be used to the desired end.

With reference to the above, we have lately received a communication from Messrs. Clarke, Reeves & Co., the well known bridge builders, of the Phœnixville (Pa.) Bridge Works, inclosing a plan of a practicable bridge, from which the annexed engraving has been prepared.

THE PROPOSED NIAGARA BRIDGE AT LEWISTON N. Y.

Lewiston, we may here remark, is situated some seven miles below Niagara Falls; and at this point the river emerges from the narrow gorge, which varies from 200 to 400 feet in width, after making a last gradual descent of some 250 feet. Messrs. Clarke, Reeves & Co. state, with reference to their proposed bridge, that the span is 600 feet. The structure is designed for a double track railway, 120 feet above the level of the river, and for a carriage way, beneath this road a distance of 75 feet. The estimated cost is $800,000. The difficulty, therefore, of erecting a single span, over swift rapids and where the water is practically unfathomable, the manufacturers claim to have overcome, and they offer to contract for construction as soon as a company is ready to supply the funds. Instead of occupying twenty years in building, Messrs. Clarke, Reeves & Co., with their present facilities, believe that the work could be accomplished in as many months. With reference to our correspondent's proposed trust fund, they add: "There is so much oldfashioned liberality (rare in these latter days) in C. A. H.'s proposition to create a trust fund, that we take the trouble of writing this letter to show him that the construction of a bridge across the Niagara river, at Lewiston, is a much simpler and less costly undertaking than he supposes."

The wide reputation of the above firm, and their uniform success in accomplishing the various difficult engineering feats which they have hitherto accomplished, are, to our minds, sufficient guarantee of the reliability of their opinions in the present. Since the work, therefore, is possible, it remains to produce the men who will supply the means and the enterprise for its prosecution. The amount required is so small that many of our great capitalists could bear it alone; so that certainly, to a few of that class, if they can be found with the progressive views which evidently characterize both C. A. H. and Clarke, Reeves & Co., the undertaking would be no difficult one.

Solders and Soldering.

The operation of soldering appears, as it is in fact, a very simple one; but simple as it may be, it is only the practised hand who can turn out a really creditable piece of work, even in the ordinary tinman's line. The amount of practice necessary depends in a great measure on the natural ability of the tyro; but a little patience and a fair amount of perseverance on the part of amateur mechanics will, as a rule, enable them to solder up ordinary work in a manner as serviceable, if not so neat, as that done by the professional. It may be of assistance if we give a brief account of the process and of the solders used for joining the different metals. Soldering is of two kinds—that in which a more or less fusible alloy is placed between the two portions to be joined, and that in which the metal itself is made to unite, a process known as autogenous soldering, and in some cases termed "burning." The principle of soldering consists essentially in creating a temporary or rather incipient fusion of the parts to be joined, by the direct application of heat, or by means of a fusible alloy which will, when in the state of fusion, unite with the metal or metals to be fastened together. In the latter case, it is obvious that the metal or the alloy forming the solder must be more fusible than the metals to be soldered, and, moreover, must have a chemical affinity for them. But although there must be an appreciable difference in the temperatures of the points of fusion, as a general rule the smaller the difference—or, in other words, the nearer the fusion point of the solder approaches that of the metal to be joined—the more perfect the joint; for, as just mentioned, the nearer the parts can be brought to a state of fusion, the neater and stronger will be the union, the solder having then formed a true alloy with the metal to be soldered. It is also essential, for this formation of a true alloy, that the parts should be perfectly clean and free from oxide, and that they should remain so during the whole operation. To insure this state of things, several substances are employed, chief among which may be mentioned sal ammoniac, chloride of zinc, rosin and tallow. The effect of all these fluxes, as they are termed, is the same: they merely preserve the metals from being oxidised, a process which goes on very rapidly when metals are melted, and are not protected from contact with the air. The chloride of zinc, which is hydrochloric acid (muriatic, spirits of salts) "killed" with zinc, that is to say, acid which has been supplied with all the zinc it can dissolve, melts over the surface of the work, removing any trace of oxide that may have formed since cleaning, and also acting as a covering from the air. Sal ammoniac, containing hydrochloric acid, acts in a similar manner, and rosin and tallow have the effect of temporary varnishes, preventing the surfaces from oxidising. The methods of effecting fusion are almost as numerous as the solders themselves; the principal are the copper bit, tinned at the part applied to the solder, the heated iron which does not require tinning, and the blowpipe flame. For certain operations in the way of soldering, commonly called brazing the heat of a fire or of a muffle is required, while for others the articles are dipped in melted solder, or melted solder is poured on the joint, and, in some cases, the heat is applied by a stream of heated air.

Of all the solders, those formed of differing proportions of lead and tin are by far the most numerous, and probably the most useful, if we take into consideration the variety of their applications. For different purposes, they are mixed in widely varying proportions; but the ordinary solder of the shops and commerce is known as either hard or soft solder, tinman's solder, plumber's solder, coarse, common, and fine, being all names for an article which is possibly never twice alike. The sealed plumber's solder (of the Plumber's Company of England) contains two parts of lead to one of tin and melts at 440° Fah., or about the melting point of tin; but a solder made of equal parts of the metals is sometimes used, though rarely, as it is of course considerably dearer. Soft solder consists of two parts of tin to one of lead, and melts at 350° Fah. or thereabout. It is said to be the ordinary solder used for joining tin plates, and, with the addition of one part of bismuth, forms ordinary pewterer's solder. As a matter of fact, however, the solder found in commerce generally is known as coarse, common, and fine; and the respective proportions of the metals are supposed to be—for coarse, two parts of lead to one of tin; for common, equal parts; and, for fine, two parts of tin to one of lead. These proportions can generally be detected in the manufactured article, for coarse solder exhibits on its surface small circular spots, caused by a partial separation of the metals on cooling; but these are wanting when the tin exceeds the lead, as in fine solder. The great bulk of the solder made in this country comes from manufactories where it is made a specialty; but many of the larger firms who use it make their own, probably from having been disappointed in the quality of the goods bought of others. In the ordinary solder of

commerce, it is very rare that the tin exceeds the lead, and No. 1, or hard solder, of the shops, will, as a rule, be found to vary between one and a half to two of lead, and one of tin. The common stuff—that which plumbers use for making wipe joints in lead pipes—contains from two and a half to three parts of lead and one of tin. Such a mixture as this melts at less than 500°, that is, considerably below the melting point of lead, and has the property of remaining semi-fluid for some little time, so that, with a thick pad anointed with grease, the plumber is able to mold it to any desired shape. To render the solder hard without increasing the proportion of tin, some makers add a little antimony or copper, which has the effect of raising the fusing point without affecting the other qualities of the alloy. Although we have spoken of hard and soft solder in regard to alloys of lead and tin, it is better to retain the names now employed in commerce, coarse, common, and fine; and when we wish to make solder, to confine ourselves to the proportions mentioned as nearly as possible, for accuracy is not material. The mechanic by "hard solder" understands an alloy for uniting metals that are difficult to melt—a compound of copper and zinc, sometimes with a little tin—a brass, in fact; hence the term brazing has been substituted for soldering.—*English Mechanic.*

Scientific American.

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NEW YORK, SATURDAY, FEBRUARY 20, 1875.

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BOGUS STATE LAWS CONCERNING PATENT RIGHTS.

We have heretofore, on several occasions, called attention to the unconstitutionality of various State laws, by which local legislatures have attempted to regulate or prevent the sale of patent rights within their borders. In some of the States, laws have been passed by which patentees or their agents who offer patent rights for sale, without complying with certain State regulations, are made liable to fine and imprisonment.

We need hardly say that all such State laws are without binding force, and are in direct conflict with the laws of the United States; and any State judge or officer who should, under pretence of a State law, arrest or interfere with a patentee or his agent in the sale of a patent right, would be liable for damages and punishment in the Courts of the United States.

This question was adjudicated by the United States Court in the case of John Robinson, agent for the Goodyear Rubber Dental Plates patent, who, on offering to sell a right under the patent, was arrested and imprisoned under a State law of Indiana. The law in question made it unlawful to sell a patent right in that State unless the patentee or seller first deposited a copy of the patent with the county clerk, and made affidavit that the copy was genuine, had not been revoked, and that he was authorized to sell, etc. A certified copy of the affidavit was also given to the patentee or seller, and he was further required to exhibit the same to any person who might demand to see it.

The United States Court held that this kind of legislation is unauthorized, that property in inventions exists by virtue of the laws of Congress, and that no State has a right to interfere with its enjoyment, or annex conditions to the grant. If the patentee complies with the laws of Congress on the subject, he has a right to go into the open market anywhere within the United States and sell his property. If this were not so, a State might nullify the laws of Congress and destroy the powers conferred by the constitution.

We believe there are some Western States that have not yet repealed their obnoxious patent laws; and for the convenience of district attorneys, lawyers, and patentees, we will state that the decision of the United States Circuit Court, above alluded to, may be found printed in full on page 137, Vol. XXV of the SCIENTIFIC AMERICAN, date of August 26, 1871.

METALINE AT THE AMERICAN INSTITUTE.

Metaline is an alloy which, when applied to machinery, is alleged to obviate the necessity of oil or other lubricants. But while we are told that it runs on everything from watchmakers' tools to big steam engines, one of its most recent applications has proved far from beneficial—in fact, instead of making the constituent parts move nicely, it has set them to grinding, cutting, jarring, heating, and disaggregating in a manner really sad to contemplate. We allude to that rather cumbrous machine known as the American Institute, the whole inner mechanism of which metaline has apparently disorganized. At the late Fair, it failed to slide smoothly through the hands of the judges, managers, and directors, and it drove the Board of the last mentioned so (morally) out of true that Professor Chandler, because the Institute gave a silver medal to metaline instead of a gold one, deliberately cut both the Board and the Institute. He resigned—he waxed warm in the journals—daily ones—he said that parts of the Board were welding themselves into a conspiracy. The alleged conspirators then published a long effusion, denying the soft impeachment.

To make matters still worse, metaline turns up again as the disorganizing element of the rotary engine tests. It did not clog the engines, but it apparently did the Fair official who supervised them. We hear of a protest to the results of the trials because the Superintendent of the Machinery, who made the calculations and had something—we know not what—to do in the way of supervision, was at the time engaged in negotiating with the successful competitor for a sale to the latter of metaline stock, and has since maintained business relations with him. Certainly no person acquainted with the gentleman will venture the assertion that he could be biased, even in prospect of a possible fat commission; but those who have denounced the tests to us, for reasons best known to themselves, as unfair, claim that such dealings on the part of an Institute official are sufficient, on their face, to invalidate the results of so very close a competition.

The award of silver instead of gold to metaline, and other equally important misdemeanors, form leading arguments against the present management by the opponents of the bill now before the New York Legislature, which the existing officers of the Institute want to have passed. This bill provides for a president and twelve trustees as substitutes for the unwieldy Boards of Managers and Directors now *in esse*. Both the metaline people and the Institute people include names which will be equally powerful in commanding the confidence of the public. The opponents of the bill assert that the measure has never been submitted to the Board of Direction or to the members generally, and that the present management attempted to rush it through the Legislature and have an election before a tithe of the members found out about it. A ring, it is alleged, would thus get themselves elected, and would be able to keep themselves in power indefinitely by exercising a right which the bill gives them to fill places among the trustees vacated by resignation, etc. This matter, however, appears to be a purely internecine war, and one which we have no doubt can be brought to a just conclusion by the exercise of good sense and moderation on both sides.

ACCURATE ALIGNMENTS.

We have a slip from a Philadelphia paper, giving some particulars of the tunnel through the Musconetcong Mountain, on the line of the Easton and Amboy Railroad. The length of the tunnel is about 5,000 feet, through a mountain some 450 feet above grade. In making a tunnel, as our readers doubtless know, we have given a hill in which a hole is to be bored, the position of the ends of the hole, and the grade at which it is to be run; and as two headings are run at once, one from each end, it is very desirable that they should be on the same line, and should conform to grade, so that they will meet in the middle of the hill. The length, direction, and grade of the headings must then be calculated from outside measurements; and it becomes an interesting matter, after the work is completed, to see how closely the lines, as actually run, conform to the requirements. In the case of the Musconetcong Tunnel, the statements are made that the length, as ascertained by chaining over the mountain, only differed from the actual length, measured after the headings were completed, by six and four tenths inches, that the center lines of the two headings were only out of line about one three-hundredth of an inch where the headings met, and that the grades of the two headings, where they met, coincided to within one eight-hundredth of an inch.

The measurements were made with ordinary instruments; and if the results are reported correctly, the work reflects great credit upon the engineers having it in charge.

In this connection, we may mention a statement, in a Virginia paper, that an engineer, in the employ of the Belcher Mining Company, in *joining* two drifts by a short tunnel, 128½ feet in length, could not detect any error in the alignment, after the two headings were connected.

The Hoosac tunnel, it may be remembered, is 25,031 feet long, and there is an ascending grade of twenty-six and four tenths feet to the mile, from each end to the central shaft. On testing the work, after the completion of the tunnel, it was found that the error in alignment was nine sixteenths of an inch, and the difference of level, between the two headings, at the central shaft, one inch and a half.

While upon the subject of "great bores," some reference to the Mont Cenis Tunnel may not be out of place. This is about 40,000 feet in length; the level in the Italian side is about 435 feet above that of the French side, and the level at the summit, where the two headings meet, is about ten feet above the level at the Italian end of the tunnel; so that the two headings run to meet each other on very different ascending grades. On testing the work, after the two headings were joined, it was found that the heading from the French end was about twenty-four inches too high, and the error of alignment was about eighteen inches.

FLYING MACHINES.

We have recently perused a very interesting paper by Dr. Barnard, of Columbia College, in which the writer, in his charming style, discourses of "Aerial Navigation," giving both his own views and the results of the researches of M. Bruignac, a French mathematician. As many of our readers are devising plans for sailing in the air, we think it well to give a brief *resumé* of Dr. Barnard's article.

As birds fly with wings, it occurred to man to employ the same device—but only to meet with failure. The reason of this is obvious. A bird has sufficient strength to fly, and a man has not. Hence the conclusion that, if a man wishes to fly, he must use some artficial motor to drive the necessary mechanism. In regard to this mechanism, it appears that a revolving wheel, such as a propeller, is better than a pair of wings, since the latter have an intermittent motion, and it is more difficult to construct them of the requisite strength and still have them light. At this stage of the inquiry, it becomes necessary to determine, by experiment, the effect of a revolving wheel in propelling a machine through the air. If the wind strikes against a plane surface, it creates a certain amount of pressure, depending upon its velocity; and inversely, if a surface is made to revolve at a high velocity, it encounters a resistance according to the velocity. M. Bruignac's experiments upon the pressure of the wind give the following results:

VELOCITY OF THE WIND.		PRESSURE.	
In feet per second.	In miles per hour.	In pounds per sqr. foot.	In pounds per sqr inch.
33	22·495	2·75	0·0191
49	33·406	6·17	0·0428
65	44·319	11·00	0·0764
98	66·815	24·50	0·1701
147	100·243	55·50	0·3854

Instead of making the aerial vessel with a flat end, it can have a conical form, by which the pressure of the air, or the resistance that it must overcome, can be reduced to about ½ of the amount required in the case of a flat surface of the same cross section. It is to be expected that the machine cannot always sail in a calm; and on the supposition that it is to carry only one man, and is to advance at the rate of 20 miles an hour against a wind of the same velocity, it must have a motor capable of exerting about 5 horse power. The method of moving the aerial vessel, however, does not present so many difficulties as the means to be provided for keeping it in the air, and enabling it to rise or descend, at the pleasure of the navigator. It can be kept up by having a balloon attached to it, in which case, as the moving surface is largely increased, it must have a more powerful motor; or either vertical propellers, or an immovable plane, can be employed. A kite is sustained in the air by the pressure of the wind against it, provided the direction of the wind is oblique to its surface; and it is easy to see that, if the kite were moved through calm air at the same velocity as the wind has, it would be sustained in exactly the same manner, and a fixed plane surface on the aerial ship, in an inclined position, will sustain the vessel when it is put in motion This fixed surface seems to be the simplest mechanism that can be devised for the flying machine, in connection with two propeller wheels, turning in opposite directions, so as to keep the machine in an upright position. The best angle of inclination of the fixed plane, that is, the angle in which the least amount of surface is required, is 54° 10′ with a horizontal line; but the power required for motion in this case is very great. By reducing the angle between the fixed surface and a horizontal line, the power required for propulsion is diminished; but it is necessary to give the machine a much higher velocity, in order that it may be sustained in the air; or if the original velocity is retained, the area of the fixed surface must be largely increased, which will of course add to the weight. It must be remembered, also, that the machine will not be sustained unless it is in motion, so that it cannot rise from the ground, but must be launched from an elevation.

M. Bruignac finds, from a number of calculations, that, by attaching balloons to flying machines, they can be propelled by the aid of less power than in the case where a sustaining plane surface is used. The best form of balloon is that of a

horizontal cylinder with conical ends, the slant hight of the cones being equal to the diameters of their bases. The resistance to motion of a plane surface has been given in the preceding table; and it is found by experiment that, if three bodies having the same cross section are moved through the air at the same velocity, having the forms respectively of a circular plane, a sphere, a cone with slant hight equal to diameter of bases, the resistances to motion in the two latter cases will be (calling the resistance of the plane R) for the sphere $\frac{R}{2}$, and for the cone $\frac{R}{3}$.

The most favorable form of aerial machine, according to M. Bruignac, is a combination of a balloon with a sustaining plane. By his calculations, it appears that the most advantageous design, for a speed of 20 miles an hour in a calm, must not weigh, with engines, navigators, fuel, stores, etc., more than 2,200 pounds, and must have the following dimensions: There must be a balloon, filled with hydrogen, 22 feet in diameter and 94 feet long, together with a sustaining plane 94 feet long and 16 feet wide; and an engine capable of exerting from 6 to 7 horse power. This is equivalent to saying that the problem is impossible with our present means of construction, and would seem to settle the matter conclusively, unless it can be shown that a more favorable plan than the best one discussed by M. Bruignac can be designed. It is pretty evident that, if a machine is not practicable even in theory, there is little hope of its actual success.

Dr. Barnard concludes his paper with an exceedingly practical suggestion, which we commend to all our readers who are endeavoring to work out this problem. If it is possible to lift a given weight into the air, and make it move in any desired direction, it is certainly easier to do the same with a part of that weight. Let the inventor, then, attach his lifting apparatus to some vehicle on land, as, for instance, a railroad train, and, by sustaining some of the weight, make it move more easily; let him remove the locomotive, and put in its place his aerial propeller. If this works well, there is some hope of actually getting into the air; but should it fail, it would seem advisable for him to abandon his experiments.

THE "SCIENCE" OF SPIRITUALISM.

Resuming the subject from page 80: Gordon's materialization was a startling novelty and too good a trick to be lost. Its successful revival, however, necessitated a patience of waiting till the little drawback of the exposure should blow over, and a shifting of the scene of action to a safe distance from the unfriendly climate of New York. The conditions were complied with; there was a waiting of a year, and the performance was repeated in the city of London under the mediumship of Miss Florence Cook. But Gordon's invention was expanded and improved, for Miss Cook substituted living persons for the masks; she constructed the celebrated and original Katie King, whose genuineness as a veritable spirit was certified to by witnesses whose testimony on matters of this world would be unimpeachable. The precise *modus operandi* was not found out. Katie appeared only a few times and London knew her no more. The medium explained that she had over-exerted herself, and thus had impaired her power of materializing, which, we take it, implies that a wholesome caution or forewarning had come upon her. The original Katie has probably made her last appearance in public.

But a duplicate or imitation Katie made her *debut* in Philadelphia in May, 1874, and was a greater success there than the original. The proprietors were practised mediums, Mr. and Mrs. Nelson Holmes. They had just returned from London; and it is pretty certain that they were acquainted with Florence Cook, and that they brought her secret with them. The theory that the London and Philadelphia tricks are substantially the same is tenable till something more plausible is proposed.

The new Katie was welcomed with enthusiasm by the leading spiritualists, and her desertion of England for America stimulated their patriotism; to them she was the final and overwhelming demonstration of practical spiritualism. The weak in faith were strengthened, and new converts were added to the fold in droves. For months, the Katie King mystery was the most prominent sensation for newspapers and magazines. But great success made the Holmeses too bold in continuing the show; and they came to a grief in November last, which early in January became wholly inconsolable. The trick was found out and fairly exposed; but the Holmeses and the devotees persisted, denied, and sophisticated, and thus kept Katie King alive as a spirit for more than a month.

The credit of the exposure is almost wholly due to the *Philadelphia Inquirer*. The facts of evidence against the Holmeses, as they were developed, were published in the *Inquirer*. But the evidence so appearing in disconnected fragments, although convincing to most sensible people, was misunderstood, perverted, and sophisticated by the spiritual partisans. A methodical statement which should end all doubt and controversy was therefore prepared and published, in an article occupying about fifteen columns of the *Inquirer* of January 9 and 18, 1875. The statement is in the form of an autobiography of the lady who personated Katie King; it was verified by her affidavit sworn to in the presence of several prominent citizens of Philadelphia. It was further confirmed by the lady having in her possession the robes and ornaments worn at the show, and the presents which she had received from her admirers in the character of Katie; she was fully identified by respectable people who had seen her at the show. Also Dr. Henry T. Childs, Hon. Robert Dale Owen, and others, who had been zealous and admiring patrons of Katie King, are witnesses to the truth of many of the essential facts. The *Inquirer* promises that the autobiography will be published in book form; we commend the book in advance as an antidote to the spiritual delusion, which will be effective as well as pleasant to take.

The lady objects to the use of her real name in connection with the spiritual fraud, and we will continue to call her Katie King. She was born in Massachusetts, January 1, 1851, was married at 15, and has a child eight years old. Her husband died two years ago, leaving her penniless, and her child and an aged mother depending on her exertions for their support. Last spring she set up the enterprise of keeping boarders in Philadelphia; the Holmeses boarded with her and got their living by the practice of spiritualism. But Katie fell among Philistines, and her enterprise lasted only a few weeks. In her extremity she entered the service of the Holmeses and was by degrees taught to tolerate and to practice deception, and at last to exhibit herself as a spirit.

The grand secret of the Holmeses was the device for getting Katie on and off the stage of exhibition without being discovered by the spectators. The device was a dummy board in a partition which constituted the rear of the cabinet, the partition separating the exhibition room from a private apartment or other hiding place; the dummy board was a board neatly cut in half, the lower half serving as a door for Katie's exclusive use. At one house in Philadelphia, the cabinet was erected against a doorway leading to a bed room, the back of the cabinet being the partition with its cut board substituted for the door. At another, the cabinet was erected against a window, the embrasure of which, by means of the partition, was made into a secure but narrow hiding place for Katie. The partition with its dummy board was an essential part of the stock in business, and was carried by the mediums in the various journeyings.

