SCIENTIFIC AMERICAN

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

Vol. XXVII.--No. 10. NEW SERIES.] NEW YORK, SEPTEMBER 7, 1872. [$3 per Annum. (IN ADVANCE.)

SPOOL BLANK ROUGHING MACHINE.

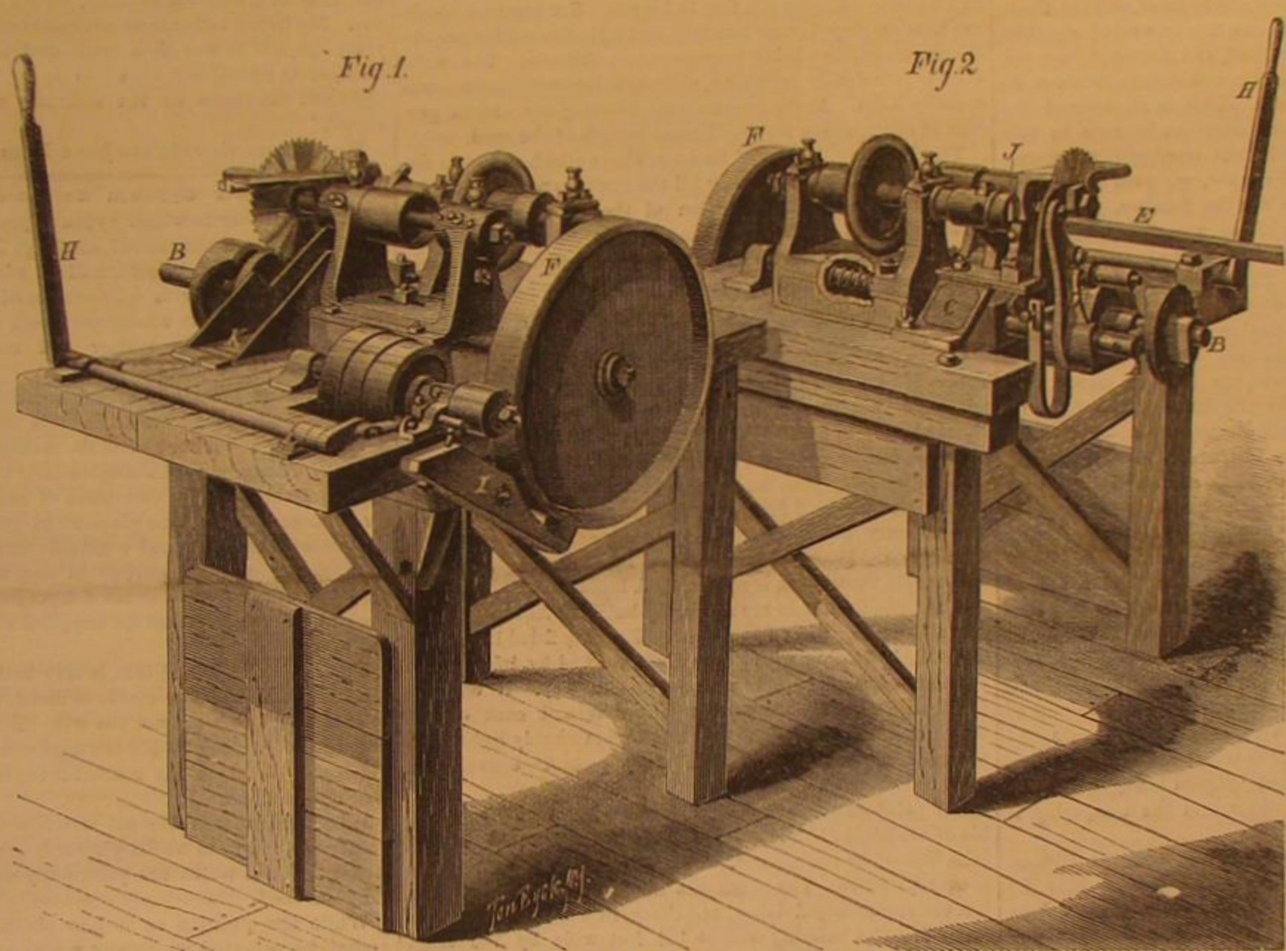
Our engraving illustrates a new and improved machine for making spool blanks, round wood boxes, and other similar articles. Fig. 1 is a perspective view taken from the rear of the machine, and Fig. 2 gives a front view of the same. The improvements consist in the following additions to the regular cutting and sawing apparatus which constitutes the ordinary spool blank rougher: namely, the reciprocating shaft, A, the rotating shaft, B, and the standard, C, with their various attachments.

The shaft, A, can either rotate or slide longitudinally in its bearings, and carries an upwardly projecting arm, D, to which is attached the V shaped carrier, E. In this carrier, which is adjustable to varying sizes of wood, is laid the square stick to be operated upon. A bent lever is pivoted to the arm, D, above the carrier, as shown in the engraving, and is actuated by a spring in such a manner as to firmly hold, by means of an adjustable clamp at its end, the square stick in the carrier while it is being cut, bored, turned, or sawn off. On a stud projecting horizontally from the end of the shaft, A, is placed a roller which engages with the cam seen in the end of the shaft, B; and on a stud projecting from the arm, D, is placed a roller which engages with an inner cam on the shaft, B, as shown. The effect of the first cam is to move the shaft, A, and carrier, E, inward during a portion of the revolution of B, and of the second to rotate the shaft, A, and to press back and hold in the requisite positions the arm, D, and the carrier. A helical spring surrounds the shaft, A, as shown through the part broken away in Fig. 2, and is attached by one end to the shaft, and by the other to a fixed part of the machine. It is thus made, by its recoil, to return the shaft and the carrier to their original positions after they are released by the cams.

The standard, C, carries a stop, against which the bent lever of the arm, D, is made to strike by the action of the inner cam, so as to compress the spring and release the stick at the moment when it requires shifting in the carrier. The shaft, B, carries upon its rear end the friction pulley, F, and is driven by the friction pinion attached to the shaft, G. This shaft runs in movable bearings, and the friction pulleys are made to engage or disengage at the will of the operator by means of the toggle joint, shaft, and handle, H, shown distinctly in Fig. 1. At I is a friction brake, by means of which, in disengaging the friction pulleys, the pulley, F, is brought to rest at any point, and as quickly as desired.

In the operation of the machine, the outer cam of the shaft, B, moves the arm, D, inward, forces the stick into the cutter head, and afterwards releases it therefrom; at which time a depression in the inner cam allows the spring to throw the arm, D, to the right and carry the stick to the saw to have the finished piece cut off. After this is done, the further rotation of the inner cam throws the arm, D, to the left and brings its lever in contact with the stop on standard, C, as before described, and releases the stick. The stick is then advanced in the carrier by the operator, according to the nature of the work; the arm falls into its central position opposite the cutter head; the clamp again grasps the stick, and the operation goes on as before. A rest, J, the operating parts of which are not shown in the engravings, is provided to support and guide the stick to the cutter after it has become too short to lie unbalanced in the carrier. An inverted rest is attached near the saw, as shown, by which the workman cuts out imperfect parts of the lumber. K is a chute by which the finished pieces are conveyed to a receptacle below.

The mechanism described can be applied, the inventor states, to any of the ordinary spool blank roughers at a moderate expense; it saves, he estimates, not less than two thirds the cost of the old manufacture. It is adjustable in every way required to make articles of various lengths and diameters, and besides spool blanks and boxes, any cylindrical goods may be made by it which are sufficiently well finished by the saw at the ends. Among the advantages claimed for it are: the correctness with which it does its work; its ability of using up lumber of any length to within a very short distance

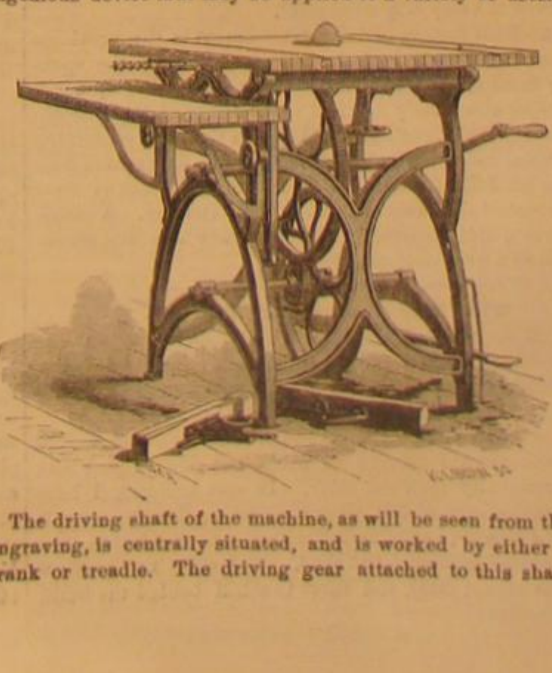


HAWKINS' SPOOL BLANK ROUGHING MACHINE.

from the end—say, one quarter inch—and also of making perfect work from crooked lumber. It can be run by a boy. The machines, as made, are geared for different speeds, and produce from 150 to 175 gross of spool blanks per day. They are in operation at the spool manufactory of Holt & Hawkins, Salisbury, Vt., who may be addressed for further information on the subject. Application for a patent is pending in the name of John T. Hawkins.

COMBINED HAND AND FOOT CIRCULAR SAWING MACHINE.

The annexed engraving represents Marston's combined hand and foot power circular sawing machine, which is an ingenious device that may be applied to a variety of uses.



The driving shaft of the machine, as will be seen from the engraving, is centrally situated, and is worked by either a crank or treadle. The driving gear attached to this shaft plays into a small gear on the saw arbor, and thus imparts the power in a most direct and simple manner to the tool. It also meshes with a pinion on a lower shaft which carries a proportionate balance wheel, by means of which the power is stored up and equalized and the easy action of the machine insured. The driving shaft is arranged to be operated with two handles, one at each end, so that two men can work, if necessary, when cutting very heavy stuff; but the treadle is stated to be sufficient for all ordinary work, as one man working an 8-inch saw by it can easily cut off 2¼ inch stuff.

The table on the top is hinged, and is raised by means of a screw and crank, so as to adapt the machine to the work of rabbeting, mitering, etc., as also for the purpose of changing the saws and wheels when required. To make these changes it is only necessary to unscrew a nut, and they can therefore be effected in very short time.

The boring attachment shown in the engraving can easily be applied to the apparatus at any time, and one man working the same by the crank can bore holes up to one inch diameter easily. To change the bits in the boring mandrel, it is simply necessary to operate a set screw, and no more time is consumed in so doing than in changing them in an ordinary bit brace. This is an especially useful attachment.

Two gages accompany the machine, one for splitting and the other for cutting off, the latter being used for mitering. Miters are also marked on the table. The saw, with gage, is said to cut perfectly square. Grooving is done by using a wabbling saw.

No belt being required in this machine, one cause of expense is avoided, while the power lost by their slipping is of course saved. It is claimed that the saw can do the work of four men, and in a more thorough manner than by the common handsaw, which makes it a valuable adjunct in the shop of any worker in wood. An emery wheel for grinding tools can be used with the machine if wished. It is a very simple and complete machine, occupying but little room, and will save its cost in a short time in any shop where the work it can be applied to is carried on.