The exhibition had two acts or parts: first, a dark *séance* wherein a guitar was thumped, bells rung, and things stirred up promiscuously, being the ordinary and silliest of spiritual performances; next came what the mediums designated as the light *séance*, wherein darkness was made visible by a single and shaded kerosene lamp, placed as far as possible from the cabinet. For the light *séance*, Holmes locked himself in the cabinet, and Mrs. Holmes kept guard, seated at the door of the cabinet. The performance begins by the display of masks at the window of the cabinet, *à la* Gordon Katie King says these false faces were generally recognized by persons in the audience as the veritable spirits of their deceased friends. At last Katie herself appears at the window or in the doorway of the cabinet, and talks and walks precisely like a human being.

Katie's first appearance was on the evening of May 12; we quote her account of it:

"I entered it the first time, after the dark *séance* was over, from the bed room. Mr. Holmes was in the cabinet. After one or two false faces had been exhibited, I gently drew aside the curtain hanging over one of the apertures, showing the audience my face, and in a very low whisper, scarcely audible, said: 'Good evening, friends,' then drew back my head and drew down the curtain. The sensation in the audience was great.

Although somewhat excited, I was amused to hear the different remarks: 'Did you hear it speak?' 'I wonder who it is?' 'How beautiful it was.' 'I do wish it would appear again.' The lady medium, who was on the outside of the cabinet, among the audience, appeared very much pleased indeed at the reception I had received, and remarked that "she thought something unusual would occur, for the spirits had been drawing from her so hard all evening, to enable them to materialize, that she had scarce any vitality left." After the excitement had subsided a little and various requests had been made that I should appear again, I pulled the curtain to one side, showed my face at the aperture, and three or four voices at the same time said: 'Who are you?—Please tell us your name.' I answered in a low whisper, as before: 'I am Katie King, you stupid.'

These cant phrases, 'you stupid,' 'I shan't,' be sure I am,' etc., were used by Florence Cook (so I was informed by Mr. and Mrs. Holmes,) when personating Katie King, and it was very important that I should use them, so that the people would think I was the same Katie who had appeared in London. The sensation among the audience was greater than at first, and often was the question asked: 'Can this possibly be the Katie King who appeared through the mediumship of Florence Cook in London?' After a few moments I again showed my face and said: 'Of course it is, you stupid.' The sensation was even greater than before. I again withdrew. The lady medium remarked that 'spirits could not remain materialized but a few moments at a time; they had to retire into the cabinet to gather strength.' On my appearance again at the aperture, Dr. Childs asked me 'when I had been in London.' I replied: 'I attended a *séance* there to-day, you stupid,' and again retired.

Mr. H. suggested that I had said enough for the first time, and I left the cabinet, passed through the bed room, upstairs to my own room on the third floor."

Katie by degrees became accustomed to her part, and overcame much of the timidity of her first appearance; she found that the credulity of the average man was her safe protection; she at last permitted the faithful, especially Dr. Child and Mr. Owen, to touch her and to converse with her. She received many tokens of regard in the form of bouquets, letters, jewelry, and other things appropriate for a young lady, and in return she gave letters, locks of hair from her wig, and pretended pieces of her dress; to supply the great demand for the latter, she carried in her pocket a roll of muslin from which she cut the pieces as they were called for. Those who were so fortunate as to possess these bits of muslin were generally willing to certify that they saw them cut from the dress, and that they saw the holes in the dress close up before their eyes; the dress had a reproducing power like that of the widow's cruise. As the show advanced in interest and popularity, the admission fee was raised from $1 to $5.

The risk of discovery of the fraud was always a subject of anxiety with the mediums and Katie; with the mediums it was only a question of business, but Katie's conscience was constantly in trouble. Various precautions against detection, besides those mentioned above, were resorted to. Care was taken that the inner circle, the visitors seated nearest the cabinet, should be composed of devotees. They knew that suspicion would be likely to be centered on the bogus partition, and they forearmed themselves. One morning they put a sound board in the place of the dummy and had a committee of ten, including several experts, to make a thorough examination. This committee took down the cabinet, including the partition, piece by piece, and then conscientiously reported that the structure was of a substantial character and that there was nothing deceptive about it, and especially that the partition concealed no fraud and could not be used for Katie's entrances and exits. The report was printed and was made into a very effective advertising circular. Katie's autobiography, as may be inferred perhaps from our brief account of it, furnishes very rich amusement as well as instruction; it is a kind of truth stranger and more readable than a first class fiction; we regret that our limited space does not allow us to say much more about it.

But there is one extraordinary fact that has been developed in this matter, which justice to a leading spiritualist requires us to publish. Dr. Henry T. Child, more than any other spiritualist, with perhaps the exception of the Hon. Robert Dale Owen, has given the most unqualified, enthusiastic, and public endorsement of the Holmes' pretensions. On the discovery of the fraud, and this is what is extraordinary, he publicly and unreservedly makes reparation for his error, a course of conduct which is a novelty among spiritualists.

On January 8, 1875, Katie King, accompanied by Dr. Child and other friends, presented herself before the Hon. William B. Hanna, Judge of the Orphans' Court, Philadelphia, and signed and made affidavit to the truth of her written confessions as prepared for the *Inquirer*. Dr. Child then took the pen and wrote upon the document, below the affidavit of Katie and the certificate of Judge Hanna, the following:

I hereby certify that I witnessed the signing of the above paper, the confession of Katie King, and that it was signed, declared, and affirmed to be true by the person who appeared at the *séances* of Mr. and Mrs. Nelson Holmes, No. 50 North 9th street and No. 825 North 10th street, as the materialized spirit of Katie King.

Henry T. Child, M. D., No 634 Race street.

NOT THE BEST WAY TO SELL A PATENT.

As soon as an invention is patented, the fact is published throughout the length and breadth of the land; and then the patentee begins to receive circulars and letters from agents of all kinds, suggesting to the inventor that they possess unequaled facilities for selling his patent. In some cases these persons state that they have a customer willing to pay several hundred dollars for the patent, and warning the patentee not to negotiate with others till he hears from them again; this conveys the impression that they have a *bona fide* offer, and, more even than this, that a greater sum may be realized from the *anxious* purchaser. But before the letter closes, it states that a power of attorney and a fee of from $5 to $25 must be sent by early mail to pay for this preliminary negotiation, and that the balance of their commission will be taken out of the purchase money. By this mode, a number of persons in different parts of the country live on the credulity of patentees, without rendering them the least equivalent for their money. They get from the inventor a power of attorney, and a small fee, and that is the last he hears from his agent. Tired of waiting for the mail to bring him the money he so confidently expects, he, after a while, writes to know how the sale is progressing. He receives no reply—he waits—then writes again; still no answer. Then he writes to us; and states what he has done, incloses the correspondence, and wishes us to investigate the matter, and tell him if he has been swindled; he asks if we know the parties, if they are reliable, etc. Sometimes a circular is inclosed, in which our names are used as references, etc.

Now we do not pronounce all dealers in patents to be swindlers; but when such parties refer to us, it is without our authority, and they should be looked upon with suspicion. We advise every patentee to be on his guard against granting a power of attorney to sell his patent to any one whom he does not know, and under no circumstances to pay in advance any sum of money, however small, under the idea that this preliminary payment is necessary to the negotiation of the sale. When patentees receive letters or circulars exacting such conditions, they will be wise in paying no attention to them; but if they do reply, we would suggest that they tell their correspondent that it will be time for them to deduct the small fee required in advance when the sale is consummated.

TREES ON BOUNDARY LINES.—The New York Court of Appeals not long since decided that a man has no right to the fruit growing upon branches of a tree overhanging his land where the trunk of the tree stands wholly upon the land of his neighbor. But the law regards the overhanging branches as a nuisance, and they may be removed as such; or the owner of the land shaded may remove them if he is careful not to commit any wanton or unnecessary destruction in so doing. Where the trunk of a tree stands on the line, the owners of the adjoining land have a joint ownership in the tree and fruit, and neither one has the right to remove it without the consent of the other

Curiosities of Ocular Spectra.

Spectra are not only the concomitant sequences of color sensations, says W. Cave Thomas in *Art*, but of the sensations of black and white. A black spot will be succeeded by a white spectrum,a white spot by a black spectrum. Ocular spectra appear to change their places with relation to our bodies with every movement of the eyes, and, for an evident reason, are still seen in whatever direction we turn the retina.

The natural sequence of the ocular spectra after a momentary glance at any object would appear to be this: The original sensation persists as a spectrum for 0·32 to 0·35 of a second, as may be illustrated by the whirling of a light or other object. Then, if the original impression be not renewed, the reaction sets in; this first spectrum is doubtless followed by feebler librations or oscillations, which, although too delicate to be perceived by the open and excited eye, may, sometimes with closed eyes, be followed for a greater length of time.

If we view for a long time a black square on a white ground, and then divert our eyes slightly to the right or left of the square object, or rather look more directly at its margin, a portion of the spectrum which it has produced will appear free as a bright margin on a white ground; the remainder of the spectrum will overlap the true image and appear as a gray space, while a portion of the true image will be free and intensely black. We have then a free portion of the spectrum very bright, a middle portion, where the true image and the spectrum are coincident, gray, as if the two conditions of black and white were there balancing each other, and a free portion of the true image intensely black. The usual explanation of the phenomenon is this: The sensation of white in the part of the retina which was previously the seat of the black image is more intense, because that part of the seat of the retina was unexcited, hence the bright margin. The part of the image where the true image and spectrum are coincident remains unchanged, while the portion of the true image which is left free appears darker than before, because it now falls upon a part of the retina which had previously received rays from the white ground, and has consequently lost part of its excitability. This, however, is far from being the exact truth, the entire explanation; for if the eyes be closed to all external influence, a white spectrum will appear in the place of the black spot, showing that a reaction in the retina has set in, producing the sensation of light, and that it is this libration which is the cause of the two coincident portions of image and spectrum appearing gray, and those beyond darker and lighter.

Backing Up of Sewer Gases.

To prevent the backing up of sewer gases through the ordinary pipe traps into the apartments of dwellings, a remedy heretofore mentioned in our columns is to lead a gas escape pipe from the drain pipe to the kitchen chimney. The fire here generally kept burning produces an upward current favorable to the carrying off of the gases in question. A correspondent tells us of a case, within his own knowledge, where this method proved insufficient, as the pressure of sewer gas was so great that it found its way through the stove pipe holes in the chimney. It is of course necessary in all cases that the chimney shall be tight; and in those cases where the sewer gas pressure is very strong, the escape pipe should be extended to the roof of the building independent of the chimney. Some architects provide a small gas escape pipe leading from the top of the bend of the sewer pipe trap, to the water leader of the roof.

New Style of Photo Portraits.

The pictures are made upon the white ferrotype plate, which is now being manufactured largely, and which combines with great beauty the most simple manipulations, and all the advantages of the porcelain picture, without any of its defects.

The plate being of a very pure white and properly prepared, all that is necessary is to pour on the collodio-chloride, dry it by a gentle heat, expose it to vapor of ammonia for a short time, and then print very slightly deeper than it is desired to be when finished. It is washed, toned, and fixed in a similar manner to the ordinary mode followed in making porcelain pictures. The result is a picture of exceeding delicacy and durability.

IRRIGATION IN COLORADO.

The system of irrigation now quite extensively adopted in Colorado has worked a great change in the character of the soil, and transformed the once almost barren country into a magnificent wheat-growing region. From the large rivers and streams, such as the Arkansas, the Platte, and the Bear rivers, long canals are dug, branching into smaller ditches, through which the fertilizing waters are conducted in every direction to the fields. Our engraving, for which we are indebted to *Harpers' Weekly*, shows two farmers opening a sluice of a main canal to let the water into a side ditch. These ditches form a regular network, as shown in the diagram.

IRRIGATION IN COLORADO—LETTING WATER INTO A SLUICE WAY.

The supply of water can be regulated at will. Towns are supplied with water on the same plan. At the head of each street is a sluice box for a lateral ditch running the whole length of the street, from which branch smaller ditches used for garden irrigation.

An Evening at the Royal Microscopical Society.

At a recent meeting of the Royal Microscopical Society, held at King's College, an unusually interesting series of exhibits was shown, illustrating the progress of optical and mechanical ingenuity in the development of the instrument, which is rapidly becoming an indispensable article of furniture in homes where intellectual culture is promoted, all over the world. One of the exhibits was a large microscope by R and J. Beck, in solid silver, fitted with every conceivable piece of apparatus, all in silver. This luxurious work of art, intended for an American microscopist, and costing $2,500, was of course the lion of the hour, and is perhaps the most costly microscope ever made. After mention of this, there is of course no further space to allude in detail to the numerous humble brass microscopes in the room. Fortunately it is the observer who utilizes it, rather than the instrument itself, who can claim the credit of a beautiful display, and to whom our advance in knowledge is due. So here the attention was riveted by many objects of unusual interest, upon each of which a long theme might be discoursed. Conspicuous among these was the exhibition of insect dissections by Mr. Loy. They were perfect marvels. Several showed the complete muscular system in certain large lepidopterous larvæ. Various slides illustrated salivary glands and other wonders of insect anatomy. All the specimens were stained in various colors, mounted in fluid, in large cells, on slides 4 inches by 2. Mr. Guimarens had a very interesting series of preparations by Bourgogne, of Paris, illustrating the vine parasite in all its stages (*phyllozera vastator*). Near him Mr. Fitch was exhibiting a mounted slide containing a harvest spider (*phalangium*), upon the back of which, and attacking the eyes, was a red parasitic mite, probably a young *trombidium*. Dr. Gray had a very curious slide on view. It was a piece of skin from the neck of a domestic fowl from Ceylon, which was completely hidden from sight by a dense mass of fleas. The size of the specimen, only a small fragment of the original, was about one third of an inch square, and on it might be counted nearly one hundred fleas. Each of them had buried her lancets (I say *her*, because only one or two males were among the crowd of fleas) deep in the skin. A remarkable series of models and specimens illustrated in a beautiful manner the structure of the cochlea of the ear in various animals. Mr. H. Lee exhibited, with Moginie's portable binocular, the larval form of the crayfish, from the Brighton Aquarium, a creature so unlike its parent that, till lately, it was considered a distinct species, and was known as the glass crab. It was a beautiful specimen. Among the vegetable preparations attracting notice was a charming slide of a fungus on wood, shown by Mr. Reeves, and named by him as a *stemonitis*. Curious deposits from solutions of silica were shown by Mr. Slack.

Sagacity of the Partridge.

Instances of the sagacity of the partridge, woodcock, and other birds have often been related. But the most singular illustration of the deception practiced by the first of those wily species to protect their young is given by Mr. Henshaw, of the Government Survey west of the one hundredth meridian. While riding through pine woods, a brood of partridges, containing the mother and eight or ten young of about a week old, was come upon so suddenly that the feet of the foremost mule almost trod on them. The young rose, flew a few yards, and, dropping down, were in an instant hid in the underbrush. The mother meanwhile began some very peculiar tactics. Rising up, she fell back again to the ground as if perfectly helpless, and imitated the actions of a wounded bird so successfully that for a moment it was thought she had really been trodden upon. Several of the men, completely deceived, attempted to catch her, but she fluttered away, keeping just out of reach of their hands until they had been enticed ten or twelve yards off, when she rose and was off like a bullet. Her tactics had successfully covered the retreat of her young.

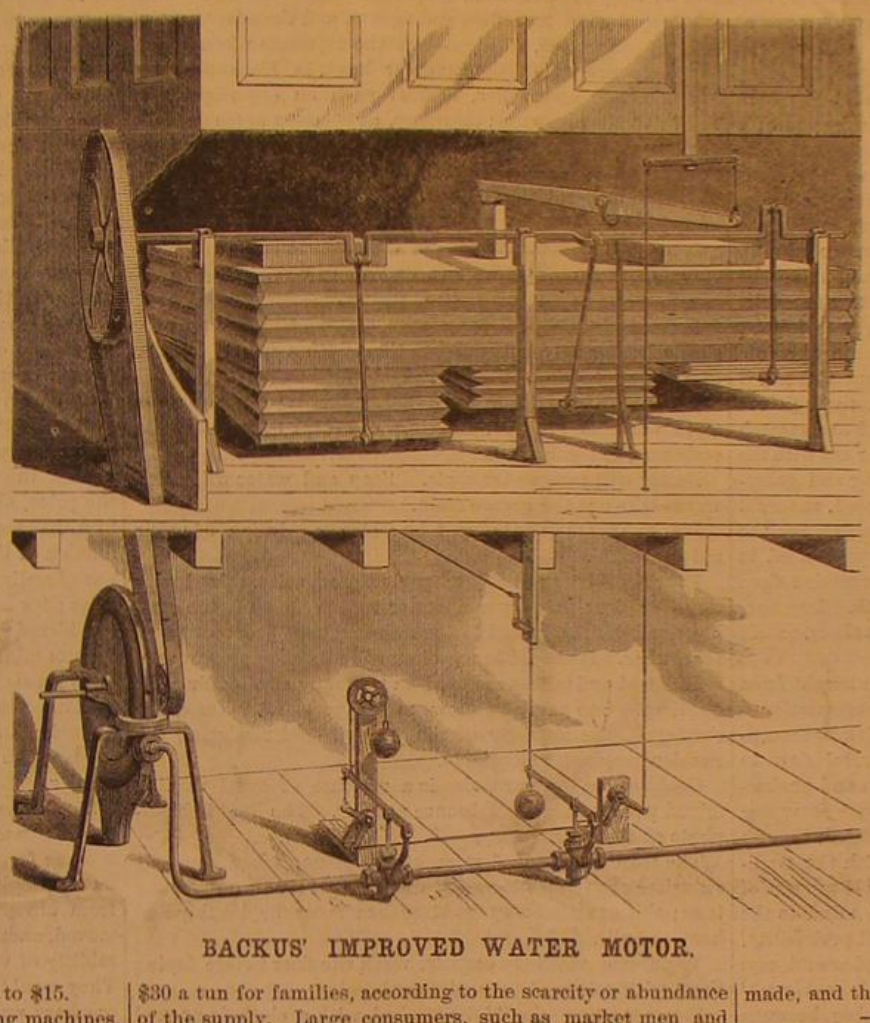
COMPOSITION OF WOOL GREASE.—According to Schulze and Urich, the bulk of the natural wool grease of sheep consists of compound ethers. A part of alcohols and fatty acids are in a free condition

OF all metals known, silver is the best electrical conductor

IMPROVED WATER MOTOR.

Another contribution to the various devices, which have lately appeared for supplying a cheap and readily available power for general usage, will be found in the novel water motor represented in the annexed illustration. Its object is to drive organ bellows, coffee mills, and sewing machines, and to perform a variety of light work ordinarily done by hand. In brief, its special adaptation is to operations requiring less than a single horse power, although the apparatus may be built to perform much heavier work.

This device consists of a light but firmly constructed iron wheel, provided on its outer rim with buckets, and the whole enclosed in a watertight iron casing. Through the casing an ordinary water pipe is so inserted that a stream of water from the pipe, flowing downward, strikes the buckets at a right angle with the radius of the wheel. The aperture at the end of the pipe is comparatively small, and on this account the water is forced through and against the buckets with a percussion-like effect, thus imparting a rapid and steady motion to the wheel.



BACKUS' IMPROVED WATER MOTOR.

In the illustration, the motor is shown attached to an organ bellows, the belt running from a small pulley on the motor to a large wheel on a crank shaft, to which the pitman from each feeder is attached. These feeders are shown at various stages, working alternately. In the supply pipe are two valves, one under the control of the organist, to admit or shut off the water, while the other is a regulator and works automatically. To start the motor, the performer has only to pull up the lever which opens the throttle valve. When the main bellows are full, the upper side, in rising, strikes a lever which is connected with the regulating valve by wire cords and bell cranks as shown, closing said valve and shutting off the water.

The inventor informs us that this arrangement is extremely sensitive, a mere touch on the keys of the instrument being followed instantly by a few revolutions of the motor, for a period just sufficient to replace the air expended. From testimonials submitted to us, it appears that the employment of the invention upon organs has been successful, and that the amount of water used has been about one third the quantity necessitated by other devices. It is stated that there is no jerking or thumping, but an even, smooth, noiseless, steady motion; while the apparatus is, besides, claimed to be simple, durable, and cheap, and to run for years without repairs. It is now in use on several organs of forty stops, doing the work with a pressure of water of twenty pounds per square inch, costing per annum, as we understand the inventor to assert, from $12 to $15.

The invention is also adapted for driving sewing machines, and, we are informed, can be applied to a single machine for domestic use so as to run at a cost of from $2.50 to $3 per annum. By regulating the water supply through a foot treadle, any speed may be attained from one stitch per second to 1,000 per minute, as desired. The apparatus can be attached to the ordinary water pipes, and it is claimed that a stream no larger than the head of a pin is sufficient to drive a sewing machine. Generally, the device can be used where the pressure is from twelve pounds upwards.

Among other practical applications of the motor may be mentioned its use for printing presses, turning lathes, jewelers' lathes, opticians' and lapidaries' wheels, grinding coffee and spices, cutting sausage, hoisting for stores and private residences, and, in fact, all light machinery requiring one horse power or less.

We understand that this motor is being used in Brooklyn and vicinity with much success, and at very cheap cost. Water sufficient for the purposes of a large organ can ordinarily be obtained for from $12 to $15 per year, or for a sewing machine for about $3.50 for the same period.

The invention was by Mr. Oscar J. Backus, of Oakland, Cal. For further particulars address the manufacturers, Backus Bros., & Co., Wright street and Avenue A, Newark, N. J.

Progress in Spain.

A very practical sign of real progress and improvement in Spain is seen in the increased demand which is springing up there for scientific information. *La Gaceta Industrial* of Madrid, formerly an insignificant publication, now comes to us enlarged to sixteen quarto pages, and is published twice a month, illustrated with engravings. It has reached its eleventh year. It is a handsome periodical and is ably edited. In the number before us the editor, Mr. Alcover, has a very excellent article upon the Centennial Exposition to be held next year at Philadelphia. He urges the authorities to provide liberally for a Spanish representation on that occasion, which, he says, is to commemorate the glorious anniversary of American liberty. It is to be a demonstration, he thinks, of the achievements of true liberty and independence, that can only be realized by labor, which is the secret of the prosperity of nations, and which has given to the North Americans such an astonishing preponderance.

Fourteen Thousand Miles of Ice.

The Hudson river ice crop for 1875 has now been harvested, and is one of the largest and finest ever gathered. The blocks average 14 inches in thickness, and the total quantity secured is about 2,000,000 of tuns, or seventy millions of cubic feet. If this mass of ice were arranged in a single line or beam, 12 inches square, it would have a total length of about fourteen thousand miles, and would reach more than half way around the world. To transport the entire quantity above named simultaneously, in ice carts, each carrying two tuns, drawn by two horses, driven by one man, would require an army of a million men, two millions of horses, and a million vehicles.

This enormous supply of ice will be chiefly consumed in the city of New York. It is brought down the Hudson river from the great ice houses, which are located at the water's edge, in large barges, towed by steam. It is delivered directly from the barges into the ice carts, and in them conveyed to the doors of private dwellings. For a quarter to half a tun a month is a common supply for a small family. The price charged is from $15 to $30 a tun for families, according to the scarcity or abundance of the supply. Large consumers, such as market men and hotel and restauraunt keepers, get the article at a much less price.

MEASURING MOUNTAINS.

Mr. Verplanck Colvin, in his report on the topographical survey of the Adirondack wilderness, elucidates some new

theories on the subject of mountain measurement, and describes one method as follows:

"For short distances, I carefully measure on the mountain side a base line with steel tape, and from its extremities take the angular position of the object, afterward computing the distance. For very distant mountains, an adaptation of tri-linear surveying has been employed. From the station of the barometer, the angles between any three of the surrounding peaks, whose positions I have before found trigonometrically, are measured, and afterward, by three point problem (usually graphically upon the survey map) the distance is obtained and the proper allowance made for curvature and refraction. Now that we have so many trigonometrically determined points throughout the region, the tri-linear method is found not only the easiest, but the most accurate.

The practical application of this method to the work of the survey is well shown by the illustration, which represents a survey party engaged in leveling observations with mountain barometers, at the levels of the different peaks seen in the distance. At A is seen the transit, by which the horizontal angular distances between three of the distant peaks are measured in order to obtain the data for correction for curvature and refraction. Below, on the same same mountain side, at e, e, and e, are stations of barometers at the apparent levels of the peaks by the lines of sight level.

At the foot of the mountain is the bark camp, and the assistant observing on barometer at lower station: a guide near by is cutting night wood for camp.

The sight lines, or lines of apparent level (e —— to —— e), are taken from points on the mountain side, which are really lower than the distant peaks; for, following to the left the curve of the earth from the barometer station (h .... to .... h), it will be seen to descend below the level of the peaks in proportion to their dis ance—the true level of the distant peaks being the curved dotted line of equal hight—above sea level, evidently considerably higher than the stations of their apparent level. The effect of refraction is not shown in the illustration. In practice, the observer on barometer at the lower station takes observations upon his instrument and the attached and detached thermometers every five minutes; and (whenever possible) similar observations are taken on the summit of the peak above the intermediate leveling stations, affording both a lower and an upper station when well determined. The observations, therefore, taken at any five minutes, will be synchronous with those taken on the mountain sides, at leveling stations, or on the peak above; they can then be computed as usual, by the upper or lower station records, and, by the tri-linear measurements, the proper corrections for curvature, etc., made, and the true hight of the distant peak is found."

SCIENTIFIC AND PRACTICAL INFORMATION.

NOT A "NEW JERUSALEM."

It may perhaps be unnecessary to assure our devouter readers that Virginia City, Nev., is not the much longed for "New Jerusalem, the city of the Saints," notwithstanding its streets are paved with precious metals. It is true, nevertheless, that the denizens of that unsaintly city boast that the very mud of their streets is rich in silver and gold. It happens that the principal streets of the city were macadamized with refuse ore taken from the mines in early days; and since then, they have been steadily dusted with rich ore sifted down upon them from passing ore wagons, making a surface so precious that an ounce or two of mud (taken from the wheel of a wagon to decide a wager) proved on assay to contain, to the tun, silver, $7.54; gold, $2.32; total $9.86. "After this," exults the *Enterprise* of that richly paved city, "we may put on airs, even though our streets are villanously muddy occasionally, for the very mud on our boots contains both silver and gold."

A NEW USE FOR MINERAL OILS.

In a late number of the *Australian Medical Journal*, Dr. John Day maintains that certain of the mineral oils, gasoline especially, are of great use as disinfectants, their value depending, he believes, on the fact that they are rich in peroxide of hydrogen. He employs the gasoline in various ways as a disinfectant, applying it to walls, to articles of furniture, and to clothing; also as a wash for the hands after treating infectious diseases, allowing the moistened hands to dry in the open air. A peculiar and valuable property of these oils as disinfectants is their continuous action, while they improve and gather force by exposure to the air.

THE MARTIAL SEAS.

M. Meunier has recently advanced the theory that the planet Mars is much older than the earth, because of the rarification of its atmosphere and the small extent of its seas. The form of the latter, he says, is exactly that which the terrestrial oceans would assume after partial absorption by the earth's crust. If, for example, the Atlantic were absorbed so that only that portion included in the contour made by the uniform depth of 12,000 feet were left, the shape would be exactly similar to that of some of the seas recognized in Mars.

LEMON JUICE IN DIPHTHERIA.

Dr. Revillout states that lemon juice, used as a gargle, is an efficacious specific against diphtheria and similar throat troubles. He has successfully thus employed it for over eighteen years.

By Whom are Inventions Made?

In the course of a paper at the Society of Arts recently, on the "Expediency of Protection for Inventions," Mr. Bramwell, F. R. S., said: "The bulk, one might almost say the whole, of real substantive inventions have been made by persons not engaged in the particular pursuit to which those inventions relate. Take a few instances. Watt was not a maker of steam engines, the fire engines of his day, but he was a mathematical instrument maker; Arkwright, the inventor of the 'water twist,' was a barber; Cartwright, the inventor of the power loom, was a parson; Neilson, the inventor of the hot blast, was wholly unconnected with smelting operations, he was the manager of gasworks; Wheatstone, who has done so much for electric telegraphs, was engaged in the manufacture of musical instruments; and Ronalds, the very originator of the electric telegraph, had nothing to do with the visual telegraphs in use in his time; Bessemer, who has so enormously increased the manufacture of steel within the last quarter of a century, was in no way connected with that industry. The fish joint for railways, the greatest improvement in permanent way that has been made since railways were introduced, was the invention of a carriage builder. I trust I have given instances enough to establish my position, that the great substantive inventions are made by persons unconnected with the manufacture or art to which those inventions relate; and we can readily see why this should be. The person who has been brought up to pursue any particular manufacture has, even before he had sufficient knowledge to be able to appreciate the merits and the principle of the processes he was taught to follow, been trained in the belief that 'certain ends are to be obtained by particular means.' Under such circumstances, it is difficult for even a powerful mind to break through the trammels which have been imposed upon it, and to approach the consideration of the subject of the particular art with the same broadness of view and power of detecting and grasping the true principles upon which that art is based, as would be possessed by a mind devoting itself to the subject for the first time; and thus the man untaught and unprejudiced in the art is more likely to make a substantive invention than is one who has been trained in it from his youth. Improvements of detail such a person may make; but there, in all probability, will be the limit of his inventions.

One can understand that a man who had been taught from his boyhood to make steel by the process of cementation—that is, by packing bars of wrought iron into brick boxes containing charcoal, and exposing the whole for several days to considerable heat, and thus carbonizing the iron and producing blistered steel—might, not unnaturally, devise some improvement by which this process could be expedited, though one can hardly imagine such a man breaking with the traditions of the industry, and casting away the whole process of cementation. But one bringing a totally fresh mind to the consideration of steel manufacture would, in all probability, study the question from the very beginning, and would say: 'What is steel? What is wrought iron? What is cast iron?' and when he discovered that steel was something between cast iron and wrought, that is to say, it contained less carbon than the one and more than the other, and when he found that cast iron was a cheaper article than wrought iron (wrought iron being commonly produced from cast by practically abstracting the whole of its carbon), he would seek a means by which he might abstract from cast iron, not the whole of the carbon, to leave wrought iron, but so much of the carbon as would leave steel. To one brought up in the steel trade, the very word 'steel' would be associated with the addition of carbon, and it would be most unlikely that he should attempt the manufacture by a process which had for its object the taking away of carbon. Once concede that the great inventions are made by 'outsiders,' then it appears to me that, to continue this, the highest class of invention, protection is an absolute necessity. An inventor must nearly in every case make trials and experiments, and these, as a rule, can only be conveniently done in places where the manufacture is being exercised; but now we are assuming that the inventor is not engaged in the manufacture: he has therefore either to incur great expense to make his experiments—an expense in many cases prohibitory—or to forego the experiments altogether, or else he must seek the aid, and trust to the honor, of some manufacturer.

Imagine a country clergyman who has some knowledge of chemistry making an invention of an improvement in smelting iron ore. If he were a man of real ability, as I have supposed, he would appreciate the great complexity, and the many practical difficulties, of that process, and he would know that nothing short of a trial of his invention in the actual furnace could assure him that his method would not be frustrated by some such difficulty. What, without a patent law, is that inventor to do? Forego the trial? Devote $25,000 of the large property which usually belongs to a country clergyman to the erection of an experimental blast furnace; trust to the honor of a manufacturer; or give up the invention? I think the probability is that he would pursue the last course, and that thus the invention would be lost to the community. But even supposing the preliminary difficulty of a practical trial not to exist. Assume, for example, that the invention be one such as that of the Giffard injector, one of the most substantive of the present day. This might have been tried in private by its inventor without insuperable difficulty, even although he were wholly unconnected with any of the mechanical arts, and he might have perfected his invention in every detail. But when he had done this, what would have been his chance of reward? How would he have set about reaping the pecuniary benefit which he would desire, and which would be his reasonable due? Would he make up his mind to forego all his usual habits of life, and to become a manufacturer? Say that he did so, and that, in spite of the difficulties to which I shall have to revert, he succeeded in making a certain number of the injectors for sale, and that then he knew enough of business to obtain purchasers for them, what would be the inevitable result? The very first mechanical engineer (a steam pump maker) into whose hands one of these injectors fell, would say: 'Here is an implement that seems likely to compete seriously with the use of steam pumps. Why should not I make it? At present I know it is being manufactured by the inventor only, a *person* who was not brought up to the trade, and who is living in a purely agricultural district; it is a hard case if I cannot hold my own against him.' Thereupon the steam-pump maker goes to work, with all the advantages of an established factory, with its befitting plant, its staff of superintendents, its foremen, and its body of workmen, to produce injectors, and with a whole system of travellers and agents, and the advantage of a large connection, to dispose of the injectors when made. What chance would the inventor have, in his capacity of manufacturer and seller, against such an organization as this? Obviously, none; therefore, as it seems to me (equally obviously), he (foreseeing this) would not have bestowed the thought necessary to invent, and even if he had, he would not have incurred the labor and expense of experimenting upon his invention."

Useful Recipes for the Shop, the Household, and the Farm.

Frosted glass, useful for screens, etc., is made by laying the sheets horizontally and covering them with a strong solution of sulphate of zinc. The salt crystallizes on drying.

A teaspoonful of powdered borax dissolved in a quart of tepid water is good for cleaning old black dresses of silk, cashmere, or alpaca.

Butter will remove tar spots. Soap and water will afterwards take out the grease stain.

Black shoes may be bronzed by a strong solution of anilin red in alcohol.

Four parts borax and three parts Epsom salts, mixed with three or four parts warm water to one part of the combined substances, is said to form an excellent fireproof wash for clothes. It should be used immediately after preparation.

Flaxseed and tallow are used in Germany as a stuffing for cushions. One part of tallow to ten parts of flaxseed are employed, the mobility of the greased seed rendering the cushion very soft and pliable.

Gold bronze for furniture is a mixture of copal varnish mixed with gold-colored bronze powder. The last is bisulphate of tin.

The total number of strings in a piano, when properly stretched to produce the right tones, exert a pull of over ten tuns; this explains why good pianos must be durably and heavily built.

To prevent moths in carpets, wash the floor before laying them with spirits of turpentine or benzine.

Straw matting should be washed with a cloth dampened in salt water. Indian meal sprinkled over it and thoroughly swept out will also cleanse it finely.

In washing windows, a narrow-bladed wooden knife, sharply pointed, will take out the dust that hardens in the corners of the sash. Dry whiting will polish the glass, which should first be washed with weak black tea mixed with a little alcohol. Save the tea leaves for the purpose.

Gray marble hearths can be rubbed with linseed oil, and no spots will show.

Sprigs of wintergreen or ground ivy will drive away red ants; branches of wormwood will serve the same purpose for black ants.

Papering and painting are best done in cold weather, especially the latter, for the wood absorbs the oil of paint much more than in warm weather; while in cold weather the oil hardens on the outside, making a coat which will protect the wood instead of soaking into it.

Never paper a wall over old paper and paste. Always scrape down thoroughly. Old paper can be got off by damping with saleratus and water. Then go over all the cracks of the wall with plaster of Paris, and finally put on a wash of a weak solution of carbolic acid. The best paste is made out of rye flour, with two ounces of glue dissolved in each quart of paste; half an ounce of powdered borax improves the mixture.

An oaken color can be given to new pine floors and tables by washing them in a solution of copperas dissolved in strong lye, a pound of the former to a gallon of the latter. When dry, this should be oiled, and it will look well for a year or two; then renew the oiling.

Kerosene and powdered lime, whiting, or wood ashes will scour tins with the least labor.

Spots can be taken out of marble with finely powdered pumicestone mixed with verjuice. Cover the spots and allow the stuff to remain for twelve hours; then rub clean, dry, and rinse.

Soapstone hearths are first washed in pure water and then rubbed with powdered marble or soapstone, put on with a piece of the same stone.

A strong solution of hyposulphite of soda is said to be excellent for cleaning silver.

Two ounces of common tobacco boiled in a gallon of water is used by the Chatham street dealers for renovating old clothes. The stuff is rubbed on with a stiff brush. The goods are nicely cleaned, and, strange to add, no tobacco smell remains.

Never use wrought iron instead of steel simply because it is more easily worked and cheaper than the latter; nor brass instead of gun metal in heavy machinery.

Shellac is the best cement for jet articles. Smoking the joint renders it black to match.

Barrels intended for alcohol may be rendered perfectly tight by applying inside a solution of 1 lb. leather scraps and 1 oz. oxalic acid in 2 lbs. water, afterwards diluted with 3 lbs. warm water.

A solution of chloride of iron will remove nitrate of silver stains from the hands.

Unslaked lime is excellent for cleaning small steel articles, such as jewelry, buckles, and the like.

Glass may be powdered to render it suitable for glass paper, for filtering varnishes, etc., by heating it red hot and then suddenly plunging it in water.

To remove old paint, cover with a wash of 3 parts quick stone lime, slaked in water to which 1 part pearlash is added. Allow the coating to remain for 16 hours, when the paint may be easily scraped off.

Aluminum Utensils.

Seventeen years have passed since Deville first produced aluminum on a commercial scale; but the expectations regarding this very interesting and meritorious invention of the distinguished French chemist have not as yet been fulfilled. Although many of those expectations were somewhat exaggerated, they were not so unreasonable as many people believed them to be; for a metal with so many valuable properties would be useful in many of the technical arts. Among these properties are a beautiful color that does not change in the air, nor yet in sulphurous exhalations, and further remarkable lightness, an agreeable reasonance, and a capability of being worked into any shape. Moreover, in the use or manipulation of aluminum, there have not hitherto been observed any deleterious effects.

It is generally conceded that the cost, and not the absence of properties which make other metals valuable, has prevented the more extensive application of aluminum; and the price, although it was considerably less than it was at first, has remained high for many years. The cost of production of this metal, which can only be extracted by the use of sodium, cannot possibly be the only cause of its high price; for the commercial manufacture of sodium may be considered as a solved problem; and as soda ash is very cheap, sodium might be produced at a moderate cost if the demand were greater than it is. Large production is caused by large consumption, and the use of aluminum has been hitherto limited, mainly because custom and use have in a measure opposed the introduction of such a novelty, except for fancy articles.

Stories have been told and written about poisoning by cooking vessels made of copper, by glazings containing lead, and the formation of verdigris on spoons of (alloyed) silver; but if people were only determined to produce these utensils from aluminum, all danger from poisoning would be removed, and they would have vessels, the appearance and durability of which would leave scarcely anything to desire. They would be more convenient to handle than our light crockery ware, for they can be made as light, and, what is important, cannot be broken. Splendid pitchers, plates, goblets, lamps, etc., might be manufactured from deadened and embossed aluminum; and the lightness of spoons of this metal would make them more convenient than those of silver now in use. In this case it is not the price, but only prejudice, which presents itself as a drawback, for the price is only half of that of good silver; beside, the difference in the specific weights of both metals and the consequent cheapness in the use of aluminum are so great that, for the value of one silver spoon, at least seven equally large aluminum spoons might be bought. True, aluminum is neither a rare nor a noble metal; but it possesses, nevertheless, advantages over alloyed silver which give it a much finer appearance; it does not get black, nor does it form verdigris, and what it lacks in brilliancy and appearance is well compensated for in its agreeable lightness. But, unfortunately, it has been found impossible to plate with aluminum, either by the electro-galvanic or the foil method.

Poisonous Magenta Colors.

Dr. Springmühl, the editor of the *Musterzeitung*, states that out of 25 specimens of magenta only one was found free from arsenic. In 14 the amount was sufficient for quantitative determination. In four samples the proportions were respectively 6·5, 5·9, 5·9 and 5·1 per cent. Such qualities, of course, must prove dangerous if used for coloring liquors, confectionary, and toys. In dyeing, however, the amount of the poisonous matter which attaches itself to the wool is relatively trifling. This the author ascertained by an interesting experiment. In a beaker he dissolved 1·55 grains of the most poisonous sample in hot water. The solution, of course, contained 0·093 grains of arsenic. In it a square foot of pure wool (woolen tissue) was dyed. It was then well rinsed in a second beaker of pure water, and again in a third. The dyed wool, the residual dye, and the two wash waters therefore contained 0·093 grains of arsenic, and it remained to ascertain its distribution. In the dye bath were found 0·072 grains, in the first washing water 0·016. In the second washing water, the amount was too small to be determined. It, however, and the dyed wool must together contain the residue, 0·005. According to Marsh's test, the wool appeared to contain less than the second washing water. Hence a square inch of the woolen could contain scarcely 0·0003 of a grain of arsenic. If the proportion of arsenic is low, as in well purified magentas, the wool, when dyed, gives no indications by Marsh's process.

The two most frequent adulterants are oxalic acid and sugar. The author has found 21 per cent of the former, and

twenty-four per cent of the latter. Joly has detected sugar to the extent of 50 per cent.

Aniline violets are more liable to sophistication than magentas, from the fact that they are sold, not in well defined crystals, but in powder or in cakes. The author has detected gum in a Hofmann's violet to the amount of 12 per cent, and 8 per cent of finely ground charcoal in a common phenyl violet.

Of 32 samples of iodine green examined, 5 were unquestionably sophisticated. One contained 18 per cent of sugar. An English sample was cleverly sophisticated with a salt of lead, probably the picrate, and deflagrated when a portion was heated upon platinum foil. Metallic lead was found to the extent of 10 per cent, corresponding to 21 per cent of the picrate. Two other samples contained respectively 14 per cent of common salt and 26 per cent of magnesia. Oxide of chrome is also a possible adulteration.

The finest sample of iodine green examined was from the manufactory of H. Siegle, in Stuttgart. The author considers that in the production of this beautiful and costly color the Germans are superior to the English and the French.

Correspondence.

The High Lakes in the West.

To the Editor of the Scientific American:

In your issue of December 22, under the caption of "The Highest Lake in the United States," you claim for Lake Harkness, Plumas county, Cal., that distinction, accrediting it an altitude of but 7,330 feet.

We have in Clear Creek county, Col., two beautiful little lakes, each of about a mile in circumference, very deep; and the water, of dark bluish green, is extremely cold. There is no apparent source of supply, as the lakes are surrounded by high mountain walls of granite blocks, piled in magnificent confusion, and quite heavily timbered. They are at an altitude of at least 9,000 feet, and are the source of the famous Clear Creek Cañon stream.

Again, about six miles south of these lakes and at an altitude of fully 10,000 feet, as it is just above our timber line, is situated Chicago Lake, now widely known as the scene of Bierdstadt's "Storm in the Rocky Mountains." It is a most picturesque sheet of clear, limpid water, but appears at a little distance to be almost black, owing to its great depth. The water is intensely cold, but contains an abundance of trout. The lake is about a half mile in diameter; and at the upper or northwest side, a perpetual bank of ice and snow creeps down to the water's edge. On the south, an imposing wall of smooth granite towers almost vertically to the hight of 2,000 feet; while on the west, there are a series of majestic terraces, like huge steps 300 to 400 feet high. The north wall slopes away at an angle of about 45°; and to the south and east, there is an easy, gradual slope down into Chicago Cañon. This lake would appear to have been the crater of some volcano. Yet there are no traces, that we could find, of any volcanic action. C. R.

St. Louis, Mo.

To the Editor of the Scientific American:

Your journal for December 22, 1874, states that a certain lake in California, having an elevation of 7,330 feet, is probably the highest in the United States.

There are hundreds of lakes in the Rocky Mountains having a greater altitude than 7,330 feet. Prominent among these are the Twin Lakes, 8,700 feet, San Cristobel and Lake Mary in the San Juan county (somewhat higher), and Grand Lake in Middle Park. There are many smaller lakes in the region of the timber line, varying in elevation from 10,000 to 12,000 feet. These lakes are all along the snowy region: in the National, Elk, Saguache, San Miguel, Uncompahgre, Sangre de Christo, and other ranges. In the National range, which, according to Professor Hayden, "is by far the largest and grandest in the United States," there are several considerable lakes above 9,100 feet, and many smaller ones, from 10,000 to more than 12,000 feet, above the sea level.

West Hallock, Ill. HERBERT R. SAUNDERS.

Hollow Bolts and Axles.

To the Editor of the Scientific American;

For several years it has cost me five dollars a week to keep the bolts on my trip or cushioned hammer heads in repair, and, finding it to wear on my patience, I tried all kinds of iron, but to no use; break they would. I made the threads of a round or U shape, which worked much better than the V; but still they broke. I finally bored a hole, one third the diameter of the bolts (1¼ inches), and put a ⅜ of an inch hole down, some way below the thread, which formed a tube. I have now run them for three months, and they show no signs of giving out. The wrench used would break the other bolts easily; but it cannot do so with these. My work on spindles requires the dies to snap together about nine times in ten, which tells very severely on the bolts; and I believe that the bolts broke because the severe strain on the nuts stretches the outside grain of the iron by the concussion, so that there is a contention between the outside and inside strain.