Further particulars may be obtained by addressing Reed & Bowen, 36 Kilby street, Boston, Mass.

Light of the Vapor of Iodine.

Vapor of iodine presents a number of curious properties. The following is one that does not appear to have been previously noticed: This vapor at a high temperature gives out rays but little refrangible, furnishing a continued spectrum. Place in a tube of Bohemian glass a small crystal of iodine, and heat the tube strongly at a certain distance from the fragment; when sufficiently red, leave it to cool until almost invisible in the dark; the iodine then vaporizes rapidly. The colored vapor, on arriving at the heated part, burns red in a very nice manner. By admitting an absorbing medium, the incandescence of this vapor can be produced in a very brilliant style. Seal in the interior of a glass tube a fine platinum spiral, which can be raised to a red heat by the electric pile; then introduce pure iodine into the tube, and seal the same after having expelled the air; volatilize the iodine, and establish the electrical communication. The incandescent platinum becomes surrounded with a vacillating flame, of which the color is modified by absorption. It is a very rich red, and gives a fluted spectrum. The author expects to draw from these facts some interesting conclusions, but, before publishing them, purposes to submit them anew to experimental verification.

HOW AXES ARE MADE.

In order to withstand the severe usage to which they are put, axes are almost always made from superior qualities of metal. The bit or cutting edge is usually of the best English steel, while the head is formed from the better grades of iron.

If our reader will now imagine himself to be with us in our late visit to one of the largest ax manufactories in the country, that of Messrs. Weed, Becker & Co, in Cohoes, N. Y., we will endeavor to lead him through the many workshops of the establishment, and thus trace the making of the ax from its first reception in the shape of bar iron and steel to its final packing in finished form, and its shipping to the trade.

The iron portion of the head is cast in a mold, but its shape is far from resembling that which it will attain when finished. The eye, in which the handle is inserted, is there, but instead of the metal tapering off to an edge it is formed in two branches, so that the casting is in fact an ax, split from its edge to the eye. As we enter the foundery, a large number of these rough pieces are being removed from the flasks; beside them lie the pieces of steel which are to form the edges, so that the process we are about to witness is the welding together of these two portions and the first shaping of the tool. A smith seizes one of the iron castings with his pinchers, heats it in his fire, and, holding it under a powerful trip hammer, welds the separated edges together. He then passes it to another workman, who again heats the piece to redness and then fits to the edge the bit or piece of steel, in the side of which a groove is cut. Another heating takes place, more hammering with the trip hammer and by hand, and the shape is complete, both steel and iron being firmly welded together. The edge is now rounded, smoothed, and flattened, and the ax is placed under a swage die from which it receives its peculiar rounded or convex form. This is all termed the "cutting process" and, as nothing more can be seen in this workshop except perhaps the different manipulations necessary to form the axes of varied shapes, we pass to another smithy where the holes or eyes for the handles, which the previous hammering has nearly closed, are opened and made into proper shape, and where the head or butt end of the ax is hammered square and even. This is done by heating and pressing on flat stones, so that, when finished, the tool is perfectly true and square at all its angles.

We next pass to a room containing several large grindstones, which, kept constantly wet, are in rapid revolution. Here the ax is smoothed and the roughness and scale on its surface removed by pressing against the stones. This completed, we follow the tool to the temperer. Each workman stands before a small coal fire, which is contained in a very narrow though long grate. Above the hot coals are bars on which the axes rest while being heated. Taking each tool separately, the temperer heats it to redness, and then suddenly plunges it into a pickle of brine and then into a tub of cool water, to wash off the salt which adheres. In this condition the ax is intensely hard; the metal is crystallized and brittle, so that it would probably snap in pieces at the first blow. It is necessary, therefore, to "draw" this temper, and the process is one involving considerable skill on the part of the operative. The ax is again placed over the coals, and as we watch it we notice its color change from white to straw color, and finally to what is termed "pigeon blue," when it is suddenly plunged in the cold water, and the tempering is complete.

The ax is now ready to be ground, and in order to witness the process, we pass through a dense cloud of dust into the grinding room. Here are forty immense grindstones driven at a fearful rate of speed. Above each stone is the saddle or piece of wood, one end of which is fastened to the frame of the grindstone, while the other is held up by a strap suspended from the roof. Across this saddle sits the grinder, who inserts the ax under the end or pommel of the saddle and bears it down with his whole weight against the stone. The labor requires considerable practice and no small degree of skill, as it is absolutely necessary that every tool should be ground perfectly even at all portions. The men engaged at this work were mostly French Canadians. We were informed that all were more or less unhealthy, and that it is common for them to die of consumption after a few years' labor as grinders. The air is filled with particles of metal and grit which they constantly inhale; this irritates the lungs and eventually causes acute disease. Polishing is the next process, and is performed on wheels covered with emery and oil. Each ax, after having gone through this operation, shines like polished silver. Inspection of the most rigid kind follows. We find a workman sitting before a small anvil, taking up the axes, one at a time, and tapping them with his hammer. Nothing passes his observation. An ax, which appears to us perfectly sound at every point, rests on his anvil. A blow or two with the hammer and his quick ear detects a difference in sound. Picking up the axe, he dashes it against the anvil, away flies a corner of its edge, proving that the temper was unequal. Another is thrown aside for a minute, almost imperceptible, crack. A third yields too readily to the file; and thus the inspection goes on, the rejected tools being, if possible, made over, or else finding their way to the scrap heap.

Now comes the painting and labeling. Passing into another apartment, we find hundreds of finished axes hanging on frames. Some are red, others black, others bronzed, in order to suit the varied tastes of the market. From a room below, we hear the whirr of lathes, and looking down, we see the great logs of hickory rapidly cut up and then placed in machines nearly resembling the lathes used for making shoe lasts; and we thus see the finished handles turned out with incredible rapidity.

Meanwhile, around us, men are engaged in branding and boxing the finished tools. Here are axes, hatchets, adzes, mattocks, turpentine tools for North Carolina, and hammers of every description. Huge Spanish axes destined for the hands of the Indians of South America to hew their way through the forests of Peru and Equador, odd shaped hatchets for the hunters and the bush rangers, marked for Australia, and dozens and dozens of other tools, all painted, labeled, and ranged in their cases, are strewn around, ready for distribution throughout the whole civilized world.

The works, our inspection of which concludes in the last mentioned apartment, cover a area of five acres of ground, and furnish employment for 250 workmen. About 150 dozen of axes and other tools are daily produced, at a yearly valuation of over $400,000.

THE CAR SHOPS OF WEST ALBANY.

The New York Central and Hudson River car shops are substantial brick buildings, covering an area of about 60 acres of ground, situated about two and a half miles from the city of Albany. The different shops range from three to five hundred feet in length. The main power of the works is derived from a centrally located building containing two low pressure engines of 200 and 125 horse power respectively. Steam is supplied by four steam boilers. An auxiliary engine of 75 horse power is located near the machine shop. The works are divided into two portions, one devoted to the construction and repair of locomotives and the other to the fitting up and building of cars. The locomotive department, under the superintendence of Master Mechanic G. B. Van Vorst, is an immense building 500 feet in length. Six hundred hands are here employed, four hundred and eighteen working in the shops, the balance being engineers and firemen. The work done is principally repairing, although locomotives are occasionally built. At the present time, two engines are in process of construction for the Central branch of the road.

The foundery, forge and hammer shops attached to this department manufacture nearly all the castings required on the line, besides a large proportion of the axles and general heavy forgings Fifty switches are now being made to be located near Syracuse in this State. The round house is one of the largest in the country, being 278 feet in diameter, and containing 41 stalls. In the oil house adjoining, is a tank holding 115 barrels of oil.

The car shops proper are superintended by Mr. Joseph Jones, Master Car Builder. Few new cars are here constructed, the work being principall the alteration and repairing of those already in use. We noticed some old cars being fitted with the Miller platform, and our attention was directed to some 40 cars designed for the transportation of horses. These are 29 feet long by 8 feet wide, and are six inches higher t an the ordinary cattle cars. The sides are sealed to within 18 inches of the top, the remaining space being slotted, so that ample ventilation is secured. A hundred new combined coal and platform cars are also being built, 29 feet length by 8 feet width being their dimensions. They are fitted in the center of their flooring with dump doors worked by iron shafts.

The blacksmith shop is a model in its way. It contains fourteen octagonal chimneys, arranged around each one of which are four fires. The building is remarkably light, airy, and spacious, and is fitted with every possible convenience and improvement.

The paint shop, which was formerly a large building capable of containing thirty cars, is now a heap of ruins, having been burned to the ground. The estimated loss by this fire is over $120,000. The plans of a new edifice to replace the lost one are already finished, and the work will shortly be commenced. The building will be 130 feet wide by 700 long, and it will accommodate 88 cars.

The storage building contains, besides a large variety of fittings, etc., a machine for cleaning old car cushions after they have become filled with dust and dirt. A large lumber yard filled with timber of every description supplies the wood working portion of the shops with material. Fire is provided against by a powerful steam fire engine and a donkey engine rigged on the top of a locomotive, the apparatus being kept constantly ready for use. A wrecking car is also kept in condition for immediate service. It is 48 feet long and contains all the necessary tools, derricks, etc., for making repairs or clearing away wrecks.

The traverse table, used for transporting cars from track to track, is a device recently introduced in the works and is one of the best pieces of mechanism in the establishment. It is the invention of Master Car Builder Jones, and its working has proved in every way successful.

An excellent feature of this establishment is the provision made for the rewarding of the most deserving of the workmen by furnishing to them commodious and admirably fitted-up cottages at a merely nominal rent. Sixty of these dwellings are now built, each 22 by 32 feet in size and containing ten finished rooms beside all conveniences. The rent is from eight to ten dollars a month, a sum barely sufficient to cover the interest of the sums laid out on their erection. A boarding house is also provided, where thirty-five men are accommodated at a very moderate price.

The Manufacture of Vinegar.

A. H. R. sends us a letter in which his troubles, labors, and expenditure as a manufacturer of vinegar are fully detailed. He certainly has gone to work in a liberal manner, as the following passage from his letter will show:

"I have been in the vinegar business for two and a half years, using in the process no acids, but cider, high wines, and occasionally malt and cider. In one building I have eleven tanks, each of 800 gallons capacity; this structure is on a sand bottom, and is floored with planks fastened to cross pieces bedded even with the sand. The walls are of stone up to the second story, and there is a hill behind the building, as high as the roof. The tanks abovementioned are of clear white pine, and were new last fall. A stove to prevent freezing was put up, and the contents of only one of the tanks was, last winter, affected by frost. The door of the building has been kept well caulked up to ensure an even temperature. Adjoining this building is a three story frame structure, having eight tanks of 1,000 gallons capacity each, on the ground floor. These tanks are filled with vinegar or cider, and are kept warm by the exhaust of our pumping engine. At this season, the average temperature on this floor is from 75° to 90°, and in winter it ranges from 50° to 60°. Going from it into the first described chamber is like stepping into an ice house.