I was apprenticed to William Fairbairn, in Manchester, England, and I have known his 8 inch axles on locomotive engines to break, owing probably to the rails resting on stone sleepers. They had some 6 inch tubular axles made, with 2 inch holes; and they never broke one of them, to my knowledge. JOHN BIRKENHEAD.

Mansfield, Mass.

Bolting Reels.

To the Editor of the Scientific American:

There is at present considerable interest manifested by millers as to the best method of constructing bolting reels and clothing the same, the best arrangement of the various numbers of cloths, etc. It is now almost universally conceded by the most intelligent millers that the less violently the meal is acted upon in the reel in the process of bolting, or, in other words, the nearer the motion of the meal is to a slide, the cleaner and whiter will be the flour. In endeavoring to attain this sliding principle, various plans of constructing and clothing bolting reels have been resorted to. Among some of the methods employed are putting the cloth on the inside of one rib and on the outside of the adjacent one putting the cloth on the inside of all the ribs, using large reels and running them at a slow motion, also using the round form of reel. The writer has tried all the plans above mentioned, and more too, but finds the round reel much the most satisfactory, both on account of the improved color of the flour and the greater capacity of the reel.

It is the practice in many of the best mills in the Northwest to bolt the meal in the usual manner, and then rebolt the flour through a bolt of the round form, covered with a somewhat finer cloth, one round bolt of twenty feet long being of capacity sufficient to rebolt two hundred barrels of flour in twenty-four hours.

I would like to hear from brother millers as to what they consider the best style of dress for millstones for grinding spring wheat. D. T. CHOAT.

Cedar Falls, Iowa

[For the Scientific American.]

THE VOICES OF ANIMALS.

BY PROFESSOR JAMES ORTON.

Aquatic animals are mute. A world of radiates, molluscs, and fishes, therefore, would be silent. Insects are about the only invertebrates capable of producing sounds. Their organs are usually external, while those of higher animals are internal. Insects of rapid flight generally make the most noise. In some the noise is produced by friction (stridulation); in others, by the passage of air through the spiracles (humming). The buzzing of flies and bees is caused in part by the vibrations of the wings; but it comes mainly from the spiracles of the thorax.

Snakes and lizards have no vocal cords, and can only hiss. Frogs croak, and crocodiles roar by the vibration of the glottis. The huge tortoise of the Galapagos Islands utters a hoarse, bellowing noise.

The vocal apparatus in birds is situated at the lower end of the trachea, where it divides into the two bronchi. It consists mainly of a long drum with a cross bone, having a vertical membrane attached to its upper edge. Five pairs of muscles (in the songsters) adjust the length of the windpipe to the pitch of the glottis. The various notes are produced by differences in the blast of air, as well as by changes in the tension of the membrane. The range of notes is commonly within an octave. Birds of the same family have a similar voice. All the parrots have a harsh utterance; geese and ducks quack; crows, magpies, and jays caw; while the warblers differ in the quality rather than the kind of note. Some species possess great compass of voice. The bell bird can be heard nearly three miles; and Livingston said he could distinguish the voices of the ostrich and lion only by knowing that the former roars by day and the latter by night.

The vocal organ of mammals, unlike that of birds, is in the upper part of the larynx. It consists of four cartilages, of which the largest (the thyroid) produces the prominence in the human throat known as Adam's apple, and two elastic bands, called vocal cords, just below the glottis or upper opening of the windpipe. The various tones are determined by the tension of these cords, which is effected by the raising or lowering of the thyroid prominence. The will cannot influence the contraction of the vocalizing muscles, except in the very act of vocalization.

The vocal sounds produced by mammals may be distinguished into the ordinary voice, the cry, and the song. The second is the sound made by brutes. The whale, porpoise, armadillo, ant eater, porcupine, and giraffe are generally silent. The bat's voice is probably the shrillest sound audible to human ears. There is little modulation in brute utterance. The opossum purrs, the sloth and kangaroo moan, the hog grunts or squeals, the tapir whistles, the stag bellows, and the elephant gives a hoarse, trumpet sound from its trunk and a deep groan from its throat. All sheep have a guttural voice; all the cows low, from the bison to the musk ox; all the horses and donkeys neigh; all the cats *miau*, from the domestic animal to the lion; all the bears growl; and all the canine family (fox, wolf, and dog) bark, howl, and whine. The howling monkeys and gorillas have a larger cavity or sac in the throat for resonance, enabling them to utter a powerful voice; and one of the gibbons has the remarkable power of emitting a complete octave of musical notes. The human voice, taking the male and female together, has a range of nearly four octaves. Man's power of speech, or the utterance of articulate sounds, is due to his intellectual development rather than to any structural difference between him and the apes. Song is produced by the glottis, speech by the mouth.

To cement metal to glass, mix two parts powdered white litharge and one part dry white lead into a dough with boiled linseed oil and lac copal. The metal is to be coated with the cement and then pressed upon the glass.

RECENT RESEARCHES IN THE SPECTRA OF THE PLANETS.

Professor Vogel has recently published an important work on the above subject, in which are embodied the results of his latest observations. The light of each planet has been analyzed by the aid of the spectroscope, and from the luminous bands and rays the author translates the self-written history of the other worlds.

The principal rays of the spectrum of Mercury coincide absolutely with those of the solar spectrum. Furthermore, certain bands which are not produced in the solar spectrum, except when the sun is very low in the horizon and when the absorption due to the atmosphere is considerable, appear permanently in the Mercurial spectrum. From this the existence of a gaseous envelope about the planet may be concluded, which exercises on the solar rays an absorbing action equal to the maximum similar effect of our atmosphere. Generally the least refrangible portions of the Mercurial spectrum are more brilliant that those of greater refrangibility; but it is impossible to separate here the effect due to our atmosphere from that produced by the atmosphere of the planet.

The light from Venus is also similar to that from the sun, with the addition of like absorption rays. It is concluded that the light is reflected from the cloud envelope which is known to encompass the planet. So far as the atmosphere of Venus is concerned, water must be present, so that one indispensable necessity for life there exists.

The spectrum of Mars gives a great number of the solar spectrum rays, beside, as in the two planets before referred to, others similar to the absorption lines of our atmosphere. It is concluded that Mars possesses an atmosphere not differing essentially from our own in composition, though richer in watery vapor. The red color of the planet seems to result from an absorption which takes place generally on the red and violet rays in their entirety. In the red, between C and B, lines appear which are peculiar to the Martial spectrum, but it has not been possible to fix their position definitely, owing to their feeble luminous intensity.

M. Vogel's observations on the minor planets, Vesta and Flora, have not been very productive of results, owing to the dimness of the spectrum; though sufficient indications relative to the former planet have been obtained to point to the existence of an atmosphere about it.

The greater portion of the lines in the spectrum of Jupiter coincide with others in the solar spectrum; but the Jovial spectrum differs from that of the sun in the existence of dark bands in the least refrangible portion, among which one in the red may be especially noted. The length of the luminous wave to which it is due has been estimated at 0·00185353 of an inch. The other lines present, different from those of the solar spectrum, coincide with the telluric lines.

While bands are produced in the less refrangible portions of the spectrum, the radiations of the more refrangible blues and violets experience a uniform absorption. The gaseous envelope which surrounds Jupiter exercises, then, on the solar rays which traverse it, an action analogous to that of our atmosphere. Hence, the presence of water in the Jovial atmosphere may be inferred. With reference to the band above mentioned, it cannot be precisely determined whether the same is due to the presence of some body not found in our atmosphere, or to the gas composing the Jovial atmosphere being mixed in proportions different from that of air. It is possible that the composition of the two atmospheres may be the same, but that their action on the solar rays varies only through circumstances of temperature and pressure, quite different on Jupiter from those found on the earth. The spectra of the dark belts observed across the disk of Jupiter are especially characterized by a very marked, uniform absorption, which is undergone by the blue and violet rays. The new absorption bands, peculiar to the spectrum of the planet, never appear, but the lines are more marked and are larger than elsewhere. This proves clearly that the dark portions of the Jovial surface are deeper than the neighboring parts. The solar light penetrates more deeply into these portions of the planetary atmospheres, and thus is subjected to more marked alteration. The red color of the planet, and especially the more decided tint of the dark belts, is attributable to the uniform absorption exercised by its atmosphere upon the blue and violet rays.

In the spectrum of Saturn, the most marked rays of the solar spectrum are present. A few bands, especially in the red and orange, have no equivalent in the spectrum of the sun; but they coincide with some groups of spectral lines belonging to the terrestrial atmosphere. The greatest absorption of blue and violet rays takes place at the obscure equatorial zone. In general, it may be stated that the spectra of the body of Saturn and of Jupiter are very similar. The same is not the case with the rings of the former planet. The characteristic band in the red is absent or marked by a feeble trace: whence it may be concluded that the rings have no atmosphere, or are surrounded only by a gaseous envelope of very small density and thickness.

The feeble light of Uranus prevents the distinguishing of the Fraunhofer lines, except to a degree which might admit extensive errors in drawing deductions from their positions. It appears, however, that the absorption of the solar rays may be sufficiently recognized to infer the presence of an atmosphere about the planet; but the direct causes of the absorption it is not possible to determine. The Neptunian spectrum is essentially different from that of the sun, but, for the same reason as in the case of the planet last referred to, little can be definitely ascertained regarding it, except a general supposition that it closely resembles that of Uranus.

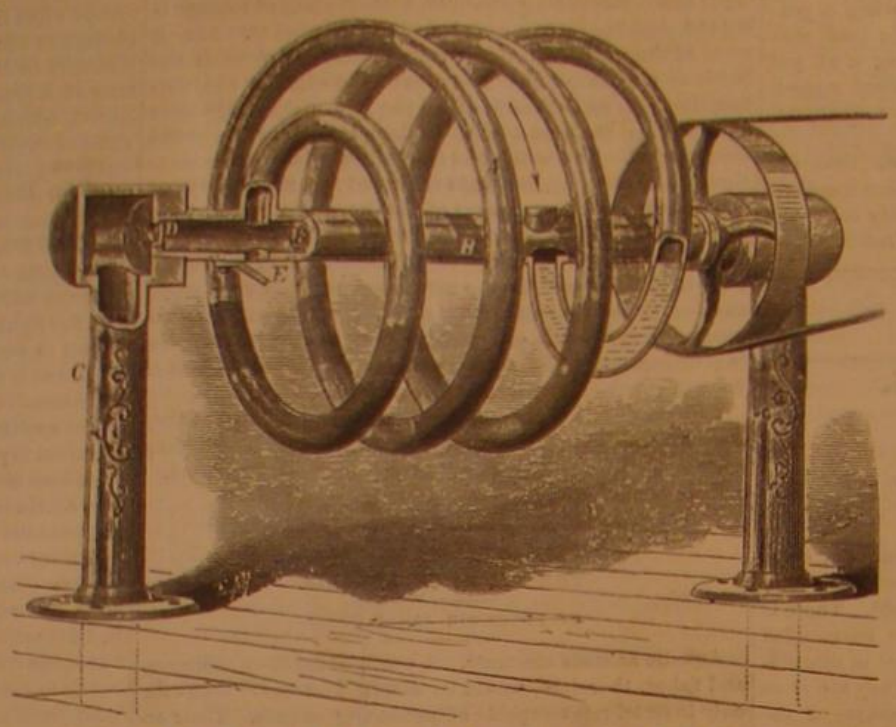
If gilt frames are varnished with copal varnish, they can be washed with cold water without injury.

IMPROVED PLENUM AND VACUUM PUMP.

The novel form of pump herewith illustrated may be used either for a bellows to force an air blast, or as a pump for raising water. By producing a vacuum in one of its receivers, and compressing air into the other, both of the above capabilities may be utilized simultaneously, or both receivers may be maintained either in a state of continuous vacuum or filled with compressed air, as may be desired.

A is a spiral tube coiled about (and the ends of which are in communication with) the hollow axial shaft, B. C C are hollow supports for the latter, and, at the same time, supply conduits, the water passing therefrom into shaft, B, by the inlet valves at D. E are the exhaust valves, and at F is a partition which divides shaft, B, into two compartments, so that, through its axis, there is no communication between the ends of the coiled tube, A. A portion of the coil is filled with mercury, as indicated by the broken-away section on the right, the hight of the column being equal to or greater than 28 inches, so as to overbalance atmospheric pressure.

When the coil is turned by the action of the belt pulley or by hand, in the direction of the arrow, the mercury, flowing along the spiral tube from one end to the other, will create a vacuum in its rear while compressing the air before it. In so doing, it will draw water or air through the valve, D, at one end of the shaft, and expel the air before it from the valve, E, at the opposite extremity. If the motion be reversed when the mercury has traversed the length of coil, A, the same takes place with the other pair of valves, while, of those first affected, the inlet valve now closes and the outlet valve opens. A moment's inspection of the arrangement of the valves in the diagram will show that a continuous suction and exhaust is thus maintained.



CAMERON'S PLENUM AND VACUUM PUMP.

If the positions of the inlet and outlet valves be changed—valves, E, being inlet valves and D, outlet—the apparatus may be used as an air compresser, of which the tubes, C, may be conduits to the reservoir. In such case valves, E, which, as represented, open outside the shaft, would open inwardly, while valves, D, now opening inside the shaft, would open into the receivers.

It is claimed that, by this device, water may be raised 33 feet. The amount of compression attained is dependent upon the weight of the mercury column and the size of the machine. Air, however, it is stated, can be compressed five times, equal to a pressure of 60 pounds to the square inch. The receivers may be made of any desired size. The diameter of the tubes and number of coils may be increased at pleasure. The diameter of the coils may be from three to fifteen feet, and either hand or steam power may be utilized for their rotation.

Patented through the Scientific American Patent Agency, November 24, 1874, to Daniel L. Cameron. For further particulars regarding sale of rights, or of patent, etc., address the patentee at Madison Station, Madison county, Miss.

A NEW SAD IRON.

Flat irons with fixed handles are fast becoming things of the past. They occupy too much room on top of the stove or range, cost more to manufacture, and, besides, require the use of a holder, which is not always at hand when required. It is a much better arrangement to have the flat portion of the iron separate, with provisions made to accommodate a light handle, which may be inserted and removed at pleasure, one handle answering for a number of irons, and which, being detached while the iron is heating, keeps cool enough to manipulate without the interposing cloth holder or the liability of burnt fingers.

Fig. 1

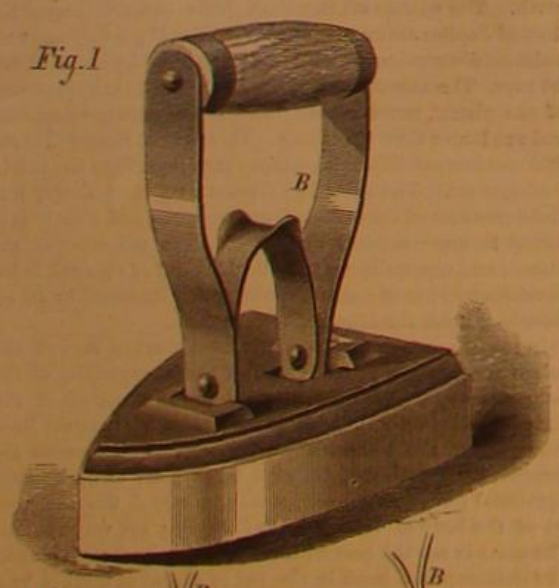
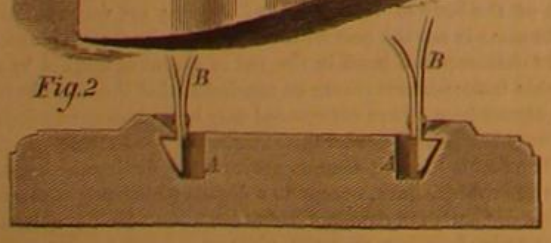


Fig. 2



An invention of this description is represented in our engraving, and is one of the simplest of the many that have come under our notice. The sectional view, Fig. 2, shows that, in the stock part of the iron, two recesses, A, having lips, are formed. The handle consists of two spring braces, B, of steel, attached to each end of the wooden piece which receives the grasp. These, at their lower extremities, are provided with catches beveled and notched to fit the lips of the recesses of the stock. The side pieces are united by an arched brace. The fingers are inserted beneath the flattened upper portion of this last, pulling it upward, and so drawing the catches on the ends of the side pieces together, so that they may be easily inserted into the recesses. On relaxing the pressure, the elasticity of the springs carries the catches under the lips. Removal is effected in the same manner.

Patented September 22, 1874, to Daniel B. Snow, of South Lancaster, Worcester county, Mass., who may be addressed for further information.

HAYDEN'S REVOLVING CARTRIDGE BELT.

Sportsmen will recognize, we think, at a glance that the new cartridge belt, represented in the engraving given here-

with, offers a very convenient way, not merely of carrying ammunition, but of so disposing it about the person that it is always in the most accessible position. This belt is double, consisting of an inner girdle, A, which is buckled about the waist and to which are attached four guides. The outer belt, B, to which the sockets for the cartridges are affixed, slides in the guides, so that any portion of it may be readily turned to the front of the wearer. The ammunition is thus always near the hand; and the necessity of reaching awkwardly about the body, as is the case when the belt is immovable, is avoided. Stout straps, which pass over the shoulders, are secured to the guides and inner belt, and sustain the weight, which is thus distributed about the person in a convenient and comfortable manner. The inner belt is fastened by a strap and buckle, and the outer one by an ingenious latching clasp, which, when closed, makes a firm and rigid joint.

The device may be worn over the vest and under the coat, and its contents are thus protected from the weather, while the outer garment need not be unbuttoned to reach the cartridges. It is also equally serviceable without a coat for summer shooting. The belt is especially adapted for army use, as it can be arranged to carry metallic cartridges of any caliber. The usual make, however, is for paper or metallic cartridges for fowling pieces. The invention appears to us to be excellently calculated both for easy loading and for rapid firing, no matter in what position the wearer may be placed.

For further particulars address the Hayden Belt Works, Columbus, Ohio.

When to Get Up.

The Duke of Wellington always slept on an iron camp bedstead eighteen inches wide. "When a man wants to turn over," he said, "it is time for him to turn out." The Emperor Nicholas did the same, Mr. Owens says. The principle is well enough; but I think the detail is wrong. Sleep itself is far too important to be made uncomfortable. My old friend Rossiter fixed his alarum so that, at the fore-ordained moment, the bed clothes were dragged from the bed, and Rossiter lay shivering. I have myself somewhere the drawings and specifications for a patent (which I have never applied for), which arranges a set of cams and wheelwork under the bedstead, which, at the moment appointed, lift the pillow end six feet, and deliver the sleeper on his feet on the now horizontal footboard. He is not apt to sleep long after that.

Rossiter found another contrivance which worked better. The alarm clock struck a match, which lighted the lamp, which boiled the water for Rossiter's shaving. If Rossiter staid in bed too long, the water boiled over upon his razor, and clean shirt, and the prayer book his mother gave him, and Coleridge's autograph, and his open pocketbook, and all the other precious things he could put in a basin underneath when he went to bed; so he had to get up before that moment came.—*Old and New.*

A Good Lawn.

The first great requisite in making a lawn is to have good drainage, after which prepare the ground by deep plowing and also by subsoiling the soil requiring to be well pulverized and enriched, to expect any success in our hot climate.

A good lawn is one of the most pleasant appendages to a house; but to make it so, it requires to be well attended to, both in the formation and by keeping it mown every two weeks at farthest, using the most approved lawn mower. By doing so you will soon have a lawn like a carpet. Inexperience and neglect have been the causes of numerous failures.

WELLMAN'S IMPROVED CAR SEAT.

The novel feature of the car seat, represented in the accompanying engraving, consists in the manner in which it is reversed. Instead of turning the back over, as is usually done, arrangements are provided whereby the back is slid from one side of the seat to the other, without being lifted or turned. To this end, fixed rods, A, are provided at the ends of the seat, over which slide the staples, B, which confine the three portions of the back. The latter consists of a center piece, C, which may be of wood or metal, or both, to the top of which are secured the outer parts, D. These last are each made in two portions, which spring out and in independently. The backs of each part, D, are of wood, and

springs or upholstery are inserted between them and the central portion, C, to give further elasticity.

It will readily be understood that the entire back is supported on the staples and rods, and hence, by the sliding of the former over the latter, is readily pushed from front to rear of the seat, or *vice versa*.

Patent pending through the Scientific American Patent Agency. For further particulars address the inventor, Mr. Edwin G. Wellman, Canandaigua, Ontario county, N. Y.

A HAIRY FACED FAMILY.

Mr. W. B. Tegetmeier, a well known English naturalist, publishes in a contemporary the portraits of three members of a Burmese family, the whole of which, through several generations, have exhibited a remarkable development of long hair over their entire faces.

"The case," says Mr. Tegetmeier, "is one of the most interesting examples on record of the hereditary transmission of a singular and very abnormal natural variation through several generations. I feel bound, even at the risk of repeating, to some extent, the previous statements, to give, as far as practicable, the history of those singular people at length. Nearly fifty years since, Mr. John Crawford, so well known to ethnologists for his researches into the history of languages of the inhabitants of the Malay peninsula and adjacent countries, described, in his 'Journal of an Embassy from the Governor General of India to the court of Ava,' a hairy man named Shwe-Maon, and his daughter, Maphoon. Mr. Crawford wrote: "We have heard much of a person said to be covered all over with hair, and who, it was insisted upon, more resembled an ape than a human being—a description, however, I am glad to say, which was by no means realized by his appearance. Having expressed a curiosity to see this individual, the king politely sent him over to our dwelling some days ago, and Dr. Wallich and I took down on the spot the following account of himself and his history. His name was Shwe-Maon, and he stated himself to be thirty years of age. Saubwa, as the chief of the country, presented him to the king as a curiosity when a child of five years of age, and he had remained in Ava ever since. His hight was 5 feet 3½ inches, which is about the ordinary stature of the Burmese. His form was slender, if compared with the usually robust make of the Hindoo-Chinese race, and his constitution was rather delicate. In his complexion there was nothing remarkable, although upon the whole he was rather fairer than the ordinary run of Burmese. The color of his eyes was a dark brown, not so intense as that of the ordinary Burmese. The same thing may be said of the hair of the head, which was also a little finer in texture and less copious. The whole forehead, the cheeks, the eyelids, the nose, including a portion of the inside, the chin—in short, the whole face, with the exception of the red portion of the lips—were covered with a fine hair. On the forehead and cheeks this was 8 inches long, and on the nose and chin about 4 inches. In color it was of a silvery gray; its texture was silky, lank, and straight. The posterior and inferior surface of the ears, with the inside of the external ear, were completely covered with hair of the same description as that on the face, and about 8 inches long; it was this chiefly which contributed to give his whole appearance, at first sight, an unnatural and almost inhuman aspect. He may be strictly said to have neither eyelashes, eyebrows, nor beard, or at least they were supplanted by the same silky hair which enveloped the whole face. He stated that when a child the whole of this singular covering was much fairer than at present. The whole body, with the exception of the hands and feet, was covered with hair of the same texture and color as that now described, but generally less abundant; it was most plentiful over the spine and shoulders, where it was 5 inches long; over the breast it was about 4 inches; it was most scanty on the bare arms, the legs, thighs, and abdomen. We thought it not improbable that this singular integument might be periodically or occasionally shed, and inquired, but there was no ground for this surmise—it was quite permanent.'

THE HAIRY FACED BURMESE FAMILY.

Twenty years since, these hairy people were seen and described by Capt. H. Youle, in his 'Narrative of the Mission sent by the Governor General of India to the Court of Ava.' By this time Shwe-Maon's child had grown into a woman of thirty, and the abnormal growth of hair had increased until it covered the whole body. Capt. Youle states:

'The whole of her face was more or less covered with hair. On a part of the cheek, and between the nose and mouth, this was confined to a short down, but over all the rest of the face was a thick, silky hair of a brown color, paleing about the nose and chin, four or five inches long. At the alæ of the nose, under the eye, and on the cheek bone, this was very fully developed; but it was in and on the ear that it was most extraordinary. Except the upper tip, no part of the ear was visible. All the rest was filled and veiled with a large mass of silky hair, growing apparently out of every part of the external organ, and hanging a pendant lock to a length of eight or ten inches. The hair over her forehead was brushed so as to blend with the hair of the head, the latter being dressed (as usual with her countrywomen) *à la Chinoise*. It was not so thick as to conceal her forehead.

'The nose densely covered with hair, as no animal's is that I know of, and with long locks curving out and pendant, like the wisps of a fine Skye terrier's coat, had a most strange appearance. The beard was pale in color, and about four inches in length, seemingly very soft and silky.

'Poor Maphoon's manners were good and modest, her voice soft and feminine, and her expression mild and not unpleasing, after the first instinctive repulsion was overcome. Her appearance rather suggested the idea of a pleasant-looking woman masquerading, than that of anything brutal. This discrimination was, however, very difficult to preserve in sketching her likeness.

'Her neck, bosom, and arms appeared to be covered with a fine pale down, scarcely visible in some lights. She made a move as if to take off her upper clothing, but reluctantly, and we prevented it. Her husband and two boys accompanied her. The elder boy, about four or five years old, had nothing abnormal about him. The youngest, who was fourteen months old, and still at the breast, was evidently taking after his mother. There was little hair on the head, but the child's ear was full of long silky floss, and it could boast a moustache and beard of pale silky down that would have cheered the heart of many a cornet. In fact, the appearance of the child agrees almost exactly with what Mr. Crawford says of Maphoon herself as an infant.

'This child is thus the third in descent exhibiting this strange peculiarity; and in this third generation, as in the two preceding, this peculiarity has appeared only in one individual.

'Maphoon has the same dental peculiarity also that her father had—the absence of the canine teeth and grinders, the back part of the gums presenting merely a hard ridge. Still she chews pawn like her neighbors.'

Six or seven years since, the family were again seen by Capt. Haughton, and photographed. By this time Maphoon's youngest child was approaching manhood, and, the early indications above alluded to having been fulfilled, he demonstrated the perpetuation of this singular variation through three generations.

The investigation of monstrosities of the kind at present under consideration has an interest beyond that of the gratification of mere vulgar curiosity. The hereditary transmission of accidental variations throws much light on the vexed question of the origin of species, and it is exceedingly interesting to note how readily variations, occurring naturally, are perpetuated in the offspring, while malformations or mutilations produced artificially never show any tendency to reproduction. The combs and wattles of game fowls have been cut off for 150 generations, yet a game cock ready dubbed for the cockpit never issued from an egg. It would be indeed a sad condition of things if the mutilations of mankind were inherited by the unfortunate children. We know, unhappily, that the constitutional defects of the drunkard and the debauchee descend to their offspring, and that in this manner 'the sins of the fathers are visited on the children even unto the third and fourth generations;' but, fortunately, we are exempted from the inheritance of accidental mutilations and losses."

Removing Snow by Steam.

Mr. William Edwards lately presented a paper on this subject before the New York Society of Practical Engineering, in which he gave a review of the various plans for melting snow in the streets to insure its removal.

The system began in the use of a steam hose, furnished with a nozzle and fitted to a stationary boiler, the hose being extended to the sidewalk, and the steam jet, properly guided, rapidly melting the snow and ice, and heating the resulting water so that it quickly evaporated, leaving the flagstones dry.

One of the earlier projects was to lay steam pipes along the gutters so that snow, brushed upon the pipes by a street sweeping machine would be melted and run off to the sewers.

Another step forward, at least theoretically, is the plan of a perambulating apparatus, constructed to act upon the snow by jets of steam, by blasts of hot air, or contact with metal plates. It is calculated that the combustion of one pound of coal would, theoretically, melt about 100 pounds of snow; in practice, perhaps three fourths of that quantity.

Within the past two years renewed attention has been given to the subject, and numerous novel inventions made. In one of these a hollow case is provided with a furnace, through which an air blast is forced by a blower. The hot air and gases from the furnace pass through a narrow horizontal opening at the front of the machine, and are directed forcibly downward against the snow and ice.

In another a portable engine operates a revolving shovel, made with a steam space, so that, when the snow is lifted by the shovel, it is melted therein.

In another a horizontal tank, supplied with steam from a boiler on wheels, is perforated at its under side, so that a shower of steam jets is thrown down upon the snow.

In still another a revolving brush sweeps the snow into a double walled hopper; steam is conducted between the walls of the hopper and melts the snow.

In another the perforated steam tank is replaced by a perforated hot air tank and blowing devices that shower down streams of hot air instead of steam.

In another hot water, or steam and hot water together, are thrown upon the snow-covered surface, and in still another the steam is superheated before use.

In still another, movable plates are heated in a furnace and lowered in contact with the pavement.

These examples give some idea of the amount of ingenuity lavished upon the subject, but nothing yet done seems to afford

an adequate solution of the problem of how to cheaply and quickly remove snow from the streets. The mere cost of coal for melting would probably not prove an insuperable obstacle, but the freezing of water resulting from the operation would be a greater evil than that sought to be remedied. The writer believed that melting the snow would be more economical than carting it away; but in order to do this, the snow must be swept from the street ways, either to the traveling machine or to fixed pipes, previous to melting; and the water must be conducted direct to the sewers to prevent the formation of ice in the streets. He knew of no means by which this could be accomplished, but expressed the opinion that improvements yet to be made will, in the future, make snow melting the most satisfactory method of cleaning city streets in winter.

Combustion.

At a recent meeting of the Edinburgh and Leith Engineers' Society, a paper on "Combustion" was read by Mr. Wm. Allan Carter, C. E. He remarked that an ordinary sample of anthracite coal is found to contain the following constituents in something like the following proportions:—Carbon, 86·32 per cent; oxygen, 7·21 per cent; hydrogen, 3·75 per cent; nitrogen, 0·41 per cent.; ash, 2·21 per cent; sulphur, 0·10 per cent. But in ordinary bituminous coal, such as from Edinburgh, Glasgow, Newcastle, Lancashire, or Durham, we find the carbon ranging from 74 to 88 per cent, and the hydrogen from 5 to 6 per cent; and in bituminous coal, the amount of hydrogen is an important feature, as it is from this gas that flame is produced during combustion.

We will suppose some time has elapsed since fresh fuel has been thrown on the fire, and we find that the fuel on the bars presents to our view a glowing, incandescent mass, with no appearance of smoke and no flame, and we will suppose that the only access for the air necessary for supporting combustion is through the fire bars from the ashpit, through the incandescent fuel and finally away to the chimney; and it need scarcely be said that the supposed case is one of very common occurrence.

The moment the air comes in contact with the incandescent fuel it is resolved into its constituents, nitrogen and oxygen, the nitrogen passes on to the chimney with no further change than increase of volume from increase of temperature; the oxygen, however, is arrested, and each atom of carbon seizes two atoms of it, and one atom or equivalent of carbonic acid is formed. If this carbonic acid got away to the chimney, nothing further could be desired, and complete combustion of the coke would be effected. But it is not destined to escape in this manner, for before the atom of carbonic acid has struggled through the mass of fuel and got free from it, it has taken up another atom of carbon, and now, instead of being carbonic acid, CO_2, it has been converted into C_2O_2, or two equivalents of carbonic oxide, and it is this gas which escapes to the chimney. Experiment has proved that carbonic acid is not combustible, but that carbonic oxide is, and it stands to reason, if anything of a combustible nature is escaping from the chimney, we cannot be having complete combustion in the furnace; but there are very few practical men who have any idea whatever as to the magnitude of the loss of heat when carbonic oxide is the result of combustion instead of carbonic acid; for we find from calorimetrical experiments that, in the former case, we only get three tenths of the evaporative power produced in the latter. Now in order to burn this carbonic oxide, we must supply each atom of carbon in it with another atom of oxygen while the carbon is at a sufficiently high temperature; if the combination is effected, then our carbonic oxide is reconverted into carbonic acid, and has given out during its reconversion the seven tenths of heat which we noted were deficient in the formation of the oxide.

The next point considered was the gaseous portion of the coal, and it was pointed out how fuel might be lost, either by the gas escaping wholly or by being only partially burned, the latter alternative causing the formation of smoke and soot. Mr. Carter showed how this latter alternative was generally attributable to the want of a proper supply of air admitted above the fire, or to the flame being brought into contact with the metal plates of the boiler, and so cooled down below the temperature necessary for ignition of the gas, and mentioned the following instance:

"Last winter I had a little stove in one of the rooms of my house; it is one of those commonly known as a gill stove; the whole of the air supporting the fire had to pass from beneath through the bars, and consequently through incandescent fuel, before reaching the flue. I was greatly disappointed with the performance of this little stove, as far as its heating power was concerned; eventually I took off the door and drilled a number of small holes in it so as to admit jets of air above the fire; the fire inside has been as bright and as lively again since this surgical operation, and the quantity of soot collecting in the flue, which before proved a constant nuisance, is now almost reduced to *nil*. This is an instance of how easily a remedy may sometimes be applied."

After going through various calculations to show the quantity of air required above and below the fire for certain quantities of coal, and how smoke and soot were formed, Mr. Carter concluded in the following terms:

"So long as popular errors prevail amongst that class of men who have the direct control of furnaces of all descriptions—I allude to the practical managers or foremen in manufacturing works—little will be done to prevent waste of fuel; and as a rule, when you begin to speak to them about carbonic acid and carbonic oxide, they look at you with an incredulous smile, you at once lose caste with them and fall from the high position of a practical man to the pitiable *status* of a mere theorist. But I maintain that this is not simply a matter of theory, but that the principles involved are of an eminently practical nature, and if applied in practice may be turned to good account. We must impress on the practical man that air is required in certain quantities and delivered in certain methods; we must combat the idea that gas is smoke, or that gas and smoke are synonymous terms. We must point out that volumes of black smoke do not constitute the only indication of waste of fuel, for, as I have shown, the waste may be enormous although no vestige of smoke is to be seen. We must challenge the idea that a furnace can consume its own smoke, that is simply impossible; we can construct a furnace to prevent the formation of smoke, but let smoke once be formed, and it cannot be consumed in the *same* furnace, its presence indicating that the furnace is wanting in those conditions essential for the completion of combustion."

OCEAN TELEGRAPHY.—THE FOREIGN CONNECTIONS OF NEW YORK CITY AND THE EXISTING RATES OF CHARGES.

Telegraphic communication between the United States and the West Indies is maintained over the following routes: From Punta Rassa, Florida, *via* Key West to Havana by cables, thence by land lines to Batabano; thence by cable to Santiago de Cuba; thence by cable to Kingston, Jamaica. From Kingston a series of cables extend to Demarara, South America, touching at Porto Rico, St. Thomas, St. Kitt's, Antigua, Guadaloupe, Dominica, Martinique, St. Lucia, St. Vincent, Barbadoes, Grenada, and Trinidad. A cable also extends from Jamaica to Aspinwall on the Isthmus of Panama.

A cable steamer is now on her way to Trinidad to lay a cable from Port of Spain, Trinidad, to Ponce, Porto Rico, touching at St. Croix, after which she will proceed to lay a cable between Cienfuegos, Cuba, to Jamaica. When these are completed, the United States and West Indies will be substantially united by a double series of cables, so that, in case of failure of any one of them, communication will not be interrupted. The shore ends of a cable to extend from Demarara, South America, to Cayenne, South America, were laid last month, and the cable steamer Hooper is now on her way to Cayenne, to lay the deep sea cable to Demarara. When this link is laid, there will be a complete line of telegraphic communication between the United States and Rio Janeiro, South America; and when another link is laid between Rio Grande do Sul and Maldonado, Uruguay, the United States will be in telegraphic communication with all of South America, bordering on the Atlantic ocean, north of Buenos Ayres, and with Chili on the Pacific. A singular fatality has thus far attended the laying of the cable between Rio Grande do Sul and Moldonado. The telegraph steamer Gamas was first wrecked in attempting to lay it, and more recently the La Plata was chartered to pursue the work and was wrecked in the Bay of Biscay, the cable and all persons on board being lost.

Until the cable is laid down between Cayenne and Demerara, communication between the United States and other parts of South America must be forwarded *via* Europe, the cable between Lisbon, Portugal, and Pernambuco, Brazil, furnishing the only means of telegraphic intercourse.

Communication between the United States and England is maintained by land lines to Sydney, Cape Breton, thence by cables, to Placenta, Newfoundland, thence by land lines to Hearts Content, Newfoundland, thence by three cables to Valentia, Ireland, thence by land lines to Wexford, Ireland, thence by cable to Haverfordwest, England, thence by land lines to London.

Communication between the United States and France is maintained by cable from Duxbury, Mass., to St. Pierre, and thence by cable to Brest, France. Communication between Great Britain and the various continental states is transmitted over two cables to Denmark; two to Germany; two to Holland; two to Belgium; one to Norway; one to Portugal; two to Spain; and six to France.

There is one cable between France and Denmark; one between France and Spain; two between France and Algeria; two between Portugal and Gibraltar; one between Gibraltar and Malta; one between Algeria and Malta; two between Sicily and Gibraltar; one between Malta and Alexandria; one between Italy and Alexandria, touching at Corfu, Zante, and Candia; one cable between Russia and Turkey, through the Black Sea; one between Norway and Denmark; one between Denmark and Sweden; one between Sweden and Russia; one between Denmark and Russia; one between Sweden and Germany; one between Egypt and India, through the Red Sea and Indian Ocean, touching at Aden; one between Persia and India, through the Persian Gulf, touching at Gwadar in Beloochistan; one from Madras, India, to Penang in the Strait of Malacca; one from Penang to Singapore; one from Singapore to Saigon, Cochin China; one from Saigon to Hong Kong and Shanghai, China; one from Shanghai to Nagasaki, Japan; one from Nagasaki to Hiogo and Yokohama, Japan; one from Nagasaki to Wladivastok, Asiatic Russia; one from Singapore to Batavia, Java; one from Java to Australia; one from Australia to Tasmania or Van Diemen's Land. The following cables are projected: From Australia to New Zealand; Ceylon to Australia; Singapore to Borneo; Borneo to Luzon; Luzon to Hong Kong; Yokahama to Hokodadi; Siberia, mouth of the Amoor, to Kamtchatka; Calcutta to Penang; Hong Kong, China, to San Francisco, touching at the Sandwich Islands; Havana to Vera Cruz; Aspinwall, Isthmus of Panama, to Carthagena, South America; Panama to Buenaventura, New Grenada; Buenaventura to Callao, Lima; Callao to Valparaiso, Chili; England to Virginia, touching at the Azores and Bermudas; Portugal to New York, touching at the Azores; Scotland to Labrador, touching at the Faroe Islands, Iceland, and Greenland.

Communication between England and India is mainly confined to the following routes: First, from Penzance on the southeastern coast of England to Lisbon, Portugal; thence to *Gibraltar*; thence to Malta; thence to Alexandria, Egypt; thence by land line to Suez, and thence by cable to Aden and Bombay. Second, by cable from Lowestoft, England, to Emden, Germany, thence by land line, *via* Berlin, Germany, Warsaw, Jitomer, Odessa, Kertsch and Tiflis, Russia; Teheran, Bushire, Henjaum, and Jask, Persia; Gwadar, Beloochistan, and Kurrachee, India. This is known as the special Indo-European line, and is worked in one circuit from London to Teheran, a distance of six thousand miles. From Kurrachee and Bombay, land lines extend to Calcutta, Madras, and Paumben. *From* Paumben a cable extends to the Island of Ceylon. From Madras a cable extends to Penang and Singapore. From Singapore cables extend to Saigon, Cochin China, and thence to Hong Kong and Shanghai in China and Nagasaki, Hiogo, and Yokohama, in Japan. From Nagasaki a cable extends to Wladivostok, the terminus of the Russian land lines in Siberia. From Singapore a cable extends to Batavia in the Dutch island of Java; from Java a cable extends to Port Darwin, Australia, and there connects with a land line extending to Victoria, Australia; from Victoria a cable connects with Tasmania or Van Diemens Land. Telegraphic communication exists between Victoria, British Columbia, and Hobart Town, Tasmania, embracing 273 degrees of longitude, and thus lacking but 87 degrees of encircling the globe; and when the projected cable from San Francisco to China is laid, the circle will be completed. When this latter enterprise is carried out, the telegraphic correspondence between North and South America and the West of Europe, with China, Japan, and Australia, will take this route, as it will be the shortest, cheapest, and most expeditious.

The telegraphs of the world, aerial and submarine, embrace 385,872 miles of line, 871,417 miles of wire, and 30,150 stations. The annual traffic amounts to about 80,000,000 messages.

The tariff upon telegraphic despatches from New York to other countries is as follows: Great Britain and Ireland $1 per word, France $10 for 10 words or less, Cuba $5.40 for 10 words or less, Jamaica $7.75, Porto Rico $11.50, St. Thomas $11.88, St. Kitt's $12.75, Antigua $13.00, Guadaloupe $13.38, Dominica $13.75, Martinique $14, St. Lucia $14.25, St. Vincent $14.50, Grenada $15.00, Barbadoes $15.13, Trinidad $15.50, Demarara $17.50, Berbice $17.50, Aspinwall $12.75, Panama $13.75, Aden, Arabia, $20.00, Port Darwin, Australia, $56.62, New South Wales $57.88, South Australia $56.62, Victoria, Australia, $57.12, Tasmania and Queensland $59.12.

Austria and Hungary $11.50, Baden $11.50, Belgium $10.84, Channel Islands $11.66, Denmark $11.40, Germany $11.10, Holland $11, Norway $11.80, Portugal $12, Roumania $11.88, Russia in Europe $12.50, Servia $11.88, Spain $12, Sweden $11.75, Switzerland $11.75, Turkey in Europe $12.25, Wurtemberg $11.50.

Beloochistan $18, Bushire, Persia, $16.12, Ceylon $20.50, Hong Kong, Amoy, and Shanghai, China, $40, Saigon, Cochin China, $38.50, Corfu $12.50, Egypt $15.30, Gibraltar $12.75, Greece $12.75, India $20, Japan $50.38 to Nagasaki and $52.62 to Hiogo, Osaka, Simonosaki, Yeddo, or Yokohama.

Java $40.62 Madeira Islands $15.38, Malta $12.50, Penang $33.50, Persia $16.12, Russia in Asia from $13.12 to $19.16, Cape de Verde Islands $24.38, Singapore $37.50, South America: Buenos Ayres $68.75, Chili $68.75, Montevideo $68.75, Pernambuco $40.50, Bahia and Para $51.50, Rio de Janeiro $56.50, Santos $62.25, Rio Grande do Sul $63.25.

Machine Belts.

In a recent paper read by John W. Sutton, M. E., before the New York Society of Practical Engineers, the author made the following observations:

Although the use of belts for the transmission of power is not, strictly speaking, an American invention, the great improvements made in this country have caused it to be known in Europe as the American system. In Europe the greater part of the power is transmitted by cog wheels, but in this country 99 per cent is transmitted by belting. The latter is used everywhere, from the sewing machine to the 500 horse power engine of the largest factory. Belts can be run in any way, at any angle, of any length, and at any speed, and can be put up by any one of ordinary skill. They can be made of any flexible material—leather, rubber, gutta percha, cloth, paper, raw hide, cord, or wire—and they may be either round or flat; and the last novelty is a sheet iron belt, and it is said to work well. Every one uses them. While so handy and so popular, they have one fault. They are not positive. If you start from the motor with a certain number of revolutions, you lose a portion of them with every belt used. This is the only fault of the system. It is noiseless, yielding, and regular, but, unlike cog wheels, it is not positive. The number of revolutions that are lost may, and do, vary continually by changes of the load or of the atmosphere. It is upon these peculiar changes of our favorite system that I propose to speak to night. Belts derive their power to transmit motion from the friction between the surface of the belt and the pulley, and from nothing else, and are governed by the same laws as friction between flat surfaces. The friction increases regularly with the pressure.

The lecturer then gave the results of some experiments with belts and pulleys to prove this. He found that there was a great difference in the friction of belts, and it was due to their elasticity of surface, that is, the more elastic the surface, the greater the friction. He made experiments with a pulley and belt, moved by a lever and spring balance, to show the difference in the actual friction between the grain and flesh sides of a leather belt in contact with a

smooth cast iron pulley. He said that the old rule, "that the number of inches in contact, multiplied by one half the velocity of the belt in feet per minute, and divided by 33,000, would give the horse power," might give it once in a hundred times, but not oftener. The rule is that a belt holds upon a pulley as the tension (pressure) and as the square of the degrees of wrap. A belt wrapped one quarter around a pulley has only one fourth the power of a belt wrapped one half around the same pulley with the same tension.

A line around a post will give a good illustration of this. One half a turn, and a man's weight is doubled: while a full turn, and his weight is nearly enough to stop a heavy boat, and two turns and his weight will stop the boat, or the line will part.