I commenced by making strong vinegar, showing 18° or 20° (Baumé, probably. EDS) when first made. One gallon of sirup was added to each 80 gallons of cider, and the whole fermented, settled, and run through generators 25 feet in hight, newly constructed and filled with shavings of red beech. A few days ago, the vinegar began to lose its strength, and to preserve it, I gave it more body, which only served to arrest the deterioration, and now it is all spoilt, and I find myself with only one tank of good vinegar, having this week allowed 2,000 gallons to run to waste. The generators are still running, and seem to work well.

The cold damp air has killed the vinegar, and the trouble spreads from one vat to another, like an epidemic; and nevertheless, the acidity remains unimpaired. Have you or any of your readers had similar experiences? If so, perhaps my case may be a warning to them, for my loss is a very serious one. My father tells me of a similar occurrence four or five years ago, and it was then attributed to the poverty of the cider, or to something added to it to keep it sweet. Any light you can throw on the difficulty will be thankfully received."

We give our views in another column.

How Gypsum Acts on Soils.

The exact way in which gypsum produces its fertilizing effects is not well understood, although it is known that the chemical changes or transformations which occur when it is brought in contact with soils are not of a uniform or fixed character. Upon the conditions which exist as regards the presence of vegetable matter and moisture, depend the changes that take place.

It has been proved by actual experiment that gypsum is capable of absorbing ammonia from the air, and also from decomposing animal or vegetable matter, in the form of sulphide of ammonium. This again may be changed into carbonate of ammonia, by absorption of carbonic acid from the air. These changes take place when gypsum is brought in contact with moisture and vegetable matter.

Whatever other decomposition may take place under different circumstances, this must be regarded as the most important, as from it plants are supplied with food of the highest value.

From this ascertained fact, it may be inferred that plaster must prove highly serviceable to moist, mossy hills, and also to meadows which are not too wet. Experiment has shown that the north side of a hill is sometimes greatly benefited by plaster, while upon the southern exposure it produced no perceptible effect.

It is certain that it does not matter much what may be the nature of the soil to which plaster is applied, since it is external agencies which are principally concerned in fitting it for plant food.

While the question as to how plaster acts as a fertilizer cannot be regarded as by any means settled, yet there are certain facts to guide its application. It would be manifestly absurd for a farmer to apply gypsum to a dry, silicious plain, or to a not impoverished slope; and also it would be unwise to use it upon a meadow under water some months in the year.

Plaster may be applied with confidence to pastures and fields which are strong enough and moist enough to support deciduous trees. A hill side where moss will grow so as to crowd out good grasses is usually promptly benefited by plaster, and the white clover comes in at once.

Artificial Hatching of the Sturgeon.

It seems that the sterlet (*acipenser ruthenus*), the smallest of the Russian sturgeons, spawns in the Volga early in May on rocky bottoms, the temperature of the water being at 10° R. (54½° Fah.). The eggs are readily fecundated by the artificial method. After they have been in the water a few minutes, they adhere to any object which they touch. The development of the embryo can be observed in progress at the end of one hour. On the seventh day they hatch. At first the young fish are about $\frac{23}{100}$ of an inch long. At the age of ten weeks, they are nearly two inches long. They feed on larvæ of insects, taking them from the bottom. Both in the egg and when newly hatched, the sterlet has been taken a five days' journey from the Volga to Western Russia, and in 1870 a lot of the eggs were carried to England to stock the river Leith. This species passes its whole life in fresh water

Colored Spectacles.

Dr. Stearns writes: "The photographer uses orange colored glass to exclude the actinic rays of light, and why some optician has not had the genius to see that orange is the proper color for spectacles, instead of green or blue, for persons with weak eyes is beyond my comprehension. A room in the hospital with which I am connected is lighted through orange colored windows, and is used by patients who have certain diseases of the eyes requiring the exclusion of the actinic rays of light. It has been very satisfactory. Orange is also, I believe, the proper color for bottles containing chemicals affected by light."

THE ADVANTAGES OF SCIENTIFIC EDUCATION.

This was the subject of a recent lecture before the Government telegraphers of Great Britain, by Mr. William Henry Preece, who said:

"The reasons why scientific study is so little popular are that it does not appeal directly to our senses, involves time and study, and because people do not like trouble. There is, unfortunately, no royal road to learning. Knowledge is fixed at the top of a hill which requires some stiff climbing; hence science is unpopular.

A scientific man is one who knows, and one who derives pleasure from that which he knows; hence, the chief advantage which I lay before you to be gained by the study of the scientific part of your profession is—pleasure.

What would be thought of an engine driver who stuck on a bank for the want of knowing how to use sand on the rails? Such, I am sorry to say, is the position of the great majority of those who are employed in the operating branch of our department.

Education itself is an inducement to seek scientific knowledge. The object of education is to attain precision of thought, and to possess the power of drawing correct inferences from facts—indeed, to exercise judgment and common sense. There is no better method of acquiring these valuable qualities than by a scientific training. We can find out many things without scientific training—trace faults, etc.; but we can do such things more quickly, more correctly, and with more gratification, with such training. Rule of thumb methods have always a flavor of science in them; and though it has been said that an ounce of practice is worth a tun of theory, an ounce of practice *with* theory is worth a tun of practice without theory.

Scientific knowledge and training are the parents of invention and improvement, and these are the highest order of education. I do not mean scheming, or the bringing forward of novelties for the sake of novelty, often in opposition to fixed principles, but the improvement of defects and the introduction of objects of real utility. Watt has said "It is a great thing to find out what will not do—it leads to our finding what will do." When we know where the shoe pinches, we can find a remedy.

Some of the schemes which ignorant outsiders have submitted to telegraph engineers as improvements are simply ridiculous. I can remember, when the Atlantic cable of 1858 failed, a lady writing and suggesting that cables should not be submarine but super-marine—that they should be suspended above the ocean; and she suggested that the Rock of Gibraltar, the Peak of Teneriffe, and the Andes formed conspicuous objects for this purpose! Again, when we suffered so much, a little later, from the rupture of our light cables in the North Sea, an officer of one of the scientific corps of Her Majesty's army thought that he had made the grand discovery that the world was growing, and that it was owing to the continents separating themselves further and further by the growth of the globe that our cables snapped! Many suggested that the Atlantic cable should be suspended by balloons, and even very recently a gentleman, who possesses no knowledge whatever of telegraphy, has endeavored, by the powerful aid of the press and other means, to thrust upon us an apparatus which we know to be radically wrong in principle, and which has been anticipated or tried by nearly every telegraph engineer who has exercised thought on the subject.

On the other hand, those who possess scientific training, and those who have devoted their attention to remedy defects, have done great service to their profession. Mr Fuller succeeded in replacing the defective sand batteries of twenty years ago by the ordinary sulphate battery, which still remains the form principally employed by the department. Mr. Varley, by the application of his powerful mind to the working of our wires, has brought the present state of insulation to the perfection it has now attained; and Sir Charles Wheatstone, by the constant and unremitting study of forty years has brought out that beautiful automatic apparatus without which it would have been difficult for the Postal Telegraph Department to have transacted the enormous business, thrown upon its hands by the adoption of the uniform shilling rate and the low tariff applied to the press. The two first named telegraph engineers owe their success entirely to those principles of self-education that I wish to inculcate into you: and Faraday, a purely self-educated philosopher, has instanced Sir Charles Wheatstone and his inventions as examples of the effect of the continued application of these principles.

There is plenty of room in the working of our instruments and wires for the display of your powers of invention and improvement. Real improvements are not the result of chance; they are the effects of the continued application of those methods of thought and study which education, and particularly scientific education, impart.

Geometry and algebra are essential to the skilled telegraphist, and it is difficult for any one to comprehend the higher branches of the profession until he has mastered the elementary principles of these two branches of pure mathematics. It is the application of algebra which enables the telegraph engineer to tell the distance of a fault in a submarine cable to within half a mile, and to direct the sailor, with unerring accuracy, to the spot where he must apply his apparatus. . . . It is the differential calculus which enables the electrician to obtain the greatest possible speed of working with the least consumption of materials out of his submarine cable.

Applied mathematics or dynamics considers force and its measurement. A current of electricity is only one form of force, and all our methods of electrical measurement are based primarily on the laws of dynamics. The stability of our posts, the strains upon our wires, the submersion of our cables, are applications of the laws of dynamics. A knowledge of chemistry, magnetism, and electricity, is indispensable to the telegraphist. They are so mutually dependent that a little must be acquired of each branch of physics by studying any of those enumerated."

In conclusion, the lecturer considered how this knowledge is to be obtained by those whom he addresses. Briefly, he recommended as aids to study, attending lectures, reading of scientific and practical works on electricity, telegraphy, and kindred subjects, observation, experiment, and reflection.

Something about Pickles.

Pickles, as an article of food, are to the best stomachs only appetizing, and to the weakest positively injurious. Still people will eat pickles, and whatever our physiological friends may say, we do not doubt that things so generally craved have some use in the animal economy. When soldiers have chronic diarrhœa, our army surgeons usually allow them to eat pickles and other things that, under ordinary circumstances, would be considered fatal. and to the surprise of everybody the hopeless patients often recover. So, without discussing the dietetics of the matter, we accept pickles as a fact. To look at the matter physiologically, a pickle is a mere vegetable sponge to hold vinegar. Any vegetable tissue that is not so fibrous or tough as to be unpleasant to masticate, and which has no disagreeable flavor of its own, will answer for pickling. If the article pickled has an acceptable flavor of its own, all the better. It is the possession of this that makes the cucumber the most popular of all pickles. Vegetables which have no marked taste are made flavorous by the free use of spices. It is customary to salt pickles before putting them into the vinegar. Why do we? It is not for the purpose of flavoring them with salt, for this can be added to the vinegar. This matter of salting pickles brings us to the question of *osmose*, which we cannot find space to discuss. Briefly, when a fresh vegetable is placed in salt and water, an interchange takes place between the juices contained in the tissues of the vegetable and the brine by which it is surrounded. The natural juices pass out and the brine passes into the vegetable; the brine being denser, it, according to a well known law, passes in more slowly than the juices of the vegetable pass out, and the salted things shrivel. When salted pickles are placed in water the case is reversed, their shrivelled tissues are full of brine, much heavier than the water by which they are surrounded, the brine passes out, and the water goes in and restores the plumpness. Soaked pickles with their tissues full of water, being put into vinegar, readily become penetrated by that liquid. The question of salted pickles has nothing to do with flavor, as the finest pickles are those from which the salt is most completely soaked.

One of the most frequent questions is "How can I make pickles like those put up at the makers?" It may be answered that the pickles referred to are put up in colorless vinegar. Home made pickles should be prepared with regard to flavor rather than appearance. As a general rule, vegetables to be pickled are first put into brine, then soaked to freshen them, and then placed in vinegar, which may be spiced or not, according to taste. One point is to be noticed: when freshened pickles are put into not very strong vinegar, the water with which their tissues are filled so weakens the vinegar that the pickles are not only not sour enough to the taste, but not enough so as to keep well. It is not necessary to enumerate the things that may be pickled, as there are few fruits or vegetables that may not be so treated; pickled peaches are delicious, and pickled purslane is not to be despised—a wide range surely. Some good housekeepers have, besides the regular cucumber and other standard pickles, a jar of

MIXED OR INDIAN PICKLE.—The basis of this is usually sliced cabbage, and cauliflower broken into bits and put into brine. After these are ready, they are covered with spiced vinegar; and then such pickle materials, fruits, or vegetables as occur during the season are added from time to time, taking care that the newly added things are covered by the vinegar. At the close of the season, the vinegar is drained off, heated to the boiling point, and poured over the pickles; this is repeated two or three times, when the pickles are stored away for use, and are usually better in the second year than the first.