Belts always run to the high part of a pulley when the shafts are parallel; but when they are not, the belt will always run toward the ends of the shafts that are nearest together, and this tendency is much stronger than to run to the highest part of the pulley. If you have a belt that gives trouble in this way, you can see if it is the fault of your shafting by drawing a line across the edges of the two pulleys. Sometimes the bearings may be in line; but the tension of your belt is so great as to spring the shaft, so as to throw the pulleys out of line. A stiffer shaft or another bearing is the remedy. Leather and rubber belts each have their advocates, and each party say theirs is very much better; but each kind is better in its place. Where the belt is clear, a rubber belt will transmit 20 per cent more power with the same tension, and will last as long and run perfectly straight. It can be made of any length or width, of exactly the same thickness in every part, perfectly smooth on its surface; and when in use, every part will come in contact with the face of the pulley. The greater tractile power of a rubber belt is due to its surface elasticity.

Leather belts have to be made from pieces, and, as the leather is not perfectly flat, a perfectly flat belt cannot be made from it. If a belt is cut from the back of a hide, the edges are not so firm as the center, and upon a crowned pulley they will not hug as well as if they were of the same firmness as the center. If the belt is cut from one side of the back, then one edge will be less firm than the other, and the belt will be crooked, and one side will have more tension than the other. Leather belts are usually riveted at the joints. Now, if a rivet head touches the pulley, the friction is less than if the leather touched. If the head is above the surface of the belt, then a portion of the belt is not in contact with the pulley; and if the head is below the surface of the pulley; then of course there is no contact. Now every rivet in a belt is in one or the other of those positions, and leather belts would be improved by using something else in their place. Double leather belts are used more than single ones; but it is clearly a mistake, as a single leather one will transmit more of the power than a double one. If you look at the face of a leather belt, you will see when it has been used for a time, the face has a mottled appearance, light and dark, showing how much of the surface of the belt has been in contact with the pulley. If an average of one inch of width has not touched, then you have paid for one inch of belt that is of no use, but is really a detriment. Double leather belts run straighter than single ones, as the flank side of one part can be put against the back of the others. A double belt will stand a greater tension than a single one, but a single one will stand all that should be put upon any belt.

The cost of belting is increasing every year, and it is well to look out for the belt of the future. My impression is that it will be made of low steel of great tensile strength, and will run upon pulleys, with an elastic surface to give greater friction. The instance I mentioned, of a sheet iron belt running upon cast iron pulleys, is, I believe, in Pittsburgh. But we have a hundred instances of the steel belt upon an elastic surface pulley in this city, in the band saw, and one of a large sawmill sawing logs with a band saw about three inches wide. Now a band saw is a belt, and the power to do work is all derived from the friction between the band saw and the lower pulley. In the case of the sawmill spoken of, it amounts to from 10 to 15 horse power, and this is all transmitted by the saw itself. It may be said that we cannot get belts of steel wide enough to take the place of our large belts. Whenever such belts are wanted, they will be made of any width and length asked for.

Belts of the present make are run with a strain of one fifth their strength; and as the strength of low steels is over 100,000 pounds to the square inch, a belt one foot wide and one eighth of an inch thick would have a strength of 150,000 pounds or more. One fifth of that would give us 30,000 pounds; this strain, upon an elastic surface pulley of, say, 16 feet, running at a speed of 2,000 feet per minute, would give us a belt with the power to transmit over 1,800 horse power. If the belt were one sixteenth of an inch thick, it would be able to transmit 900 horse power. We have no belts now capable of anything like this. How will this belt be joined? When the band saw first came out, that was looked upon as the stumbling block in its way, but to-day they are joined without a thought, and in about the same time that it would take to join a belt of leather. The steel belt would be joined in the same way. Whether this steel belt is the belt of the future or not, there will be wanted a better and cheaper one than we now have, and it is to the practical engineers that we are to look for it.

Encke's Comet.

The return of Encke's comet to our heavens has been for some time expected, but its immense distance (182,000,000 miles) rendered all search with ordinary instruments useless. The large equatorial at the Naval Observatory, Washington, D. C., was recently put into service, and the comet was seen through this superb instrument by Professor Holden and Paymaster Tuttle of the U. S. N. Its distance rendered the use of the micrometer impossible, and it will scarcely be observable under ordinary conditions for several weeks.

It is known to our readers that the equatorial telescope above mentioned is one of the finest in the world. It is Alvan Clark's masterpiece, and has an objective 26 inches in diameter. Its power is now demonstrated in a remarkable manner

THE POST OFFICE A CARRIER OF MERCHANDISE.

Since the adoption of postal cards for cheap communication by mail, there has been no modification of our postal laws which so greatly accommodates the public as the one permitting the sending through the mails of nearly all classes of merchandise, in packages not exceeding four pounds in weight, at the low price of one cent for every two ounces. The following are some of the articles officially named as belonging to the class of merchandise that can be mailed at this low rate:

We copy from the *Post Office Guide*, which gives this provision of the law:

Rates of postage on third class matter: Mailable matter of the third class embraces all pamphlets, occasional publications, transient newspapers, magazines, handbills, posters, unsealed circulars, prospectuses, books, book manuscript, proof sheets, corrected proof sheets, maps, prints, engravings, blanks, flexible patterns, articles of merchandise, sample cards, phonographic paper, letter envelopes, postal envelopes and wrappers, cards, plain and ornamental paper, photographic representations of different types, seeds, cuttings, bulbs, roots, scions, and all other articles not above the weight prescribed by law, which are not, from their form or nature, liable to destroy, deface, or otherwise injure the contents of the mail bag or the person of any one engaged in the postal service.

All packages of matter of the third class must be wrapped or enveloped, with open sides or ends, so that their contents may be readily and thoroughly examined by postmasters without destroying the wrappers; but seeds and other articles liable, from their form or nature, to loss or damage unless specially protected, may be inclosed in unsealed bags or boxes which can readily be opened for examination of the contents and reclosed; or closed bags, made of material sufficiently transparent to show the contents clearly, without opening, may be used for such matter.

No writing will be permitted on articles of this class, or their wrappers or envelopes, except the address of destination. Any other writing in or upon any package or article of this class will subject it to letter rates of postage.

Matter of the third class inclosed in sealed envelopes notched at the ends or side, or with the corners cut off, cannot be mailed except at letter postage rates.

The following, and some other articles unnecessary to specify, are unmailable: Packages containing liquids, poisons, glass, explosive chemicals, live animals, sharp pointed instruments, sugar, flour, or any other matter liable to deface or destroy the contents of the mail, or injure the person of any one connected with the service.

Persons living at a distance can send small models much cheaper by mail than by any other means; and if properly packed, they usually arrive at their destination in good condition. We receive a number of models from various parts of the country by every mail; and the only trouble we have with packages so sent arises from the sender not following the official rule, which requires that the package shall not be sealed, and shall not contain any writing; and that the full postage on the package shall be prepaid. When the sender does not observe these requirements, we are obliged to pay full letter postage, which makes the cost by mail greater than by express.

By observing the law's requirement, inventors can avail themselves of the mail, for transmitting their models from distant places to this office, to great advantage. But one thing which we would forcibly impress upon our clients is that, by the same mail in which they forward the model, they should *announce the sending* in a separate letter, giving description of the invention, time of sending model, name of post office and State, and full name of inventor. Observing these rules will save us much trouble, and insure a prompt answer to the sender.

Spiritualism to be Medically Considered.

Dr. G. M. Beard lately read before the Medical Society of the County of New York an extensive paper on "The Relation of the Medical Profession to Popular Delusions, Spiritualism, Mind-Reading, Clairvoyance and Animal Magnetism." He reviewed the many delusions which have appeared in this country on this subject. He looked upon them as a species of epidemics which from time to time immemorial have periodically made their appearance.

A committee of five, consisting of the following gentlemen, Dr. J. C. Peters, Dr. Fordyce Barker, Dr. Ellsworth Eliot, Dr. Austin Flint, and Dr. A. B. Crosby, was appointed to consider, and report on, the following questions:

1. Is the state or condition of mind known generally as the mesmeric state a reality or a deception?

2. If it is a real physiological state, what are the conditions necessary to its production, and what the phenomena attending it?

3. Is it a state to which one mind can subject another, or does it depend on some conditions voluntarily submitted to by the individual?

4. Is it possible, while in this so-called mesmeric trance, or at any other time, or in any other condition known to man in his mundane experience, for one person to divine what is passing in the mind of another, except through the medium of signs?

5. Is there any such faculty known to our race as perceiving, by some mysterious second sight, what is transpiring in places far beyond the reach of ordinary human vision, or what is written on a paper when an opaque object lies between it and the person attempting to read?

6. Is there any evidence that the well known law of gravitation is ever overcome by a force hitherto unrecognized by scientists?

The members of the committee are all of them eminent physicians in this city, and will doubtless be glad to receive statements of evidence and experience from all who can supply such information.

In no case in general practice should the pressure, on even the slowest moving journals, be allowed to exceed 1,000 pounds per square inch of longitudinal section with steel journals, or about 600 on iron, in well-worn boxes.

Apples should be stored in cellars where there is a thorough circulation of air.

DECISIONS OF THE PATENT OFFICE.

NEW PATENT RULE CONCERNING REJECTED CASES.

In the matter of the application of George L. Rouse and M. W. Stoddard for a patent for an alleged "Improvement in Wheels," filed May 18, 1874. On appeal from the Examiner-in-Chief:

Two claims are left in the application which the examiner rejects for want of novelty, citing as references the patents of P. Murphy, August 12, 1873, and the application of Charles Spofford filed August 2, 1874, and rejected the 8th day of the same month. The Examiners-in-Chief have affirmed the decision of the Examiners below, on the ground that the patent of Murphy is a good and sufficient answer to the claims of applicants. They have not discussed the pertinency of the rejected application of Spofford, as a reference.

After a careful examination, I have come to the conclusion that the Murphy patent is not a sufficient answer to the claims of Rouse and Stoddard, which are limited to the special construction shown and described by them. It is admitted, however, that the construction of wheel hubs shown and described in the application of Spofford is almost identically the same as that of applicants. More than two years having elapsed since the final rejection of Spofords' claim, his application is regarded as abandoned under the 32d section of the patent act.

It is insisted on the part of the applicants that, in view of recent decisions of the courts, a rejected and abandoned application does not constitute a bar to the grant of the patent sought by them. It becomes necessary, therefore, to examine this question and determine the practice of the Office in view of the decisions referred to.

Within a few years, several decisions have been rendered in the United States Circuit Courts, in which the effect on patents of prior rejected applications has been discussed; but the question did not receive the attention of the Supreme Court, until the case of Brown *vs.* Guild came up on appeal during the October term of 1873. One of the defenses set up against the Brown patent was an old application filed by Remy and Kelley in June, 1850, which was rejected and withdrawn the August following. The evidence showed that only one machine was ever made by them, and this merely for experiment, in the year 1849. In discussing the effect of this application on the validity of Brown's patent, the court uses the following language:

"The experiment made in 1849, when Remy worked it by hand, was a mere experiment which was never repeated. It may have presented one or two ideas in advance of other machines, but it can hardly be said to anticipate the machine which we have described as Brown's. Were it not for the application for a patent, it would justly be regarded as an abandoned experiment, incapable of being set up against any other claim. Can the fact that such an application was made and afterward voluntarily withdrawn, and never renewed make any difference? We think not. Had a patent been actually granted to Remy and Kelly it would have been different. The case would then have come directly within the seventh section of the act of 1836, which makes a "patent," or a "description in a printed publication" of the invention claimed, a bar to further patent therefor. But a mere application for a patent is not mentioned as such a bar. It can only have a bearing on the question of prior invention or discovery. If upon the whole of the evidence it appears that the alleged prior invention or discovery was only an experiment, and was never perfected or brought into actual use, but was abandoned and never revived by the alleged inventor, the mere fact of having unsuccessfully applied for a patent therefor cannot take the case out of the category of unsuccessful experiments." Brown *vs.* Guild, 6 *Off. Gaz.*, 392.

There can be no mistake as to the meaning of this language; the doctrine is distinctly announced that a mere application is not a legal bar to the grant of a patent to a subsequent applicant. This decision must be heeded by the Commissioner of Patents, and govern him in regulating the practice of the Office. I have had frequent occasion to state my views on the necessity of harmony between the practice of the Patent Office and rulings of the courts. There can be no question about the propriety of this course. The Commissioner ought not either to issue patents which the courts will declare invalid, nor to refuse the grant on grounds which have already been considered judicially and declared insufficient. But it will be noticed that the Supreme Court does not entirely ignore abandoned applications, for it is stated that they have a bearing on the "question of prior invention or discovery," and the effect of the application is made to depend on the question of actual use of the invention described therein.

It has been urged in argument that, if no objection appears to the grant sought by Rouse and Stoddard except the abandoned application of Spofford, the Commissioner should issue the patent and allow the question of public use to be determined hereafter in the courts. The suggestion must have its origin in a misconception of the duty of the Commissioner of Patents. The law makes him something more than a mere ministerial officer, whose function is to issue letters patent simply for the asking. The Commissioner is made the guardian not only of the rights of inventors, but also of the interests of the public. It is just as solemnly his duty to refuse to issue a patent which clearly ought not to be granted, as to grant the issue when the applicant shows an unimpeached right to the invention.

In this case, if without further inquiry the Commissioner should issue a patent to Rouse and Stoddard, and it should afterwards appear that the invention of Spofford was put into public use, it would be invalid, as I understand the decision which has been quoted.

It is his duty, therefore, to inform himself on this question, if possible, and the application of Spofford indicates the direction in which inquiry may be made. The only question in my mind is how to prosecute the investigation. The law restricts interferences to unexpired patents and pending applications.

An interference, therefore, cannot be declared with an abandoned application. I have no doubt whatever, however, that the Commissioner of Patents has ample authority to institute an *ex parte* inquiry at any time, for the purpose of determining whether or not a statutory bar exists to the grant of a patent for which application is pending. This is necessary to enable him to comply with the statute. Unsatisfactory as *ex parte* evidence may be, it appears to be the only source of information open to the Commissioner in cases like the present, without further legislation; and I do not believe that in a single instant a patent should issue for an invention shown in a prior abandoned application without an attempt, at least, to settle the question of public use.

The decisions of the Examiners-in-Chief, affirming the Examiner on reference to the patent of Murphy, is reversed. The application of Rouse and Stoddard is remanded to the Examiner, who is instructed to forthwith dispatch letters of inquiry to the applicant Spofford, and to his attorney of record, for the purpose of ascertaining whether the invention of the former has been brought into actual use. At the same time, they will be informed that an application is now pending for the same invention, and that the inquiry is made for the purpose of determining the right of subsequent applicants to a patent therefor. Information furnished by them should be in the form of affidavits, clearly and fully setting forth the facts in the case. Counter affidavits will also be received from applicants if they so desire. The issue of a patent will be determined by the information thus received.

Until otherwise ordered, this will be the rule and practice in the Patent Office in like cases.

J. M. THACHER, Commissioner of Patents.

Jan. 28, 1875.

NEW BOOKS AND PUBLICATIONS.

DIGEST OF PATENTS RELATING TO BREECH LOADING AND MAGAZINE SMALL ARMS (except Revolvers), granted in the United States from 1836 to 1873, inclusive, Classified according to the Movements for Opening and Closing the Breech. By V. D. Stockbridge, Examiner in the U. S. Patent Office (Class of Fire Arms). Price $25. Washington, D. C.

The author, in undertaking a work requiring very laborious and patient research, has done good service to a large class of inventors. Over 700 patents are here fully described and illustrated, forming a complete history of the art during nearly 40 years. The illustrations are very clear and elaborate, and the work is sure to be much referred to by inventors and patent solicitors. The author states, with apparent justice, that the high price of his work is justified by the limited sale which such a production can attain.

REPORT OF THE TOPOGRAPHICAL SURVEY OF THE ADIRONDACK WILDERNESS FOR THE YEAR 1873. By Verplanck Colvin. Albany, N. Y.: Weed, Parsons, & Co.

The important survey of the Adirondack region covers nearly 5,000 square miles, and was commenced by Mr. Colvin at his own expense; but it was found to be so important that State aid was, in 1872, granted for the extension and continuation of the work. It is not possible here to describe the scenes of grandeur and the picturesque traveled, or the many valuable results in meteorology and topography achieved, by the investigators; but if any of our readers are interested in this region, the volume now before us will well repay them for the trouble of perusal.

THE BRITISH JOURNAL PHOTOGRAPHIC ALMANAC AND PHOTOGRAPHER'S DAILY COMPANION. Edited by J. Traill Taylor. New York city: E. & H. T. Anthony & Co., 591 Broadway.

This volume is replete with information on the latest discoveries in photography, written in a pleasant and readable style. We have read the book with

much pleasure, and cordially recommend it to the profession.

THE AMERICAN SPORTSMAN, West Meriden, Conn.

The issue for January 30 has been received. It contains many articles of interest both to the naturalist and the sportsman.

PRINCIPLES OF METALLIC MINING. By J. H. Collins, F. G. S., Honorary Secretary of the Miners' Association of Cornwall and Devon, Author of "A First Book of Mineralogy," etc.

ELEMENTS OF MAGNETISM AND ELECTRICITY, with Practical Instructions for the Performance of Experiments, etc. By John Angell, Science Master of the Manchester Grammar School.

These two excellent little treatises are issued by Messrs. G. P. Putnam's Sons, Fourth avenue and 23d street, New York, at 75 cents each. They are included in the publishers' "Elementary Science Series."

Inventions Patented in England by Americans.

[Compiled from the Commissioners of Patents' Journal.]

From December 28, 1874, to January 14, 1875, inclusive.

BUTTON FASTENER.—D. Heston, Providence, R. I.
CAR JOURNAL BOX.—J. N. Smith, Jersey City, N. J.
CASTING UNDER PRESSURE.—J. Mackintire, Cambridge, Mass.
CLASP OR BUCKLE.—C. J. Weldon, San José, Cal.
CRIMPING APPARATUS.—A. B. Lowerre *et al.*, Newark, N. J.
CUTTING PLANE.—R. E. Lowe, Kane, Ill.
DRAWERS.—J. J. Fitzpatrick, Philadelphia, Pa.
ENAMELING PIPE, ETC.—American Enamel Co., R. I.
FIRE ARM.—J. Lee, Milwaukee, Wis.
FORMING HAT BODIES.—J. Wharton *et al.*, Newark, N. J.
FURNACE GRATE.—H. Ryder, Mass.
GAS LIGHTING AND HEATING.—L. Arnold, New York city.
HAMMER.—C. Parker, Meriden, Conn.
HAT MAKING MACHINE.—J. W. Corey, Newark, N. J.
KINDLING FIRES.—D. S. Silcox, Charleston, S. C.
KNITTING HATS, ETC.—A. Reed *et al.*, New York city.
LIFE MATTRESS.—J. F. Peck, Springfield, Mass.
LITHOLYCITE.—H. W. Bradford, Randolph, Mass.
LOOM.—C. H. Chapman, Shirley, Mass.
LOOM.—G. Crompton, Worcester, Mass.
MAKING HORSE SHOES.—J. Russell, New York city.
METAL CARTRIDGE.—A. C. Hobbs *et al.*, Bridgeport, Conn.
MUSICAL INSTRUMENT.—M. J. Matthews, Boston, Mass.
PACKING MATERIAL.—W. S. Fish (of Mystic, Conn.), Glasgow, Scotland.
PIANOFORTE.—W. R. Miller, Baltimore, Md.
RIVETING MACHINERY.—M. Bray, Boston, Mass.
ROTARY PUDDLER.—W. Sellers, Philadelphia, Pa., *et al.*
SCHOOL TEACHING APPARATUS.—M. McVicar, Potsdam, N. Y., *et al.*
SHARPENING TWIST DRILLS.—C. Van Haagen, Philadelphia, Pa.
SLIDE VALVE.—S. F. Dodge, Detroit, Mich.
STEAM OR AIR ENGINE.—G. J. Wardwell, Rutland, Vt.

Recent American and Foreign Patents.

Improved Self-Discharging Hay Rake.

S. G. Huribut, South Union, Ky.—This invention consists of pivoted parallel rake heads, mounted on a rockshaft, for the purpose of dumping or raising the teeth off the ground when the rake is being transported from place to place. The wheels are smaller than usual, and the heads extend over and beyond them on either side. The teeth, which are hinged at their connection with the head by means of a hinge plate, are so controlled that they can be set at an angle receding one from the other, to the right or left, for the purpose of discharging the hay at either side of the rake in one continuous windrow without lifting them from the ground, thereby making a continuous raking, discharging the hay as fast as gathered from the side in a neat, light manner, leaving it in good condition for further curing.

Improved Coffee Roaster.

Michael W. Fry, Guyandotte, W. Va.—This invention relates to certain improvements in coffee roasters, and it consists in the combination, with a rotary moving cylinder, of an angular projecting air chamber upon the inside of said cylinder, which causes the coffee, when passing from one side of the cylinder to the other, to leave the hot periphery of the cylinder and fall over the shelf formed by the air chamber, by means of which the coffee is roasted uniformly and prevented from burning. It also consists in combination with the air chamber of a stop pin or plate attached to the cylinder, and ledges or flanges upon the framework, which limit the reciprocating motion of the cylinder to a semi-revolution.

Improved Hay Derrick.

George W. Martin and James C. Moor, Brookston, Ind.—This invention relates to certain improvements in hay derricks. It consists in two A-shaped frames, connected at the top by a wire cable, and held slightly inclined toward each other by guy ropes attached to picket pins. Upon said cable rests a movable frame containing two sheaves, one running upon the cable and the other supporting the rope attached to the hay fork. This movable frame engages with a latching catch at one end of the cable to hold it stationary until an adjustable stop unlatches the devices and allows the frame to pass laterally to the desired position, the movable frame being restored to its original position by a weight suspended upon a pulley running on the guy rope.

Improved Shutter Fastening.

John D. Jones, Omaha, Neb.—The invention consists in using a box that allows the notched locking bar or rod to pass through slots thereof, while the bolt and spring are fully protected, and yet easily operated by the thumb piece.

Improved Lamp Burner.

Aaron C. Vaughan, Rainsburgh, Pa.—The invention consists in means whereby a stronger light may be obtained without the consumption of additional oil, the same being accomplished by a more perfect supply of oxygen and less consequent waste in the shape of partially combusted carbon.

Improved Car Coupling.

Menasseh Pettengill, Minneapolis, Minn.—The invention is an improvement in automatic car couplings, and consists in providing the sliding head of the buffer with a series of parallel, horizontal, semi-circular grooves or cavities to receive the curved end of the link, the construction being such that the latter may be held or supported horizontally at various angles, or readily changed from one groove to another without withdrawing the coupling pin.

Improved Lamp Stove.

Edward A. Rippingille, Holborn, Middlesex county, Eng.—The object of this invention is to provide a combined stove and lamp in which the heating properties of a lamp are utilized to form a small cooking stove, and the lamp still allowed to perform its function of lighting the room. It consists in a flat lamp of peculiar construction which slides into the stove frame, which latter is provided with reflectors and a glass door.

Improved Car Coupling.

Benjamin Slusser, Sidney, Ohio.—The invention consists in novel means whereby cars may be conveniently coupled, securely held together, and easily uncoupled, while a car that switches off the track will at once become disengaged, and those whose drawbars are of unequal hight are coupled with the same facility. It is without a coupling pin or other device susceptible of being lost or readily stolen.

Improved Croquet Mallet.

Thomas H. Logan, Fort Leavenworth, Kan.—The invention consists in making the mallet stock in two sections, recessed to receive a handle, and held by clamp screws.

Improved Smoke Stack.

Darerick Allard, St. Albans, Vt.—This invention relates to certain improvements in smoke stacks for locomotives, etc, and it consists in an adjustable discharge pipe for the cinders and sparks contained inside the smoke stack, and terminating above in a funnel-shaped mouth, in combination and concentric with an inverted conical plate provided with spiral grooves, an annular cap for directing the current down the interior of said plate, and an inverted conical cage of gauze wire; whereby the draft of the smoke stack is regulated and the sparks and cinders eliminated and carried off.

Improved Funnel for Barrels.

August Pforr, Baltimore, Md.—The invention relates to funnels through which liquids are run into barrels, casks, and other packages, and consists in a novel indicator by which it will always be promptly shown when the package is full, and by which all waste is effectually prevented.

Improved Box for Car Axles.

John M. Brosius, Richmond, Va.—The invention relates to axle boxes generally, but particularly to the middle boxes of trucks adapted to changeable gages, and consists in the several features of improvement whereby the axle box is rendered more easily removable, the lubricant more readily injected upon the ends of the journals, and each axle to certainly follow the other in turning off upon switches.

Improved Design for Graves.

Isaac G. Lunday and C. G. Anglin, Hickory Flat, Ala.—The invention consists in placing over the grave successive slabs growing successively smaller, until the highest is reached, when a monument, shaft, or column surmounts them all.

Improved Railroad Car Truck.

John M. Brosius, Richmond, Va.—The invention consists in certain novel features of invention by which car trucks may be adapted to use on railroads of different gages, spacing the wheels automatically to suit each change of gage, and thus rendering entirely unnecessary the breaking of bulk in the freight, or the transfer of passengers from one road to another.

Improved Car Coupling.

George W. Call, Nashua, N. H.—On the approach of cars, link-supporting lever frames are first brought in contact, and are gradually swung below their respective drawheads, while the link enters at the same time into the cavity of the drawhead to be coupled. The concussion of the drawheads carries both in backward direction, and releases thereby latch levers from their seats, dropping thereby pin guide frame and pin, and coupling the cars.

Improved Cotton Press.

William T. Crenshaw and Robert J. Carothers, Burton, Tex.—The invention relates to a perforated hopper into which the cotton is received from the gin, and from which it is discharged by feed rollers into the press; also, to locking the revolving press box to a fixed base, and thereby relieving its pivot bearings of the strain due to the action of the screw which operates the follower.

Improved Car Coupling.

Henry Dutcher, Port Jervis, N. Y.—As the cars are run together and heads formed upon the coupling bars catch upon each other, the downwardly projecting parts of the upper head straddle the body of the lower head, which prevents the coupling from being uncoupled by the lateral movement of the cars.

Improved Toy Bubble Pipe.

F. Wright Pease, Metuchen, N. J.—This invention consists in the combination, with a flexible stem and suitable mouth piece, of a bowl provided upon the edges of its mouth with ledges, projections, or grooves, which, by retaining a portion of the soap solution, enable the operator to blow a much larger bubble.

Improved Eaves Trough Hanger.

Edward Kirk, Jr., Sheridan, Ill.—This consists of a lateral brace, with forked ends or prongs, which are driven in horizontal direction through the gutter near its inner edge into the frame of the roof. The prongs are bolted to a metallic band, arranged to embrace with one end the outer rim of the same, while the upwardly inclined rear part is attached to the shingles and roof frame.

Improved Range.

Edwin O. Brinckerhoff, New York city.—The space between the bottoms of the inner and outer cases is occupied by a drawer, the interior of which is divided into two equal parts by a vertical division plate. The side parts of the drawer are divided into flues by vertical division plates, extending from the ends of said drawer nearly to the central division plate. The rear division plates are placed a little in front of the rear wall of the inner case. The spaces between the inner ends of the rear division plates and the central division plate are provided with dampers, which are raised and lowered, to close and open said spaces. The flue for conducting the products of combustion from the range to the chimney projects in the rear of the middle part of the back of the outer case, and fits into a recess formed to receive it in the brick work inclosing the rear part of the range. The flue is divided into two equal parts by a vertical division plate, openings into the flue being formed through the lower middle part of the back wall of the outer case, and in line with the spaces at the sides of the central division plate of the drawer.

Improved Horse Power.

Reuben Stiles, East Troy, Pa.—This invention is an improved horse power for operating a churn, and for other purposes, which is so constructed that its rear end may be conveniently raised and lowered to give the endless chain any required inclination, and the endless chain may be conveniently tightened or slackened, as may be desired. To the front parts of the frame of the machine, at a suitable distance from their lower ends, are attached bearings in which a shaft revolves. To one end of the shaft is attached a crank wheel, from which motion is given to the machinery to be driven, and which is made heavy, to adapt it to serve as a fly wheel. To the middle part of the shaft, at a suitable distance apart, are attached two wheels, the rims of which are notched to receive rods, which are connected to each other by straps to form an endless chain, and to which are attached the cross bars or planks, upon which the horse or other animal walks, to give motion to the machine. The inventor is willing to negotiate for the sale of territory or to manufacture on royalty, and can furnish patterns and directions for the use of intending manufacturers.

Improved Harrow.

Peter S. Carhart, Collamer, N. Y.—The bars of which the beams are composed are clamped together by bolts with teeth, and bars or metal plates between them, either one or both being notched to receive and hold the teeth. The notches in the clamping plates are contrived with extensions inclined front and back, above in one direction and below in the other, and the teeth are pivoted, so that when the harrow is drawn in one direction the teeth will be vertical, and when drawn in another direction they will be inclined. The tooth shifts according to the way the harrow is drawn, but at the same time is held tight.

Improved Cheese Knife.

George E. S. Phillips and William A. Young, Berryville, Va.—The knife is made of such a length as to reach from the center to the edge of the cheese, and the ends are attached to a semicircular bar so that it has a slight longitudinal rock. The outer end of the knife and bar are held down by a spring, the free end of which rests upon the outer end of the curved bar, so that the knife may operate with a sliding cut, cutting the cloth first. A suitable construction enables the arm, to which the knife and bar is secured, and its attachments to be swung out of the way to enable a cover to be placed over the cheese.

Improved Pump.

George Harrison Laub, West Lebanon, Ind.—The invention relates to the means whereby the lower valve is detachably connected to the side of the inclosing cylinders, and the seat for said valve is adapted for ready removal when the sand collected beneath and around it requires to be washed out of the cylinder.

Improved Bouquet Holder.

Jurias G. Dreher, Pine Grove, Pa.—This invention is an improved bouquet holder, simple in construction and convenient in use, which will keep the stems of the flowers moist, and thus keep the flowers fresh for a long time, and which may be carried about without spilling the water. It consists in the combination of a slotted tube, conical flange or cup, gum elastic case, and sponge with each other and with a rod and conical base, a rubber plate, a flanged tube, and a spring bolt, which together form a well arranged device for the stated purpose, adapted for use as a vase as well as for carrying in the button hole, etc.

Improved Beer Regulator.

John Obrecht, Tell City, Ind.—For the purpose of providing a simple apparatus for regulating and preserving beer, a larger water receptacle is provided, with an interior smaller gas reservoir. The same is connected, by intermediate branch pipes with a check valve and stopcock, to the gas-distributing pipes, with stopcocks and water indicators, and then to the kegs containing the beer for the action of the gas thereon. The water tub is connected by a pump with the faucets of the empty kegs, for pumping water therein, and so as to force, by the distributing and reservoir connecting pipes, the liberated gas back to the reservoir for being applied to the next keg to be tapped.

Improved Process of Coloring Photographs.

Jeremiah Gurney, New York city.—The photographs are retouched and colored on the front side in the usual manner, and then rendered transparent by the application of a suitable mixture of white wax and kerosene. The colors are thus already fastened to some extent to the front side of the picture. A thin coat of glycerin is then applied to the front side of the picture, for fixing the colors and protecting them completely against the action of the gelatin, into which the picture is immersed, and then, face downward, placed on the collodionized plate glass. The gelatin or binding substance forms the connection of the photograph and the collodionized surface. The excess of gelatin is then gently pressed out and the whole dried and hardened, being ready to receive the finishing coloring on the back of the picture. As the picture is transparent, it may be worked up with equal facility as on the front side, without the risk of losing the likeness, while the colors appear with an exquisite softness and delicate finish. One or more thicknesses of cardboard soaked in warm gelatin are next placed on the back of the picture and the whole dried again, to be then cut around the edges for taking it, with the enameled surface, off the glass plate, the enameled surface adhering firmly to the photograph and protecting the same.

Improved Car Propeller.

Casper Devilbiss, Shellsburg, Iowa.—A series of posts is set in the ground on each side of the railroad, in order to support wheels having a high flange on the outside. These wheels may have each a separate shaft, but it is preferred to hang them on the ends of shafts which span the road. The bars of the car frame are made to run between the flanges of wheels and on their peripheries. A guide and friction bar is elevated over the middle of track, and friction rolls are provided, between which the bar is passed. The upper roll is attached to a sliding gate and made adjustable, so as to increase or diminish the friction, according to the load. The lower roll is connected with and worked by the engine, which is arranged on the car in any convenient position. By turning the crank the rolls are turned so as to then bite upon the bar, thereby drawing the car over the wheels.

Improved Sawing Machine.

George W. Bell, Orange, Tex.—In this device sleeve boxes for the shaft which drives the saw are employed in consequence of the great weight of the saw and swing frame, to relieve the shaft, by being permanently fixed in the frame, so as to support the weight. The push bar, for feeding the saw to the log, is jointed to the swing frame at one end, and works between friction feed rollers, one of which is arranged in fixed bearings, and the other in sliding bearings, which are connected with a lever. The latter is forced down on the feed bar to set it in motion by the hand, and raised to throw it off to stop the bar by a spring. A weighted cord turns an eccentric pulley, which is so connected with the swing frame by a cord that, when the feed rollers are thrown out, the weight will, by turning the pulley and winding a rope upon it, swing the saw back.

Improved Machine for Melting Snow.

Charles G. Waterbury, New York city.—The essential feature of this invention consists of a series of burners for hydrocarbon oils, arranged on a portable machine, in combination with a reservoir or a retort and suitable pipe connections for supplying the oils or vapors to the burners. The arrangement is such that when vapors are burned they will be discharged into the burners with the requisite force by means of pressure in the retort, to drive the flame down on the snow and ice to be melted with great force. The invention also consists of the combination, with the above, of a steam boiler and pipes, for discharging steam jets into the burners, or below them, to combine with the vapors or oils, both for impelling the flame and for increasing the heat. Another feature of the invention consists of runner plates attached to the sides of the machine for closing in the space under the machine to the ground, for confining the heat, the said plates being capable of rising and falling, as required by irregularity of the surface, and for lifting them off the ground when the machine is to be turned around. There is also a horizontal revolving brush of steel wires, closing in the under space immediately in front of the burners, to prevent the escape of heat that way, and to be used for stirring and breaking up and throwing the particles of snow into the flames behind.

Improved Combined Baby Jumper and Swing.

Clara Jane Haney and Sarah Ann Coleman, Edwardsburg, Mich.—A bracket supports, by means of a strap, a frame made of two vertical rods and two cross bars. The vertical rods pass through a sliding cross piece, beneath which are spiral springs. The straps for holding the child are connected with the cross piece.

Improved Almond Grater.

Julius Levy, San Francisco, Cal.—This is a roughened porous cylinder revolving within a hopper, the bottom and sides of which are also roughened, and conform with the roundness of the cylinder near its base. This insures the almonds being thoroughly grated before passing into the receptacle below.

Business and Personal.

The Charge for Insertion under this head is $1 a Line.

Agricultural Implements, Farm Machinery, Seeds, Fertilizers. R. H. Allen & Co., 189 & 191 Water St., N.Y.

Magic Lanterns, Stereopticons of all sizes and prices, for Parlor Entertainment and Public Exhibitions. Pays well on small investment. Catalogues free. McAllister, Man'f'g. Optician, 49 Nassau St., N. Y.

Fleetwood Scroll Saw, with Boring Attachment, or all descriptions of light Scroll Sawing. See adv't., page 93. Trump Bro's, Manufacturers, Wilmington, Del.

Wanted—A situation by a first class Tool Maker, to work on Tools or Model Work. Would prefer situation with some one Experimenting. Also competent to take charge of men. Address P. O. Box 601, Stamford, Conn.

Steam and Water Gauge and Gauge Cocks Combined, requiring only two holes in the Boiler, used by all boiler makers who have seen it. $15. T. Holland, 57 Gold St., New York.

Nickel Plater's Complete Set—Nickel Anodes, all Salts, &c. L. Feuchtwanger & Co., 180 Fulton St., N.Y.

A Manufacturing Co., having unemployed machinery and capital, would like to purchase an established business, or secure the right to make some useful implement—in the hardware line—protected by a patent. Address Manufacturer, Box 3,793, P. O., New York.

For Sale, Cheap—The patent right for the best Broiler and Cake Baker out. Address Clayton Denn, Frankford, Pa.

Send for Circular of a very Superior Boiler Feed Pump. D. Frisbie & Co., New Haven, Conn.

Geo. P. Rowell & Co.—The success of this firm has been something unparalleled in the history of the business. We lately heard an anecdote related of a traveling representative of a well-known patent medicine firm who was endeavoring to contract with the publisher of a leading Western paper. "I am impressed, said he, "with your establishment; it reminds me of that of Geo. P. Rowell & Co., of New York, with only this distinction: you ask a great deal of money for a little advertising, and they give a great deal of advertising for a little money." This is the impression that many obtain and not without justice, for although Messrs. Geo. P. Rowell & Co. have never claimed to be able to insert advertisements in newspapers at lower prices than the publishers would accept from equally responsible advertisers, who furnish a similar amount of patronage, yet in this last clause lies much of their success. For some years they have been the largest customers of most of the newspapers published in the United States.—[New York Standard, October 20th, 1870.]

"Book-Keeping Simplified." The whole system briefly and clearly explained. Complete Instruction. Cloth, $1. Sent, post paid, on receipt of price. D. B. Waggener & Co., 424 Walnut St., Philadelphia, Pa.

The Whitmore Engine, 4, 5 and 10 H. P. Vertical Tubular Boilers, all sizes—at reduced prices. Lovegrove & Co., Philadelphia, Pa.

$20,000, more or less, as needed, with services, will be furnished by a person of experience in business, for an interest in a first class established and profitable Manufacturing Co. Address "Capital," Box No. 130, N. Y. Tribune.

Steel Springs tempered or made after pattern. J. F. Dubber, 48 Hicks St., Brooklyn, N. Y.

Every Metal Worker should have a Universal Hand Planer. Address J. E. Sutterlin, 60 Duane St., New York.

Circulars addressed and stamped ready for owner to mail. Lists of all trades, very complete. H. Walsh, Copyist, 6 Gold St., New York, up stairs.

Scientific Books. Send stamp for Illustrated Catalogue. E. & F. N. Spon, 446 Broome St., New York.

Petroleum Gas Works—J. D. Patton, Trevorton, Northumberland County, Pa. References: Sunbury (Pa.) Gas Light Co.; Mahanoy City (Pa.) Gas Light Co.; Ashland (Pa.) Gas Light Co.; Philadelphia & Reading RR. Co., Reading, Pa.; Bloomsburg (Pa.) Gas Light Co.; Shamokin (Pa.) Gas Light Co.; Shenandoah (Pa.) Gas Light Co.; Col. W. R. Murphy, Trenton, N. J.

Screw Cutting Index & Rule for Compound Gearing, Price 10c. Address E. Lyman, C. E., New Haven, Ct.

Wanted—A second hand 15 or 18 inch turbine wheel. For information, address W. W. Shepherd, Fayetteville, N. C.

Soap Stone Packing, in large or small quantities. Greene, Tweed & Co., 18 Park Place, New York.

The Mystic Puzzle, or the Yankee's Dream. Sent by mail. Address, with 25 cts., W. F. & J. Barnes, Box 2,044, Rockford, Winnebago Co., Ill.

Extension Engine Lathe, the best Jobbing Lathe built. Send for cut to E. Harrington and Son, North 15th and Pennsylvania Avenue, Philadelphia, Pa.

Engines, 2 to 8 H.P. N. Twiss, New Haven, Ct.

Baltimore Steel Hoe Works, Manufacturers of the "Lockwood Hoe." Send for Sample and Price List.

Peck's Patent Drop Press. Still the best in use. Address Milo Peck, New Haven, Conn.

To Inventors—A responsible firm wishes the right to manufacture some useful article in Cast Iron or Machinery, as a specialty. Address, giving description of article, "Machinist," Station B, Philadelphia, Pa.

Our Taper-Sleeve Belt Pulleys fasten securely, using no Keys, Set-Screws or Bolts. Our Dead-Pulleys stop all loose-pulleys and belts, attached to machinery not in actual use. Cold-Rolled Shafting, Collins' Couplings, best Hangers. A. B. Cook & Co., Erie, Pa.

Hand Fire Engines, Lift and Force Pumps for fire and all other purposes. Address Rumsey & Co., Seneca Falls, N. Y., U. S. A.

Metallic Pattern Letters and Figures, to put on patterns of castings, all sizes. H. W. Knight, Seneca Falls, N.

Millstone Dressing Diamond Machines—Simple, effective, economical and durable, giving universal satisfaction. J. Dickinson, 64 Nassau St., New York.

Walrus Leather Wheels, for polishing Iron, Steel, and all fine Metals. Greene, Tweed & Co., 18 Park Place, New York.

For small size Screw Cutting Engine Lathes and Drill Lathes, address Star Tool Co., Providence, R. I.

Inventors of Electrical and Telegraphic arrangements are invited to communicate with the Electro-Magnetic M'f'g Co., 36 Broad St., P. O. Box 1894, New York.

Genuine Concord Axles—Brown, Fisherville, N.H.

Wanted, by Manufactory of Steam Engines and Standard Articles, $20,000. Address John, 1892 Olive St., St. Louis, Mo.

Spinning Rings of a Superior Quality—Whitinsville Spinning Ring Co., Whitinsville, Mass. Send for sample and price list.

Mining, Wrecking, Pumping, Drainage, or Irrigating Machinery, for sale or rent. See advertisement, Andrews' Patent, inside page.

Faught's Patent Round Braided Belting—The Best thing out—Manufactured only by C. W. Arny, 301 & 303 Cherry St., Philadelphia, Pa. Send for Circular.

Temples and Oilcans. Draper, Hopedale, Mass.

The "Scientific American" Office, New York, is fitted with the Miniature Electric Telegraph. By touching little buttons on the desks of the managers signals are sent to persons in the various departments of the establishment. Cheap and effective. Splendid for shops, offices, dwellings. Works for any distance. Price $6, with good Battery. F. C. Beach & Co., 263 Broadway, New York, Makers. Send for free illustrated Catalogue.

For best Presses, Dies, and Fruit Can Tools, Bliss & Williams, cor. of Plymouth and Jay, Brooklyn, N. Y.

Engines and Boilers a Specialty—1st class; new patterns; late patents; reduced prices. Plain and Cut-off Hor'l and Vert'l Engines; Hoisting Engines; the celebrated Ames' Portable Engines; Boilers of all kinds; Climax Turbine; and the best Saw Mill in the market. Large stock always on hand. Hampson, Whitehill & Co., 36 Cortlandt St., New York. Works at Newburgh, N. Y.

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Small Tools and Gear Wheels for Models. List free. Goodnow & Wightman, 23 Cornhill, Boston, Mass.

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For Surface Planers, small size, and for Box Corner Grooving Machines, send to A. Davis, Lowell, Mass.

Planing Mill Machinery Wanted—Address, price and terms, Hunter & Tilley, Berkley, Norfolk, Va.

Hotchkiss Air Spring Forge Hammer, best in the market. Prices low. D. Frisbie & Co., New Haven, Ct.

Price only $3.50.—The Tom Thumb Electric Telegraph. A compact working Telegraph Apparatus, for sending messages, making magnets, the electric light, giving alarms, and various other purposes. Can be put in operation by any lad. Includes battery, key, and wires. Neatly packed and sent to all parts of the world on receipt of price. F. C. Beach & Co., 263 Broadway, New York.

For Solid Wrought-iron Beams, etc., see advertisement. Address Union Iron Mills, Pittsburgh, Pa., for lithograph, &c.

Fairy Electric Engines, with battery complete, $6; without battery, $4. Electro-Magnetic Manufacturing Co., 36 Broad St.—P.O. Box 1804, New York.

Cast Iron Sinks, Wash Stands, Drain Pipe, and Sewer traps. Send for Price List. Bailey, Farrell & Co., Pittsburgh, Pa.

For Solid Emery Wheels and Machinery, send to the Union Stone Co., Boston, Mass., for circular.

Mechanical Expert in Patent Cases. T. D. Stetson, 23 Murray St., New York.

All Fruit-can Tools, Ferracute, Bridgeton, N. J.

Hydraulic Presses and Jacks, new and second hand. Lathes and Machinery for Polishing and Buffing Metals. E. Lyon, 470 Grand Street New York.

Brown's Coalyard Quarry and Contractor's Apparatus for hoisting and conveying materials by iron cable. W. D. Andrews & Bro., 414 Water St., New York.

Notes & Queries

R. can mold rubber by the process described on p. 393, vol. 30.—F. will find a description of harness oil on p. 284, vol. 30. Black ink is described on p. 233, vol. 29; it may be made copyable by the addition of a little refined sugar.—R. H. will find full directions for modeling in clay on p. 58, vol. 24.—W. F. should consult a physician.—T. F. W. will find directions for removing ink stains on p. 43, vol. 31.

(1) E. H. asks: 1. What was the name of the first steamship that crossed the Atlantic Ocean from west to east? A. The Savannah, in 1818. 2. What was the first steamship that crossed from east to west? A. The Savannah returned in the same year.