In the making of the spiced vinegar, probably no two will agree. As a suggestion we give two recipes. The various directions differ greatly; the chief object seems to be to get in enough spice. In looking them over, we are reminded of the toper's directions for making punch, "too much of lemons, sugar and whisky, and not enough water." One recipe gives: Vinegar, 6 pints; salt, ¼ lb.; bruised ginger root and whole mustard seed, 2 oz. each; mace, 1 oz.; shallots, ¼ lb.; cayenne pepper, a dessert spoonful, and some sliced horse radish. Simmer together for a few minutes, then put into a jar and cover close. Another, claimed to be "very superior," directs for each gallon of vinegar 6 cloves of garlic, 12 shallots, 2 sticks of sliced horseradish, 4 oz bruised ginger, 2 oz. whole black pepper, 1 oz. allspice, 12 cloves ¼ oz cayenne pepper, 2 oz. mustard seed, ¼ lb. mustard (ground), and 1 oz. turmeric. All the above, except the mustard and turmeric, are put into the jar with cabbage, cauliflower, and other pickle vegetables, and the vinegar boiled and poured over them. The ground mustard and turmeric are to be made into a paste, with cold vinegar added.—*London Farmer.*

THE manufacture of ice in New Orleans has been the means of reducing the price to $8 per tun.

Manufacture of Gold Leaf.

The process of gold beating is exceedingly interesting in its various details, and is one which requires the exercise of much judgment, physical force and mechanical skill. The gold must first be properly refined. The process is as follows: The coin is first reduced in thickness by being rolled through what is known as a "mill," a machine consisting of iron rollers operated by steam power. After being rolled, it is annealed by being subjected to intense heat which softens the metal. It is next cut up and placed in jars containing nitro muriatic acid, which dissolves the gold, and reduces it to a mass resembling Indian pudding, both in color and form. This solution is next placed in a jar with copperas, which separates the gold from the other components of the mass.

The next process is to properly alloy the now pure gold, after which it is placed in crucibles and melted, from which it is poured into iron molds called ingots, which measure ten inches in length, by one inch in breadth and thickness. When cooled, it is taken out in the shape of bars. These bars are then rolled into what are called a "ribbon," usually measuring about eight yards in length, of the thickness of ordinary paper, and retaining their original width. These "ribbons" are then cut into pieces an inch and a quarter square, and placed in what is called a "cutch," which consists of a pack of French paper leaves resembling parchment, each leaf three inches square, and the pack measuring from three quarters of an inch to an inch in thickness. They are then beaten for half an hour upon a granite block, with hammers weighing from twelve to fifteen pounds, after which they are taken out and placed in another pack of leaves called a "shoder." These leaves are four and a half inches square, and the gold in the "shoder" is beaten for four hours with hammers weighing about nine pounds. After being beaten in this manner, the gold leaves are taken out of the "shoders" and placed in what are called "molds." These "molds" consist of packs of leaves similar to the other packs, and made of the stomach of an ox. After being made ready in the "molds," the gold is beaten for four hours more with hammers weighing six or seven pounds each.

It will be noticed that the thinner the leaf becomes, the lighter are the hammers used, and it is also necessary in beating the gold, especially in striking the "mold," that the blow should be given with the full flat of the hammer and directly in the center of the "mold." Should the beater strike with the edge of the hammer, there is every chance that the leaf will be broken and the pack spoiled. The leaf, after being taken out of the "mold," is cut into squares of three and three eighths inches, and placed in "books" of common paper. Each "book" consists of twenty-five leaves, and there are twenty "books" in what is known as a "pack."

The same process is used in the manufacture of silver leaf, the only difference being that the metal, being softer, requires less time to manufacture.

Gold foil is made in a manner similar to gold leaf, except that the sheets are thick and are annealed separately, while the chief distinction is that it has, if a genuine article, no alloy whatever. The article known as "German gilt" is not made from gold at all. The wood upon which it is to be placed is first made exceedingly smooth, and then painted with a preparation which, being covered with silver leaf, has the property of producing a gold-like appearance.

The busiest season for selling leaf or foil is just approaching, and the present evidences are that the demand will be large. The summer business has been good, better, in fact than business generally.—*Commercial Bulletin.*

Decorative Painting on Tin.

Tinfoil is spread out upon a smooth surface, such as glass the latter having been first moistened to aid the laying out of the foil and to maintain it in its position. The painting is then executed upon it in oil. This painting on tin, when dried and varnished, can be rolled up like ordinary paper hangings, from which it essentially differs in possessing all the variety of tones and coloring that oil paintings admit of. The tin groundwork constitutes a waterproof protection, and, on account of its great flexibility, will follow the various moldings and contours of the object to be ornamented. To the latter should be applied a hydrofuge mixture, when it will be ready for the decorator. This method can replace ordinary gilding, as the gold can be applied in the workshop and the gilt tin fixed afterwards. The advantage of gilt tin over gilding on other metals is that it is inimical to oxidation; whereas it is known that gilding upon other metals, and notably upon zinc, deteriorates rapidly.—*M. C. Daniel.*

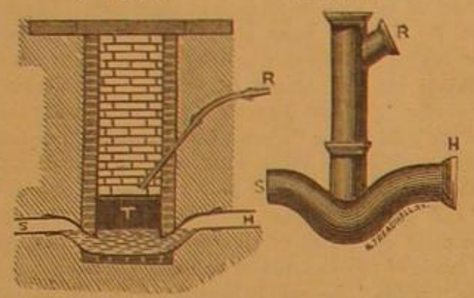
BRIDGE OVER THE NILE.—The Fives Lille Company are reported to have completed and opened for traffic a large new bridge between Kasr el Nil and Gehsireh, uniting the suburbs of Cairo with the opposite or left bank of the river Nile. This bridge is of iron, double trellis girders, and constructed in two parts, one fixed and the other movable, for the service of the navigation. Its length is about 450 yards, or a little over a quarter of a mile, and the width between the centers of the girders is not quite 40 feet. The total weight of the bridge is 1,600 tuns, and it has been built within two years.

THE Belgian government some time ago appointed a commission to inquire into the sanitary relations of factories where chemicals are made. In their report, the commission places alkali works among the most noxious of all. They also condemn tall chimneys as being more hurtful than short ones, in consequence of the greater surface over which they diffuse deleterious gases and vapors, as well as for the reason that, by increasing the draft, tall chimneys discharge gases into the air, which would be otherwise absorbed in the passage.

House Drains.

Mr. Osborne Reynolds, Professor of Engineering at Owen's College, Manchester, Eng., proposes to abolish all house traps altogether, and deal with the sewer gas outside the house. He places an ordinary siphon pipe between the house and the sewer, connecting the bend in the siphon—which practically forms the trap—with the open air. He has applied the principle to his own house, as shown in the annexed section. All the drains in the house are connected with the pipe, H, Fig. 1, which leads to a siphon trough, T, at the bottom of the man hole, the latter being constructed as near the house as may be convenient. The floor of this man hole is 2 feet above the bottom of the drain, which passes through it in the shape of an open trough, T, 2 feet and the width of the pipes deep, the sides being rendered in cement. This trough is so laid that the water stands half an inch above the orifice on the sewer side, S, and an inch on the house side, H, while, to prevent scum forming on the surface, the pipe, R, brings rain water from the roof and discharges it at the upper part of the trough, T. Of course, in most cases a much simpler arrangement than this will suffice for the sanitary requirements of the house, for a siphon trap, Fig. 2, with a pipe communicating with the surface and connected with the rain water pipe, will be found to prevent all influx of gas into the house. In this way, a trap is formed which effectually closes both the house and the sewer from the man hole, and doubly closes the house from the sewer; and

FIG. 1 FIG. 2



if care is taken to arrange the orifices of the pipes in the man hole, as recommended, it will not be possible for the water to be sucked out of the trap even should the pipe run full.

Importance of Fuel Saving Appliances.

In his recent address before the Institution of Mechanical Engineers, London, President Siemens stated that the annual coal production in Great Britain amounts at present to 120 million of tuns, which, if taken at 10s. per ton of coal delivered, represents a money value of £60,000,000. It would not be difficult to prove that, in almost all the uses of fuel, whether to the production of force, to the smelting and reheating of iron, steel, copper, and other metals, or to domestic purposes, fully one half of this enormous consumption might be saved by the general adoption of improved appliances which are within the range of our actual knowledge without entering the domain of purely theoretical speculation, which latter would lead us to the expectation of accomplishing our ends with only one eighth or one tenth part of the actual expenditure, as may readily be seen from the following figures: One pound of ordinary coal developes in its combustion 12,000 units of heat, which in their turn represent 12,000×772=9,264,000 ft. lbs., or units of force, which represents a consumption of barely ¼ lb. of coal per indicated horse power per hour, whereas few engines produce the indicated horse power with less than ten times that expenditure, or say 2½ lbs. of fuel. Again, the heat required to raise a tun of iron to the welding point of say 2,800 degrees Fahrenheit requires 2,240×2,800×0·13 (specific heat of iron) = 815,360 units of heat, which are producible by 815,360 divided by 12,000=68 lbs. of coal) whereas the ordinary heating furnace consumes more than ten times that amount. In taking credit, however, for only 50 per cent of the actual average expenditure, we arrive at an annual money saving of £30,000,000 per annum—a sum equal to nearly one half the national income! Nor does this enormous amount of waste indicate all the advantages that might be realized by strict attention to appliances for saving fuel, which are, generally speaking, appliances for improving the quality of the work produced.

Soapstone Manufacture.

Soapstone has recently found a new application as a raw material for buttons, dominoes, and other similar objects. Chips and refuse pieces of the mineral are ground to powder, mixed with silicate of soda—water glass—and after a repose of some hours, drying on a plate, when the mixture is again pulverized. The powder is then subjected to powerful pressure in molds, and afterwards baked in airtight fireclay crucibles. The pressed objects are a second time saturated with water glass, and again heated out of contact with the air. The hardness of the products depends, in a great measure, upon the number of times the heating is repeated. The last stage of the process of manufacture consists in washing in water in a rotary tub, drying and agitating in a suitable vessel with soapstone powder, which imparts a polish to the surface.

THERE is something more than a daily ferry now between Europe and America. In fact, the rate is something like a steamer for every 12 hours from the port of Liverpool alone. During the month of May, 53 steamships left the Mersey, of which 17 belong to the Cunard company, 11 to the Inman, 5 to the National, 5 to the White Star, 10 to the Allan, and 6 to the Guion Company, respectively. When to these are added the ships of the French and the German lines, we get some idea of the prodigious increase of late in steam communication between the continents.

DETECTION OF IMPURITIES IN MILK.

A recent number of the *Lens* contains an interesting report by Professor James Law, of Cornell University, upon certain microscopic examinations, by him made, of some samples of suspected milk. The latter was supplied by one of the best farmers near Ithaca, N. Y., and the author took the usual precautions to prevent the access of foreign matter after the receipt of the liquid for examination. This milk, when delivered, looked rich and good, presenting nothing unusual in color, consistency or flavor. But after standing for twelve hours, it had become viscid, and fell in fine threads from the point of a needle dipped therein. Placed under the microscope, it showed an abnormal adhesiveness of the oil globules, which had accumulated in dense masses instead of remaining apart as in healthy milk. Intermixed with the globules were dark colored spherical bodies of a much larger size (spores) and filaments. This cryptogam, or species of plant, steadily grew, and at the end of forty-eight hours presented the form shown in Fig. 1.

FIG. 1.

The farm buildings, pastures, and water supplies, where the cows were kept, were then examined and found to be in excellent order. The water drunk by the cows issued from a couple of springs, and, to the naked eye, looked perfectly clean and pure. But, under the microscope, it was found to contain numerous diatoms and spores of some low form of vegetable life. A little of this water was placed in a portion of milk which, by previous examination, had been found to be pure. In three days the milk so treated had become viscid, and contained numerous spores and mycelium (as shown in Fig. 2) which continued to grow.

FIG. 2.

Two cows, from which the impure milk first mentioned was obtained, were then examined. The animals appeared to be in good health in every respect; but on application of the clinical thermometer, it showed a temperature of 102°, while the temperature of the other cows, giving pure milk, indicated only 100°.

A little blood was then drawn from the affected cows, and, by aid of the microscope, was found to contain ovoid bodies, double the size of the ordinary blood globules. After standing corked for a few days, this blood exhibited a luxuriant growth of mycelium, or substance from which fungus is derived. A drop of this blood was also added to a sample of pure milk, and in a few days it presented a rich fungoid growth, as shown in Fig. 3.

FIG. 3.

The farm springs were now fenced, and the cows supplied with water from another source—a well upon the premises. Dram doses of the bisulphite of soda were given, for one week, to all the stock. The impurities of the milk at once disappeared, and have not returned.

The chain of evidence now appeared complete. The water contained vegetable spores, which developed into a luxuriant growth of mycelium, when allowed to stand or when added to milk of known purity. The presence of similar germs in the blood was demonstrated by microscopical examination, by the further development of the cryptogam when the blood was allowed to stand, and by the appearance of the same product in milk to which a drop of this blood had been added. The constitutional effect of its presence was slight, being manifested by a rise of temperature not exceeding 2° Fah. The germs in question were present in the milk, and grew with great rapidity in this medium. Lastly, the disuse of the contaminated water and the administration of sulphites put an end to the affection.

There is one more feature of the case which ought not to be passed without notice. Out of a herd of about twenty cows, only one or two were attacked at first, and after giving tainted milk for a week or more they recovered, while one, two, or three more had in the meanwhile been taken ill. At first the whole of the milk was injured by the admixture of the impure, and it was only by setting aside a little milk from each cow in a separate vessel that the owner was enabled to fix on the affected ones.

This unsusceptibility of the majority of the cows to the agent which all alike were swallowing, and the acquirement of this susceptibility by one after another at irregular intervals, demand investigation.

It may be added that Dr. Percy's report to the New York Academy of Medicine, in 1858, "On Swill Milk," shows the presence of spores in such milk when drawn and the growth of mycelium within twenty-four hours thereafter, though the liquid had stood in a well corked bottle in the interval. This report shows, further, the tendency of such milk to induce severe and even fatal disorders of the digestive organs of infants fed upon it exclusively in its fresh condition.

HANDLES FOR BARRELS AND BOXES.

This is the invention of M. S. Scofield, of Stamford

Conn. The construction and manner of using these handles can be readily understood from the engraving. To adapt them for use on boxes or other packages without chimes, the jaws are serrated or toothed, so that, by a sudden thrust of the handle, the teeth of the hook-shaped jaw will be forced into the side of the box sufficiently to give the handle a firm hold upon it. This seems a simple, useful, and practical invention.

Progress of the Telegraph.

The progress of the electric telegraph within the past six years has been very great in every quarter of the globe. Upon this continent, the electric wire extends from the Gulf of St. Lawrence to the Gulf of Mexico, and from the Atlantic to the Pacific Ocean. Three cables span the Atlantic Ocean, connecting America with Europe, and another submerged in the Gulf Stream unites us with the Queen of the Antilles. Unbroken telegraphic communication exists between all places in America and all parts of Europe; with Tripoli and Algiers in Africa, Cairo in Egypt, Teheran in Persia, Jerusalem in Syria, Bagdad and Nineveh in Asiatic Turkey, Bombay, Calcutta, and other important cities in India, with Hong Kong and Shanghai in China, Irkoutsk, the capital of Eastern Siberia, Kiakhta on the borders of China Nagasaki in Japan.

A direct line of telegraph, under one control and management, has recently been established between London and India, with extensions to Singapore, Hong Kong, Java and Australia.

Europe possesses 450,000 miles of telegraphic wire and 13,000 stations; America, 180,000 miles of wire and 6,000 stations; India, 14,000 miles of wire and 200 stations; and Australia, 10,000 miles of wire and 270 stations; and the extension throughout the world is now at the rate of 100,000 miles of wire per annum. There are, in addition, 30,000 miles of submarine telegraph wire now in successful operation, extending beneath the Atlantic and German oceans; the Baltic, North, Mediterranean, Red, Arabian, Japan and China seas; the Persian Gulf; the Bay of Biscay, the Strait of Gibraltar, and the Gulfs of Mexico and St. Lawrence.

More than twenty thousand cities and villages are now linked in one continuous chain of telegraphic stations. The mysterious wire, with its subtle and invisible influence, traverses all civilized lands, and passes beneath oceans, seas and rivers, bearing messages of business, friendship and love, and constantly, silently but powerfully, contributing to the peace, happiness and prosperity of all mankind.

RE-SENSITIZED PHOTOGRAPHIC PLATES.—After the collodionized plate has been sensitized in the nitrate bath in the usual manner, it is exposed to a weak diffused light; the picture is then taken in the ordinary way. Singular as it may appear, this exposure to diffused light increases the sensitiveness of the plate for pictorial purposes. Anthony's *Photographic Bulletin* states that Mr. H. J. Newton, of this city, has fully tried the plan, and finds that it reduces the time of exposure nearly two thirds without any photographic loss. Mr. Gutzlaff, of Bahia, Brazil, is the patentee of this new method.

M. GAUDUIN has been making experiments to supersede borax, which is generally employed in soldering, and the result is that he finds that an excellent flux for soldering iron, and brazing copper and aluminium bronze, is obtained by a mixture of equal parts of cryolite and chloride of barium Cryolite is a product and export of Greenland, and consists of a double fluoride of aluminium and sodium.

BED BOTTOM.

The improved bed bottom here illustrated is designed to present an elastic surface just where the same is needed and not elsewhere, and also to allow of the stretch of the canvas or cord employed in its construction being easily taken up. Fig. 1 gives a perspective view of the bedstead and bottom, and Fig. 2 is a detail longitudinal section of the same.

A is one of the side rails of the bedstead, which is of ordinary construction. Near the ends of the rails are attached the stops, B, and at the middle part, the stop, C, which is made with steps or shoulders as shown, is affixed. D and E are the head and foot frames. They are constructed by attaching the ends of ordinary slats to side bars, which side bars extend along the inner side of the bedstead rails, A, and rest upon the stops, B and C, as represented. In the head frame, D, enough cross slats are used to occupy about one foot of the length of the bed bottom, and in the foot frame, E, a number sufficient to extend about two feet of the length is used. Cords, as shown in Fig. 1, or a piece of strong canvas, as may be preferred, are secured to the inner slats of the two frames so as to form, with them, a complete bed bottom. This part of the bottom should, in practice, be about three feet in length. If desired, the two frames may be made with equal numbers of slats.

By this construction, the head and legs of the person lying on the bed are supported firmly by the slats of the head and foot frames, and the body, from below the hips to the neck, is supported by the cords or canvas. In this way, th: ced bottom is given elasticity exactly in the place where the quality is desirable. Furthermore, should the canvas or cords stretch, the slack can be taken up by raising the outer ends of the head and foot frames, or either one of them, and dropping the inner ends of the side bars into the next notch or notches of the stop, C. By this means, the difficulty which has heretofore been found in taking up the stretch is stated to be completely overcome.

The invention was patented, through the Scientific American Patent Agency, July 16, 1872.

For further information the patentee, Mr. Frederick Wellhouse, of Leavenworth, Kansas, may be addressed.

Fig. 2.

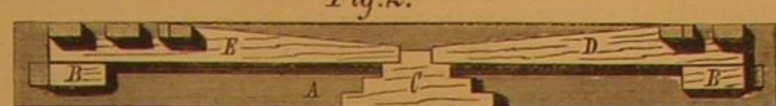
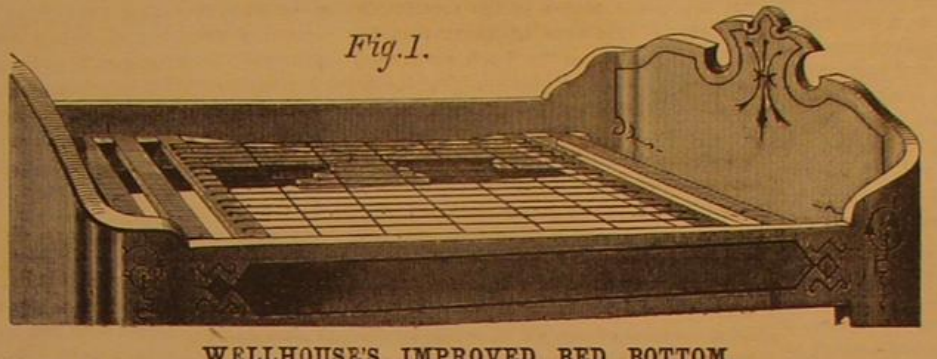


Fig. 1.



WELLHOUSE'S IMPROVED BED BOTTOM.

GIFFARD'S UNIVERSAL PISTON.