(2) J. P. L. asks: How can I tint tracing cloth so that the tinted places will not wrinkle? A. Common tracing cloth will wrinkle at the first touch of moisture; but there is an oiled or varnished cloth that can be tinted with water color.

(3) J. A. K. asks: How can I cement amber? A. Take 4 ozs. orange shellac and 3 ozs. strongest rectified alcohol. Digest in a warm place. When of the consistence of molasses, it is ready for use.

(4) G. F. asks: If a man takes a pistol loaded with ball, and shoots straight up in the air, standing so that the bullet should happen to hit him, would it not kill him? A. We think not, as the resistance of the air would affect its velocity. We would not care to try the experiment, however.

(5) F. H. asks: Which is the hardest, 14, 16, or 18 carat gold? A. 14 carat is the hardest of the three.

How long are the days on the equator? A. The days and nights at the equator, meaning by day, the time the sun is above the horizon, are equal.

(6) E. asks: 1. Can copper be tempered? If so, to what degree, and what is the process? A. It can be hardened by hammering or rolling, but the temper cannot be drawn as in the case of steel. 2. Did the ancients know of a process by which copper could be tempered as hard as steel is now? A. The very hard ancient tools and weapons were made from an alloy of copper with other metals.

(7) N. N. asks: What action will frost have on cast iron pipe ⅝ inch in thickness, about 20 inches under the street paving, with the water all out? A part of the pipe is flanged and bolted together; the other is common socket soil pipe with leaded joints. A. It would cause the pipe to contract somewhat in length; but if provision were made for this, it would give no trouble.

1. I am about to build some sprinkling tubs of 900 gallons capacity. Can you give me an idea of the best shape to make them, to get the widest spread of water? A. It makes little difference about the shape of the tub, as the spread of water is usually obtained by the use of a sprinkling pipe of suitable form. 2. Is fresh or salt water used for sprinkling the streets in New York city? A. Fresh water. 2. Is fresh water considered unhealthy? A. We do not consider it so. There are some persons, however, who do.

(8) E. H. asks: What is the radius of the sharpest curve that a train can safely turn? Is there any difference whether the train be long or short? Is there any difference whether it be an arc of 10° or the whole circle? A. We doubt whether any one can answer these questions, as there are many curves on railroads, to-day, that a few years ago were declared to be impossible. They are not desirable features, however, and most engineers make the curves as large as circumstances will permit.

(9) F. W. asks: How can I cut a design in iron, as on a watch case? A. The designs on watch cases are usually cut by a tool, either by hand or machine.

How can I polish iron and brass? A. Use emery cloth for iron, after it has been filed or turned, and polishing brick for brass.

What power can I get out of an engine with a cylinder, 3¼ inches bore by 6 inches stroke, with 80 lbs. of steam? A. From 2¼ to 3 horse power.

(10) W. D. asks: What kind of cement is generally used between French millstone blocks when they are put together? A. A mixture of alum, the dust of the stones, and water, or molasses.

(11) M. V. O. says: A question has arisen as to how the lead of the valve of a locomotive is affected by raising or lowering the link. One party contends that the lead is greatest when the reversing lever is in full gear, either forward or back, and is least as the lever is hooked up nearer the center of the quadrant. Another party thinks that the lead is increased by hooking up. How is it? A. Both parties may be right, since the lead increases by hooking up if the forward eccentric works the top of the link, and diminishes if the contrary is the case.

(12) W. S. W. asks: How can I set the valves of a locomotive? Can it be done without taking off the steam chest covers? A. It would require a treatise to answer your question. Consult Auchincloss on "Link and Valve Motions."

(13) R. C. asks: What are the ingredients and what their proportion for enameling iron pots, sauce pans, etc.? A. A paste is made by fusing together 100 parts by weight of calcined ground flints, and 50 parts calcined borax, grinding the product, mixing it with 20 parts potter's clay, and enough water to give it the proper consistence. The pot is lined with this paste, which is allowed to dry in a warm room. Then fuse together 125 parts white glass, 25 parts borax, 20 parts soda. Pulverize the compound; and make it into a paste with 4 lbs. of soda and a sufficient quantity of hot water. Cover the lining of the pot with the paste, and heat it in a muffle until the glazing is fuzed.

(14) P. W. D. says: My friend says that the same power that will run a circular saw through a log with a feed of ¼ inch to revolution, will start the saw when standing in the middle of the log, with the same feed choking the teeth of the saw. I say that it will not. Who is right? A. Judging from the general practice of sawyers, who back the carriage when a saw stops in the cut, we should say that you were right. The amount in the difference of the two cases could only be determined by experiment.

(15) L. G. asks: What chemical preparation will purify or improve strong and rancid butter? I noticed recently an account of experiments (by Sonstadt) with iodate of calcium, which kept butter for three weeks, and rancid butter was improved by it; also that stale herring, immersed in a weak solution, came out perfectly fresh, etc. I sent for some of the iodate and received iodide of calcium. Is there any difference in the effect of the two salts? A. What you received is not the required salt, being a compound of calcium with iodine, whereas the salt employed for this purpose is a compound of calcium with iodic acid. The characteristic properties of the two are widely different.

(16) J. M. R. asks: 1. Would a shot gun barrel manufactured of decarbonized steel be apt to burst? A. We do not think it would be perfectly safe. 2. Is not decarbonized steel a fancy name for common iron? A. Probably.

(17) L. S. C. says: In a recent issue you state that a large circular saw requires more driving power than a small one, which is apparent, the number of revolutions per minute being the same with both saws: but will it require more power to drive a sixty inch saw, through a piece of timber, than a thirty inch saw, time employed being the same and size of timber the same in both cases? I claim that the larger saw will require only half the number of revolutions to give the same speed to the teeth as the smaller, and that the same power will do the same work in the two cases. A. You appear to have the correct idea. As we recollect the former question, however, it was supposed that both saws made the same number of revolutions per minute.

1. Does water expand in passing from the boiling to the freezing point? A. Yes. 2. Will a piece of ice exposed to an atmosphere of zero become as cold as the atmosphere, or as cold as any other object exposed in same atmosphere, or does it remain at same temperature as when changed from water to ice? A. Yes. 3. Does it expand in passing from 32° to zero? A. It will contract.

(18) E. E. K. asks: 1. Would a receptacle having an internal hydraulic pressure sufficient to show an external moisture cause the cast iron receptacle to break? A. Not necessarily. It would depend upon the strength of the receptacle or casting. 2. If such moisture should appear, would the internal pressure be reduced? A. We think not. 3. Would a constant pressure producing such a moisture eventually fracture a casting? A. Not necessarily.

(19) P. & W. ask: 1. How are burglar alarms applied to the doors and windows of a dwelling house? A. Strips of metal are attached to the doors and windows, and to the frames, in such a manner that the raising of a window or the opening of the door will close a circuit and ring a bell. 2. What kind of a battery is best? A. A Callaud, Smee, or Leclanché battery will furnish a cheap and constant electromotive force, and all are equally good.

(20) R. asks: How can india rubber be hardened? A. Take 30 parts sulphur, and 70 parts pure rubber cut fine, mix thoroughly, put into a mold; keep under pressure of about 12 lbs. to the inch in a heat of 315° Fah. for 2 hours.

(21) G. C. P. Jr. asks: How can I make printer's ink? A. Take balsam capivi 9 ozs., lampblack 3 ozs., indigo and Prussian blue together 1¼ ozs., Indian red ¾ oz., yellow turpentine soap (dry) 3 ozs. Grind to an impalpable smoothness.

(22) W. H. H. asks: Can you give me a recipe for a baking powder containing ammonia? A. Take tartaric acid ¼ lb., alum ¼ lb., bicarbonate of soda ¾ lb., farina 1 lb.; powder them all, dry, mix, and add 3 ozs. sesquicarbonate of ammonia in powder. Keep closely packed or in a stoppered bottle.

(23) J. J. asks: How can I solder brass? A. Mix copper and zinc in equal proportions, cover the surfaces to be joined with a paste of borax and water, put in the alloy in powder, lute together, and hold in a flame till the solder melts.

(24) C. A. R. asks: How can I soften old putty on window frames? A. Pass a red hot iron over it, near the surface of the putty.

(25) F. M. H. asks: What materials are used in making a nickel solution for plating with? A. Dissolve the nickel in nitric acid; add cyanide of potassium to precipitate the metal. Wash the precipitate, and then dissolve it by the addition of more cyanide of potassium. Another method is to precipitate the nitrate solution with carbonate of potash. This should be well washed, and then dissolved in cyanide of potassium. This method of preparing the nickel-plating solution is simple and good. The electrotyping is done by a process analogous to that of silver plating. Of course you must use an electrode of nickel.

(26) W. H. F. asks: 1. Given the resistance of a line, how shall I determine the electromotive force necessary to operate it? A. You require about one volt for each 80 ohms, or about one cell of Daniell or gravity battery for each two miles of wire. 2. Can you give me the average resistance of No. 23 copper wire, B. W. G., at 60° Fah.? A. It is 83·16 ohms. 3. What is the electromotive force of the ordinary Hill gravity battery compared with the electropoion cell? A. Calling the electropoion 100, the electromotive force of the Hill, Callaud, gravity, Minotti, Eagles, or any other modification of the Daniell battery, is 56.

(27) A. M. says: I would often make use of the electric light if the Grove and Bunsen batteries were not so troublesome. I have seen a metallic battery praised as the most powerful of constant batteries. Could I produce, with such a battery, an electric light equal to one produced by 50 Groves (the platinum being 6 by 2½ inches), and what number of cells would be required for this purpose? A. Yes. It would require 100 cells.

(28) C. C. asks: 1. In electrotyping, must the wood blocks or engravings be oiled before taking a wax impression? A. No. Brush them over with black lead. 2. How is the electro deposit removed from the wax (after it is taken out of the battery) so as to be perfectly true and level? A. Melt the wax by dipping the plates in hot water. 3. What is the metal backing composed of? A. Lead. 4. How long must it remain in the battery to receive a sufficient coat of copper for ordinary printing? A. About 24 hours. 5. What battery would be necessary for electrotyping an engraving 4 inches square? A. Two cells of a Daniell or Callaud battery.

(29) C. E. C. asks: What are the best treatises on electroplating? A. "Elements of Electro-Metallurgy," by Alfred Smee; "A Manual of Electro-Metallurgy," by James Napier; Walker's "Electrotype Manipulation;" Sturgeon's "Art of Electrotyping," and How's "Manual of Electro-Metallurgy."

(30) E. T. T. says: A friend and myself have a couple of telegraph instruments, with a large wire between them. We tried to use a ground, but we could not close the circuit. Our houses are only about 200 feet apart, and we had 4 cups of battery. I then bought enough of No. 18 copper wire for another main wire; and it worked splendidly and has never troubled us since. At what distance will a certain number of cups close a ground? At what distance will they close a double wire circuit? A. Different substances conduct electricity with more or less freedom, according to their composition. Dry earth conducts very poorly. It is the moisture in the earth which gives it most of its conductive capacity, but water itself is many million times a poorer conductor than copper; hence, in order to conduct as well as a copper wire, the volume of water must be many million times as great as the wire. If the two ends of your wire had been soldered to a water pipe which was buried for a considerable distance in wet earth, it would have worked; or if you had buried copper plates twelve feet square in wet earth at each end of your line, and attached the ends of your wire to them, it would have served your purpose. The cheapest plan for you, however, was to run another wire, and make a metallic circuit.

(31) J. N. G. asks: How many Callaud cells would be required to work three relays on a small copper wire of *half* a mile long, wire No. 17? A. Four.

(32) E. A. F. T. asks: 1. Will an engine, 1½ inches bore x 3 inches stroke, with a conical boiler 18 inches high and 8 inches across at top, and 12 inches at bottom, of ¼ inch iron, be large enough to run a 6 inch swinging lathe for ordinary work, or an 18 inch grindstone? A. Yes. 2. Could

I run such a boiler safely for two hours with one filling? A. Yes. 3. Why is it that engines for the above purpose are not more extensively used in small shops, as it hardly costs anything to run run them? A. We judge from the number of letters that we receive on the subject that they are in extensive use.

Are gunpowder engines in use? A. We do not think that there are any in the market.

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

F. D. L. says: I enclose you a specimen of deposit which is found floating upon the surface of the water and covering the flues of several boilers in this vicinity. It works over into the cylinders of the engines, stopping up the cylinder cocks, and in one instance caused the breaking of the fly wheel, by so closing the cocks that, upon the steam being let on (the water not escaping from the cylinder), the wheel was completely demolished. What is it? A. It consists of silica, silicate of alumina (the basis of clay) and carbonate of lime, along with a little vegetable matter. On heating to whiteness, the latter is burnt off, and the powder becomes quite white. The difficulty lies in the excessive fineness of the particles of the powder, which, under the microscope, look like fine specks and needles, and, when put into water, float upon the surface. They would subside if allowed to stand in a settling reservoir for a very long time, or your water might be run through one of the sponge or other filters now in use.—E. B. S.—It is a lead ore containing 85·5 per cent of lead, the remainder being sulphur, iron, and a trace of silver.—R. G.—This is similar to a great many other pieces recently sent to us, and consists of quartz and decomposed mica. It contains no lead, and is of no pecuniary value.—R. C. H.—It is a very impure coal, containing a large amount of ash. It may be used for fuel in certain cases.—A. B.—It is radiated limonite, which is a brown hydrated sesquioxide of iron. Send the specimens, but not too small ones, in which case satisfactory analysis and determination are often impossible.

Some of our correspondents who send mineral specimens in powder are so careless in doing up the packages that they come to us in a leaky condition, soiling desks and papers, and other articles upon which they are laid. All such packages are thrown into the waste basket without an examination. In sending specimens of soft or powdery substances, care should be taken to enclose the same so that the packages will not leak.

G. E. K asks: What can I mix with ordinary printer's ink to make it indelible?—P. S. H. says: I have heard that on old Christmas night, January 5, no matter how cold the weather might be, the elder bushes would sprout, and leaves put forth, where previously not a sign of any was visible. I supposed it to be mere tradition; but this year I saw it demonstrated, and saw elder leaves an inch long gathered, there being no sign of any on the previous day. The weather was exceedingly cold, and the leaves were frozen stiff. How is that accounted for?—O. B. asks: Supposing a fly to be on the rim of a locomotive wheel, of 8 feet diameter, through what space would the insect travel while the locomotive travels 50 miles?—F. C. says he wants to make linseed oil varnish, and wants to know what kind of a vessel to use to heat the oil to 600° Fah., how to secure the thermometer bar to conduct a vessel to be filled and emptied, capable of making 25 to 30 gallons at once.

COMMUNICATIONS RECEIVED.

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

On Meteorological Observations. By J. B. W.
On a Match under the Microscope. By H. A. W
On Railroads on Ice. By C. E. T.
On Experiments with Honey. By J. H. M.
On a Cheap Galvanic Battery. By W. H. S.
On Mill Dams. By J. W.
On the American Institute Fair. By J. W. B.
On Meteorology. By L. W.
On Heating Horse Cars. By B. F. L.
On Amalgam Fillings. By D. W. C.
On Heat as a Mode of Motion. By X.
On Spiritualism. By H. W.
On the late Dr. Sarphati. By M. C.
On a Flying Machine. By D. J.
On Transportation. By I. I. S.
On the Glacial Theory. By D. B.
On a Steamer's Log. By ——.

Also enquiries and answers from the following:

C. H. B.—W. M. H.—R. G. S.—J. K. L.—J. B. R.—S. M. V.—A. J. T.

HINTS TO CORRESPONDENTS.

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

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

Hundreds of enquiries analogous to the following are sent: "Who makes automatic fountains Who sells ferns, rock work, fish, etc., for aquaria, and who publishes a good book on the subject? Who sells the best churn? Who publishes a book on tanning? Who makes steam, water, and mechanical elevators? Who makes a knife sharpener and glass cutter? Who makes steel or iron ferrules for walking canes? Why do not makers of small engines (3x6 inches cylinders, and less) advertise in the SCIENTIFIC AMERICAN?" All such personal enquiries are printed, as will be observed, in the column of "Business and Personal," which is specially set apart for that purpose, subject to the charge mentioned at the head of that column. Almost any desired information can in this way be expeditiously obtained.

[OFFICIAL.]

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8,010.—STREET LANTERN, ETC.—R. B. Hewitt, Phila., Pa.
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8,018.—SODA WATER APPARATUS.—F. H. Shephard *et al.* Lowell, Mass.

TRADE MARKS REGISTERED.

2,171.—SHIRTS.—Markewitz & Price, New York city.
2,172.—PERFUME.—Miller Bro's, New York city.
2,173.—CARPET WARP.—H. E. Vogell, New York city.
2,174 & 2,175.—COFFEES.—Barkley *et al.*, Baltimore, Md.
2,176 to 2,178.—PUMPS.—W. & B. Douglas, Middletown, Ct
2,179.—PERFUMERY, ETC.—Eddy Bro's, New York city.
2,180.—PAINTS.—Hainemann & Steiner, New York city.
2,181.—FIRE KINDLERS, ETC.—J. D. Husbands, Jr., St Louis, Mo.
2,182.—SAUCE.—Lewis & Co., Chicago, Ill.
2,183.—CIGARS.—J. F. Miles, Boston, Mass.
2,184.—PILE CURE.—Montgomery & Co., Philadelphia, Pa.

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CANADIAN PATENTS.

LIST OF PATENTS GRANTED IN CANADA, JANUARY 21 to JANUARY 25, 1874.

4,282.—F. H. Wilson, Chicago, Ill., U. S. Improvements on cans for oils, called "Wilson's Oil Can." Jan. 21, 1875.
4,283.—G. W. Bowman, Morrow, Warren county, Ohio, U. S. Improvements in dryers, called "Bowman's Champion Dryer." Jan. 21, 1875.
4,284.—J. B. White, Fort Wayne, Allen county, Ind. U. S. Improvements on omnibuses, called "White's Omnibus." Jan. 21, 1875.
4,285.—C. R. Taylor, Ionia, Ionia county, Ind., U. S. Improvements on apparatus for steaming and treating lumber, called "Taylor's Lumber Steamer." Jan. 21, 1875.
4,286.—E. B. Decker, New York city, N. Y., U. S. Improvements in flexible shanks for boots and shoes, called "Decker's Flexible Shanks for Boots and Shoes." Jan. 21, 1875.
4,287.—W. R. King, Chicago, Cook county, Ill., U. S. Improvements on baling plastering hair, called "King's Improvement in Baling Plastering Hair." Jan. 21, 1875.
4,288.—Wm. Ascough, Buffalo, Erie county, N. Y., U. S. Improvements on a combined bevel square, try square, protector, level, slope level, and compasses, called "Ascough's Combination Square." Jan. 21, 1875.
4,289.—Wm. Inglis, Bolton, Lancaster county, England. Improvement on floating vessels for storing grain, called "Improved Grain Storage Boat." Jan. 21, 1875.
4,290.—H. Ryder, Somerville, Mass., U. S. Improvements on grates for furnaces, called "The Ryder Grate." Jan. 21, 1875.
4,291.—F. Rhind, Brooklyn, N. Y., U. S. Improvements in lamps, called "Rhind's Safety Lamp." Jan. 21, 1875.
4,292.—R. C. Brooks and A. J. Van Winkle, San Francisco, San Francisco county, Cal., U. S. Improvements on a process and apparatus from distilling alcohol extract from wort so that said alcoholic extract shall be free from fusel oil, called "Brooks' Improved Distilling Apparatus." Jan. 22, 1875.
4,293.—J. K. Feick, Berlin, Waterloo county, Ont. Improvements on lasts for making seamless boots, called "Feick's Improved Last for Making Seamless Boots, etc." Jan. 23, 1875.
4,294.—W. S. Wisner, Brantford, Brant county, Ont., assignee of C. P. Brown, Manchester, Ontario county, N. Y., U. S. Improvements on seed sowing maching, called "Valve for Grain Drill Double Distributer." Jan. 23, 1875
4,295.—C. C. Moore, Elizabeth, Union county, N. J., U. S. Improvements in pencil holders for slate frames, called "Moore's Pencil Holder for Slate Frames." Jan. 23, 1875.
4,296.—J. O. Peacock, Finsbury Park Row, Middlesex county, Eng. Improved form of stove and apparatus connected therewith, called "Peacock's Diathermic Gas and Fuel stove." Jan. 23, 1875.
4,297.—D. D. Cattanach, Providence, Providence county, R. I., U. S. Improvements on treating oil for paints, called "Cattanach's Oil Process." Jan. 23, 1875.
4,298.—M. Hutchinson, Norfolk, St. Lawrence, N. Y. U. S. Improvements on heating drums, called "M. Hutchinson's Heating Drum." Jan. 23, 1875.
4,299.—T. A. Edison, Newark, Essex county, N. J., U. S. Improvements in electric telegraphs, called "Edison's Domestic Telegraph." Jan. 23, 1875.
4,300.—T. and J. C. Peacock, Finsbury Park Row, Middlesex county, Eng. Improvements in gas cooking apparatus, called "Peacock's Thermostatic Gas Roaster." Jan. 23, 1875.
4,301.—Wm. A. Lamb, Orleans, Ontario county, N. Y., U. S. Improvements on wagon seats, called "Lamb's Seat Fastener." Jan. 23, 1875.
4,302.—M. Goldman, Syracuse, N. Y., U. S. Improvement on a pocket candlestick, called "Goldman's Attachable Candlestick." Jan. 23, 1875.
4,303.—J. W. Morgenmeier, Sheboygan, Sheboygan county, Wis., U. S. Improvements in varnishes for coating photographs, negatives, and glasses, called "Morgenmeier's Ground Surface Negative Retouching Varnish." Jan. 23, 1875.
4,304.—G. Ramsdell, Detroit, Wayne county, Mich. Improvement in the process of making wood gas, called "Ramsdell's Wood Gas Generator." Jan. 23, 1875.
4,305.—J. J. Higgins, New York city, N. Y., U. S. 1st extension of No. 4,151, on "Higgins' Automatic Umbrella Runner." Jan. 23, 1875.
4,306.—J. J. Higgins, New York city, N. Y., U. S. 2d extension of No. 4,151, on "Higgins' Automatic Umbrella Runner." Jan. 23, 1875.

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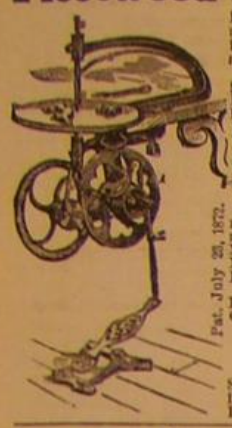

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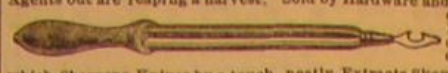

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