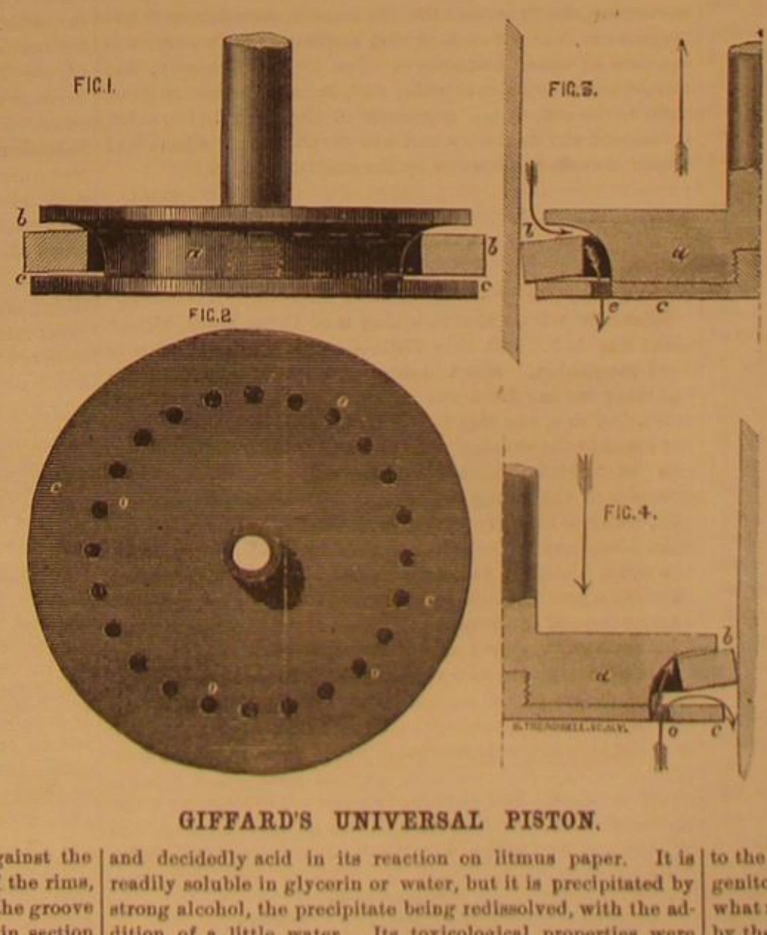
The name of Paul Giffard, civil engineer, of Paris, is by no means unknown to fame, in connection with the well known injector that goes by his name; but we are inclined to think that he will hereafter be quite as well, or even better, known as the designer and inventor of a simple and ingenious form of combined piston packing and valve, which we illustrate herewith.

From the annexed engravings, it will be seen that the body of the piston is formed somewhat like a deeply grooved pulley, in diameter smaller than the cylinder, and that a ring of suitable material, leather or india rubber, fits loosely within the groove, wherein it is adjusted to act simply as a gas or fluid tight packing, or for combined action as a packing and as a valve, in suction or in forcing action.

In the latter case, *vide* Figs. 1, 2, 3, and 4, there is not only a difference in the diameters of the cylinder and piston, and in the depth of the groove and the flexible ring, *b*, but there is also a space between the inner edge of the ring and the bottom surface of the groove, as also a difference in the diameters of the two rims forming the groove, the smaller rim having numerous perforations made so as to admit of a free communication, for the fluid or gas, between the space within the groove and the cylinder space above the piston. Thus, while moving in one direction, the fluid pressure keeps the ring tight against the larger rim and the cylinder, forming a perfect joint, whereas, when moving in the other direction, the ring will be pressed against the smaller rim, leaving free communication from one side of the piston to the other through the inner groove space and the apertures.

When, however, the ring is to be used as a piston packing only, the rims are equal, and both unperforated; and thus at each stroke in either direction the fluid presses the ring firmly against the inner surface of the cylinder and one or the other of the rims, securing perfect action in the pump. The form of the groove may be varied, but it is preferably made conical in section and polygonal in plan, as most advantageous in combination with the hollow cylindrical form of the flexible ring. The details of the construction, which is very simple, are clearly shown in the engravings: the piston, *a*, is shown in elevation in Fig. 1, and in section in Figs. 3 and 4; Fig. 2 shows the plan, *c*, of the piston and perforations, *o*; and the ring, *b*, is shown in section in Figs. 1, 3, and 4, in the former at rest; in the latter respectively as affected by the up and down stroke.

This piston is wonderfully effective, leakage and friction, or in other words, waste of power, being reduced to a minimum; and apart from its adaptation to various purposes of hydraulic and air pumps, blowing engines, gas exhausters, etc., in which it will be found of great value, there are other applications of equal or greater importance, which only await development.—*Mechanics' Magazine.*



GIFFARD'S UNIVERSAL PISTON.

Extracting Poison from the Rattlesnake.

The process of extracting the poison from the rattlesnake (*crotalus horridus*) for medicinal purposes whilst the reptiles were still living, has been successfully accomplished by Mr. J. C. Thompson and Dr. Hayward, of Liverpool. The following was the *modus operandi*, if any of our readers care to do likewise:—The reptiles were in separate compartments of a large case, fitted with a double lid for extra security. A long staff, fitted at the end, with a thick india rubber noose which could be loosened or tightened by the hand at pleasure, was inserted through the partially opened lid, and the opportunity quickly seized of slipping the loop over the snake's head, the loop being immediately drawn tight by means of the cord attached thereto. With a similar contrivance the tail was next fastened, and the snake, being thus securely held, was lifted out of the box on to the floor of the room. A pickle bottle containing chloroform was then thrust over the snake's head, and carefully held in its place by keeping time to the animal's efforts to extricate itself. As the reptile became stupefied, the noose was gradually relaxed to enable the lungs to have full play, and when it appeared powerless, the snake was laid in a long narrow box, made for the purpose, with an aperture at one end, out of which its head projected while the after operation was performed. Its jaws were then opened and fixed, and the poison glands were pressed with forceps, then with the gloved finger and thumb, while a small blown graduated phial was held to receive the drops as they slowly oozed out through the poison fangs. Twenty drops were the average quantity yielded by each snake. The venom is of a straw color, thick and gummy in consistency, and decidedly acid in its reaction on litmus paper. It is readily soluble in glycerin or water, but it is precipitated by strong alcohol, the precipitate being redissolved, with the addition of a little water. Its toxicological properties were fully tried on a variety of animals. Half a drop produced death in a linnet within three minutes after being injected under the wing.—*Hardwicke's Science Gossip.*

AMERICAN HORSES.

Vermont has long been celebrated for its trotting horses, and the Morgan breed is so identified with that State that the name is almost a synonym for horses raised there. In New York, however, the greatest attention is paid to this business. The single county of Orange has over one hundred breeding establishments, some of which are very extensive. Charles Backman's, for instance, includes six hundred acres, where are collected upward of one hundred and fifty horses, of all ages, many of which are of the finest trotting lineage. In the rear of the immense stables of this equine village are yards, exercising grounds, and a mile track for training the young animals. The whole business is as completely equipped as a commercial establishment in a large city, and the owner calculates with almost equal certainty upon the profits of his enterprise. Millions of dollars are also invested on stock farms all along the Hudson river in the breeding of trotting horses. There are similar breeding establishments in Iowa and other western States. For the last thirty to forty years, the value of trotting horses has increased even faster than their numbers and speed, the rate being at least 100 per cent every decade. In 1858, Flora Temple was sold for $8,000; in 1862, the California Damsel for $11,000; in 1866, Young Pocahontas for $25,000; and in 1867, Dexter, which in that year surpassed all previous speed—trotting a mile in 2 minutes 17¼ seconds—sold for $33,000. It is now no unusual thing for fast trotting horses and fine stock horses of the best trotting blood to sell for from ten to twenty thousand dollars. This shows the immense popularity of the American breed of trotting horses, and the amount of wealth they represent. The founder of this breed seems to have been Messenger, whose lineage is traceable back to some of the finest Arabian blood in England. He was imported into New York in 1788, and was of superb form and extraordinary power and spirit. His form, with the remarkable vitality and endurance of his race, has endowed his progeny—which has been persistently used and trained to trotting—with extraordinary courage and endurance. So great has been the impress of his wonderful stamina and splendid form upon American horses that his value to the country may be estimated at millions of dollars. His stock has been bred in-and-in to an unprecedented degree, without any of the disastrous effects generally feared from inbreeding. This success has led many to think that where sire and dam are affected with no disease, inbreeding may be resorted to with safety, the only effect being to intensify in the progeny the charcteristics common to both parents.

In this connection, a few words in reference to a very remarkable auction sale of horses which took place in July last at Tattersall's, London, will not be out of place. The animals offered belonged to the stock of the late Mr. Blenkiron, of Middle Park, near London, who was one of the most scientific and successful stock raisers in the world. Many of the nobility and the most noted horse breeders and fanciers of Europe were present.

At the appearance of Blair Athol, the finest stallion in the world, the cry of "Hats off" was raised, and the whole assemblage uncovered in honor of a horse.

The sale of this stallion was the great event of the entire auction, and the bidding was of nation against nation. Started at 4,000 guineas, the offers rose, amidst intense excitement, until, on the bid of the New Stud Company, Blair Athol was knocked down at 12,500 guineas, or the monstrous sum, in American currency, of $65,625. This was the largest sum ever paid for a horse, and by the side of it the prices paid here in America for such horses as Dexter, however much criticised, sink into insignificance. The famous Gladiateur, the triumph of the French turf, was sold to a private buyer at $35,000. Mandrake, who brought $10,500, comes to America. The twelve stallions realized altogether $182,280, an average of $15,190 each, while the entire stud, comprising, besides these, 198 mares with foals and 63 colts, brought the astounding and unprecedented sum of 102,370 guineas, or $536,440—over half a million dollars in a four days' sale.

The enormous prices which these animals brought are simply an index, says the *Evening Mail*, of the importance which is being put upon horse breeding as a branch of national industry. There was much criticism on the price paid for Blair Athol, but it was stated, in defence of that extreme valuation, that he has earned during his career as a stallion the immense sum of 32,000 guineas all told, or at the rate of $16,000 a year. It is of the utmost importance to a country, from the purely industrial point of view, that its horseflesh should be of the highest quality, and experience seems to have shown that this result is obtained by the breeding of these fancy horses, in themselves so absurdly valued, as sires. How much is owed in this country to the Morgan breed, or that of half a dozen other noted progenitors, it would be difficult to estimate justly. No matter what may be the increase of other means of transportation by the extension of railroad lines, there must be more and more demand for horseflesh, and that of the best quality; and perhaps, in this light, the high prices paid for the English stallions we have named, are not, after all, as extravagant as might at first sight be thought, even from the rigidly economic point of view.

ANCIENT manuscripts were written without accents, stops, or separation between the words; nor was it until after the ninth century that copyists began to leave spaces betwe en the words.

ABOUT 25,000 steel shuttles for sewing machines, embracing twenty patterns, are turned out monthly by the Billings and Spencer Manufacturing Company, of Hartford, Conn.

Correspondence.

The Editors are not responsible for the opinions expressed by their Correspondents.

Rubber and Leather Belts.

To the Editor of the Scientific American:

I have had considerable experience with belts for fifteen years, a good deal of it under varying circumstances, in dry and hot places, in damp and wet places, and exposed to rain, snow, and ice, with portable saw mills, grist mills and other machinery; and my experience has been the very opposite, in nearly every particular, to the statements in your journal. I began almost exclusively with leather belting, but, occasionally trying gum belting, I liked it so much better that I do not think I will ever buy another foot of leather belting; and indeed, in half the situations or uses of belting, I would buy gum in preference to using leather if furnished without cost. The severest test, that ever I put belts to in actual use, was a two inch belt on a quarter twist for driving sawdust elevators. The best leather I could get lasted only from 6 to 10 days, double lasting but little longer than single. Running two single belts, one on top of the other, however, increased their durability about fifty per cent. After wearing out several leather ones, I got a three ply gum one which lasted two months before it finally failed; and it required less than a fourth the time to tighten and repair that the leather did. With larger belts my experience has been somewhat similar, though I have never yet worn out a gum belt where it was not overstrained for want of width or sufficient pulley surface. I once had a seven inch leather belt run off a drum, draw tight across the corner of it, and while I could run down two pair of stairs and stop the engine, the belt was cut and burnt about half off, so that it had to be repaired before it could be further used; afterwards a gum belt ran off and caught in the same way, remained the same time and only had the surface gum rubbed off for a few square inches; it was hot, but sustained no substantial damage and needed no repairs. The writer further asserts that it is next to impossible to repair rubber belts; while wide ones cannot be cut up into narrow ones like leather. Now I have never found it any more nor any less difficult to repair gum than leather belts, and I do it in precisely the same way; and I have cut up pieces of wide gum belts and riveted them together into narrow belts and, when properly run, I find no difficulty with the cut edges. "A rubber band, costing hundreds of dollars, may be spoiled in a few moments by the lacing giving out, and the band being run off into the gearing, or by being caught in any manner so as to damage the edges, or by stopping of either driving (!) or driven pulley." Exactly so with a leather belt; they can be repaired alike. I once tore a new eleven inch belt in two, because it had not adhesiveness enough to do the work, and flew off and caught fast. If it had been only a nine inch gum belt, it would have done the work without slipping off; or if it had torn in two, I should have mended it in precisely the same way, namely, laid the two ends together, and put a patch of leather or gum on the outside to lap on each end and riveted through with copper rivets, a job taking ten minutes when tools and material are kept ready as they always should be. Speaking of tearing a gum belt, the writer says "if the rent strikes a seam, it is most certain to follow it, even the entire length, if the machinery is not stopped." Is he so ignorant of the subject whereof he writes as to suppose there are seams in gum belts running lengthwise? This shows how much practical knowledge he has, and how much he would impart to us. Every person, I presume, who has any practical or even correct theoretical knowledge of this subject knows that the webbing in gum belts is in long seamless bags placed one within another when over "three ply," while the three, or five, etc., ply consists of one or more bags with a flat selvaged edge strip in the center, with the gum placed around and between all parts cementing it together, making it waterproof, and giving it 30 to 50 per cent more adhesiveness than leather, as long as the gum is on it; and, if worn off, still as much as leather. Gum belts do sometimes though rarely, tear lengthwise, not because of seams, however. I have seen but one torn in that way to any length, and that was about ten feet, but was repaired without much difficulty. Animal oils spoil the gum on a belt; there is no demand nor expence for oil on them as for leather, and no intelligent person allows any put on them, though I have seen ignorant men pour oil on when the trouble was in not setting the pulleys right. A gum belt will stretch the first day or two as much as leather till it gets a certain length, or set, then it stretches very little and will run frequently for years without having to be altered, while leather continues to stretch as long as there is anything left of it; and leather stretches every dry warm day, stretches more on getting damp, then again on drying, and so on; while dampness or dryness has no effect on gum. I have never known moisture and water to soak into a gum belt, much less have I had water freeze in a belt and burst it; I never knew the gum to pull off the belt when frozen to the pulley, though I have very often started them when frozen to pulleys and sheeted with ice between pulleys; but one round scales off all ice by bending over the pulley, while a leather belt must be taken off and folded away in the dry, or you have trouble. I have used gum belts crossed and quarter twist, and with sliding friction for hoisting and stopping loads, where they would heat too hot to bear my hand upon them, and they were not damaged when used with discretion at the start till they get a polish and a good solid working surface, after which there is little danger. A gum belt requires more care while new than afterwards, as the gum is more sticky and softer; but it may be heated to over 300 degrees any time without injury, if not done by harp, cutting or scratching points or edges, while leather is crisped and ruined for all purposes at about 200 degrees, less than the boiling point of water. I lately put two seven inch leather belts on a machine for hoisting coal, because, as there was some sliding of belts, I thought they might do better than gum, but they utterly refused to lift the load required; so I laid them away to sell to the shoemakers, and got three ply gum ones, and the coal comes up easy enough now. The worst objection I have to gum belts is the disagreeable smell of the sulphur on their surface while new, which is hard to keep off one's clothes. But the advantage is that they always do their work well, without trouble, always run to their places true and straight as long as they last; while even the best factory leather belts will draw crooked by use, and the longer they run, the worse they get.

THOMAS HOGE.

Waynesbury, Pa.

How is Erratic Motion Caused?

To the Editor of the Scientific American:

I read, in an excellent and very interesting article, published in your journal of August 10th, that the results of Professor Agassiz's geological researches in Patagonia, prove that the grand march of the erratics, in that country, was *northward*. He says of them that the "grand general movement, was from the South, northward;" and that "their direction is such that glaciers from the adjoining mountains cannot be supposed to have caused the abrasions and furrows of the rocks." Does not this scientific discovery, this mass of facts, go a great way in establishing the theory I propounded and published in your valuable journal, Vol. XVIII, page 37, 1868, nearly five years ago? I said, in that article, that all the glacial epochs that ever the earth saw were caused, and would be caused, by the poles of the earth laying in the ecliptic plane; and that through the combined attraction of the sun and ice, the grand movement of the vast fields and mountains of ice, which would be formed alternately at the poles, would be toward the equator, with an eastward or westward tendency, according to the position of the sun to the earth at the time. I venture to say that all geological research made, from Patagonia to the most northern boundaries of Brazil, will show that the grand march of the erratic family has been northwestward; and that all such research will as surely prove that all erratic motion from the north pole, has been in a southern direction.

I have merely thrown out these few remarks to, as it were, stimulate scientists, geologists and astronomers, to give the theory and the subjects it involves more candid consideration, and more thorough investigation. The earth has, undoubtedly, seen many glacial periods in its time, at least one undeniably; and to find out what is the cause of that one, or of the many, must surely be, to studious and scientific minds, of vast interest and importance. If the ice had grown and and accumulated for many ages together, as some scientists think, then it seems to me that the tops of a great many mountains, and especially hills, would be worn off and furrowed, but such phenomena are very rare indeed; whereas striations on the rocky coasts of lower lands and of mountain sides show that the ice formed, though massy and magnificent, was not of such vast magnitude as to cover hill and dale of either hemisphere. The ice, undoubtedly, was formed annually, at each pole; and, in being presented gradually to the sun, by the movement of the earth in her orbit, it loosened and broke up, and was drawn in vast sheets and blocks towards the equator by the sun's attraction.

JOHN HEPBURN.

Gloucester, N J.

Lightning.

To the Editor of the Scientific American:

Scientists tell us that lightning is of three kinds, zigzag, sheet and ball. But this distinction, I think, is without good foundation. Sheet lightning is nothing but zigzag lightning darting from one cloud or part of a cloud to another. Of this, one may satisfy himself by observing a thunder cloud in the evening which is manifesting the phenomenon of "sheet lightning" He will occasionally catch glimpses of the zigzag and be able to trace its general direction, which is most frequently horizontal, but sometimes upward into space. The streak is sometimes seen to divide into a dozen branches, radiating in all directions, and when shooting upwards, these branches occasionally extend several degrees beyond the outline of the cloud. This phenomenon I have witnessed scores of times. The reason why the zigzag is so rarely seen is because it is in the interior or upper part of the cloud, and seldom comes near enough to the surface to be caught by the eye. As to ball lightning, the evidence of it is not satisfactory. The witnesses of this phenomenon are, for the most part, ignorant peasants of Europe, living during the last century. I have yet to learn of a single instance of ball lightning of recent date being seen in this country by a person whose testimony is worthy of credit.

Franklin, N. Y. J. H. P.

Sulphuric Acid in Vinegar.

To the Editor of the Scientific American:

The simplest way of detecting sulphuric acid in vinegar is to add a few drops of baryta water, when the liquor, if sulphuric acid be present, will become cloudy, sulphate of baryta being formed, which is insoluble. As baryta is poisonous, the experiment should be made with a small quantity. Every druggist keeps or ought to keep baryta water.

New York city. E. W.

TO REMOVE iron rust from linen, apply lemon juice and salt, and put it in the sun. Use two applications if necessary.

MISCELLANEOUS ITEMS.

An improvement "for imaginary horseback riding" is the designation given in a recent patent granted to C E. S. Scripture, for a combination of see-saw levers, which are made to canter or trot the rider, to suit his taste. It is intended as a sort of mechanical gymnastic machine.

William M. Welling's patent for the manufacture of artificial ivory, has lately been extended by the Commissioner of Patents for seven years. The article is composed of 10 ounces of white shellac, 4½ ounces acetate of lead, 8 ounces of ivory dust, and 5 ounces of camphor. The ingredients are reduced to powder, heated, and mixed, then pressed in heated molds into sheets or other desired forms.

A PATENT BREAKFAST.—The Commissioner of Patents has lately issued a patent to John R. Weed for a hash of dried fish and potatoes, as an article of food. Boarding house keepers will now have to discontinue the practice of letting their fish balls stand over.

The tornados, it appears, are not all confined to the western parts of our country. On the 15th of August, Massachusetts experienced a touch of one of these peculiar visitors. A tornado swept from East Longmeadow to Wilbraham, and leveled everything in its path for a distance of five miles, its course being northeasterly. Stone walls and fences were strewn in every direction. A strip from five to fifteen rods in width was cut clean through a forest of large trees, and several buildings were thrown down, but no dwellings. Total loss, about $15,000.

The prospects for business this fall are excellent. The crops in nearly all parts of the country are good, and the merchants generally predict a large fall trade. Increasing activity is manifest in all departments of industry.

Dr. Robertson, in *Dental Cosmos*, gives an account of the destruction of a considerable portion of the jaw bone of a patient who had been poisoned by the fumes of zinc. The man was a brass founder, and in pouring the alloy of copper and zinc, the fumes of the latter were abundantly thrown off The action of zinc fumes upon the bones of the human system appears to be analogous to that of phosphorus.

The Erie Railway is not likely to be very profitable to its shareholders for a long time to come, if we may judge from a recent report of its new directors, who succeeded the notorious Fisk & Co. in the management. According to this report, the Company own or have under lease 1,547 miles of track, on one of the best routes in the country. But the stock was so heavily watered by Fisk, the increase having been from $16,000,000 to $80,000,000 since 1867, that it will take a considerable augmentation in the receipts before the stockholders will receive so much as a one per cent dividend.

We recently alluded to the subject of bank robberies, and suggested that the managers of such institutions ought to furnish their premises with the improved electrical alarms as the most reliable means of protection. We further stated that some of the most daring bank robberies had been perpetrated even when special watchmen were employed to guard the safes. Another remarkable example of these bold depredations was lately committed in Baltimore, Md. The safes of the Third National Bank were opened, by cuts made through the walls of the adjoining building, and completely rifled. From five hundred thousand to one million of dollars in bank notes and securities were stolen. The bank building was guarded by watchmen, who knew nothing of the matter until after the thieves had fled. This robbery might have been prevented and the thieves captured had a suitable electrical alarm been attached to the walls of the safes.

Some of the glass tanks of the new aquarium at Brighton (Eng.) are 100 feet in length. Of smaller sizes, there are a great many. We hope that one of these days the Commissioners of this city will erect aquaria of large size at the Central Park.

MOSCOW INDUSTRIAL EXPOSITION.—A large and extensive industrial exposition is now open in Moscow (Russia), and attracts great attention. We find here, as in other European countries, that the inventions of citizens of the United States, such as firearms, sewing machines, reapers, and woodworking devices, occupy the prominent places and receive the highest patronage. But in a material point of view, this is of little benefit to our people. In the first place, our tariff and tax laws have brought up the costs of manufacturing goods in this country to such a high figure that we can not fill orders for our own goods half so cheaply as can the foreign imitator. Specimens of our improvements are eagerly sought for from abroad, simply that they may be copied; but we get comparatively few important orders. In the second place, many of the continental patent laws are so framed as to discourage American inventors from undertaking the introduction of their improvements. For example, in Russia the expenses of securing a patent are very heavy, and the grant only lasts for ten years. The formation of companies, the inauguration of new enterprises, the movement of individuals, are all burdened and discouraged by governmental surveillance and official interference. At the present Moscow exhibition, the best specimens of Russian cotton are those raised from American Sea Island seed. The display of American sewing machines is quite large; although few, if any, of the machines came from this country. They were mostly made in Germany, and are copies of our patterns.

The celebrated American yacht Sappho is now in England, and Mr. Douglas, her owner, has challenged all the British schooner yachts to race with him across the channel and back. It is believed that the Sappho can beat anything there is afloat of equal size in European waters.

Recent Patent Decisions.

APPEAL FROM THE BOARD OF EXAMINERS-IN-CHIEF IN THE MATTER OF THE APPLICATION OF PHILIP C. SCHUYLER FOR LETTERS PATENT FOR IMPROVEMENT IN FLOUR SACKS.—DECIDED JULY 31, 1872.

Leggett, Commissioner.

The alleged invention in this case is a flour sack, made of a fabric consisting of cloth and paper attached to each other; to be made in such a manner that the cloth shall be on the outside.

The applicant is rejected upon an application made by Charles E. Howland, who invented a bag made of precisely the same fabric, except that he describes it as having the cloth on the inside and the paper out; in other words, Howland's bag is made of a fabric with one side out, and applicant's of exactly the same fabric with the other side out.

It seems to me ridiculous to talk of the difference between these two bags constituting an invention. The reference I regard as well made and as fully answering the claim of the applicant; but even in the absence of any reference I would not regard a bag made of such a fabric as being patentable.

Bags have long been made of cloth, and also of paper. The fabric consisting of paper and cloth, or a fabric having one surface composed of paper and the other of cloth, is old, and has been used for a variety of analogous purposes for many years. To say that a person entitled to the use of this fabric should not have the right to make it into so common an article as bags, with either side out that he might prefer, would be placing a restriction upon the use of the article which is not justified by the patent laws nor by common justice.

The decision of the Board is affirmed.

HENRY AND F. J. L. BLANDY.—EXTENSION OF LETTERS PATENT NO. 21,059, FOR IMPROVEMENT IN STEAM ENGINES.—DECIDED JULY 27, 1872.

Novelty.—Diligence.—Remuneration.

Where the validity of the patent has been sustained in court, and no new references are brought to the attention of the Office, the novelty of the invention patented must be regarded as unimpeachable.

Where the inventors have manufactured their improvements, but their reasonable profits have been reduced by inferior machines put upon the market by infringers, and where active and persistent efforts have been made to bring such infringers to justice: *Held*, that it cannot be charged upon the inventors that it is through neglect or fault of their own that they have failed to secure reasonable remuneration for their invention.

The invention having been proved of great practical utility in its application to portable steam engines: *Held*, that a net profit of $9,000 is an insufficient remuneration for the time, ingenuity, and expense bestowed upon the invention.

Thacher, Acting Commissioner.

United States Circuit Court, Western District of Pennsylvania.—Smith *et al. vs.* Frazer *et al.*—*In Equity.*

PATENT OF J. R. SMITH, AUGUST 27, 1867, FOR STONE CRUSHER—MECHANICAL MODIFICATIONS WITHOUT INVENTION—NOTICE OF PRIOR KNOWLEDGE AND USE.

McKENNAN, Circuit Judge.

A claim for introducing water into the pan of a stone crushing machine to aid in disintegrating the rock and to cleanse and discharge the pulverized sand, the auxiliary and dependent relations of the water to the mechanism and its coöperative agency being fully set forth in the specification, held to embody patentable subject matter.

The patent of John R. Smith pronounced invalid in view of the Chilianmills previously used in crushing and washing ores.

Where the gate in a machine for crushing and cleansing gold ores had been placed in the side of the pan, above the bottom, with view to discharging the water and lighter impurities, but retaining the gold: *Held*, that if it were desired to discharge the entire contents of the pan, this could so obviously be effected by extending the aperture to the bottom that the change would fall far below the rank of an invention. To conceive and make it would require but a small amount of mechanical knowledge.

If, in the notice of special matter relating to the novelty of the patented invention, the sources of defendants' proofs are indicated with such distinctness that the complainant can identify and resort to them, the purpose of that provision of the law which requires the defendant to give "names and residences of those whom he intends to prove to have possessed a prior knowledge of the thing, and where the thing had been used" is answered.

Where the defendants gave the name of certain mining establishments in a specified county as the places where the prior use of the invention had taken place: *Held*, that they had fairly supplied the complainants with the means of verifying their proofs, and had filled the measure of their legal duty.

Complainants, John R. Smith, William H. Denniston, and Christian Snyder; defendants, William E. Frazer, Harvey Fry, George H. Holtzman, and David L. Furnier, treading as Fry, Frazer & Co.

The claims of the patent were as follows:

1. The introduction of a stream or flow of water into the crushing pan of a revolving sand, sand rock, or sandstone crusher, to aid the crusher or crushers in disintegrating the rock, and to cleanse and discharge the pulverized sand, substantially in the manner and for the purposes hereinbefore set forth.

2. The rotating and revolving crushing wheels, *b*, in a sand rock crusher, in combination with a crushing pan, *a*, provided with a discharge gate, *s*, and a water supply pipe, *h*, or its equivalent, all constructed and operated substantially as and for the purposes above set forth.

Bakewell and Christy, for complainants; John Mellon and John H. Bailey, for defendants.

THE AMERICAN INSTITUTE OF INSTRUCTION held its forty-third annual meeting in August last at Lewiston, Me. Several of our prominent and indefatigable workers in the cause of improved education were present, and quite a number of valuable papers were read. Mr. Nathaniel T. Allen, who, as an agent for the United States Government, has visited Prussia and examined the educationary system there in vogue, stated that he found the *Prussian system* to be far ahead of the American system, and urged a course of united action among educators which shall bring ours up to a level with theirs. He, however, considered the Prussian system to be defective in the following particulars, namely: 1. It is autocratic; 2. It is unjust to girls; 3. It is thoroughly undemocratic in its teachings; 4. It is sectarian.

Glass Lined Iron Pipes.

This is a new and valuable manufacture now carried on in this city by the Glass Lined Pipe and Tube Company of New York. Through these pipes the water comes in contact with nothing but glass, and cannot become impregnated with any oxide, as in all metallic pipes; there being no oxidation or corrosion, their purity and durability cannot be questioned. The inner surface of the pipes being perfectly smooth, there is no friction, and the flow of water is greater, and can be carried up in houses with less pressure than through any other pipe of the same diameter. The lining between the iron pipe and the glass tube inside consists of plaster of Paris, a nonconductor of heat; this prevents the water therein from freezing in winter and keeps it cooler in summer, thus saving these pipes from bursting. The lining in the pipes is protected against any moisture by a layer of hydraulic cement, which is put on the end of each length of pipe, thus preventing the plaster of Paris from being affected. The resisting power of the glass lined pipe is five times greater than lead, and the difference in the expansion and contraction between iron and glass is overcome by the compressible plastic substance between the two materials. The glass lined pipes are invaluable for conveying chemicals or any other liquids that are to be kept free from impurities, and also for ale and beer pumps, condensing of salt water on steamers, purifying gas, and for numerous other purposes. It is a fact well known that quite a percentage of gas escapes through the pores of the iron. When lined with glass this waste is prevented, and the pipes rendered much more durable. Great expense for continual repairs is almost entirely overcome, and the cost of this pipe is not much above lead pipe.

New Process for the Preservation of Alimentary Substances.

In a communication recently made to the French Academy, M. Sacc described his process and submitted specimens of meat and vegetables so prepared. The food to be preserved is placed in a barrel, with layers of powdered acetate of soda, in the proportion of one fourth by weight. In winter, the temperature must be raised to 20° C. After twenty-four hours, the barrels must be turned, and after forty-eight hours the process is complete, the salt having absorbed the water of the meat, which may then be headed up in the pickle, or dried in the air.

If the barrels are not full, they are to be filled up with brine of one part acetate of soda in three parts water. The pickle is evaporated down to half its bulk, crystallizing and regenerating for use one half the salt employed.

The mother liquors form an excellent extract of meat, representing three per cent of the total weight, and must be preserved and poured over the preserved meat when prepared, so as to restore the original flavor of the fresh meat, of which it is otherwise bereft by the retention of the potassic salts in the pickle.

For cooking, the preserved meat must be steeped for from twelve to twenty-four hours, according to size, in tepid water containing ten grammes of sal ammoniac per liter. This salt decomposes the acetate of soda contained in the meat, forming salt, and also ammoniacal acetate, which causes the meat to swell, and restores to it the odor and acid reactions of fresh meat.

The bones also yield an excellent and tasty soup. By adopting the precaution of simply removing the intestines, animals, etc., may thus be preserved whole. Fish, poultry, and game have been so treated, with excellent results. Meat may be dried in a stove, losing one quarter in weight thereby, in addition to one quarter lost in pickling; but, in general, fish cannot be dried at all.

Vegetables are similarly prepared, losing generally five sixths of their weight; before salting, they should be heated until they lose their rigidity. In twenty-four hours they may be pressed and dried in the air. For use they must be steeped for twelve hours in fresh water, and then boiled as if fresh. Potatoes must be steamed before salting.

Finally, all food thus prepared must be kept perfectly dry, as the salt absorbs moisture from the air.

New Galvanic Battery.

M. Gaiffe has recently introduced to notice a new electric pile, devised by him with a special view to its universal cheap production. It resembles in form Callaud's cell, which has been employed for some years on telegraph lines, but the elements are different. The poles are rods of lead and zinc, immersed in a ten per cent aqueous solution of ammoniacal chlorhydrate, contained in a suitable vessel. The zinc rod is only half the whole depth, whereas the lead rod reaches to the bottom, where there is a layer of saline oxide of lead (minium). The electro motive power of this pile is about one third of that given by a Bunsen couple; its internal resistance is small and little variable, as the chloride of zinc formed does not sensibly change the conductibility of the exciting liquid; its constancy is great; and finally the cost is merely nominal when the circuit is open.

The Medicinal Use of Carbolic Acid.

Carbolic acid is very largely employed in the treatment of wounds and festering sores of all descriptions; but hitherto few experiments have been made with it as an internal remedy. There is good ground, however, for believing that in certain cases it will be found a very valuable therapeutic agent, and under these circumstances the *Lancet* describes some experiments which have been made by two French *savants* to ascertain in what doses it may be poisonous.

MM. Paul Bert and Jolyet, of Paris, have undertaken experiments to make out this point. Between forty-five and sixty grains will kill a dog of large size; nor should it be concluded that a man could bear a dose in proportion to his weight compared to that of the dog, as thirty grains of hydrochlorate of morphia have been injected into the jugular vein of a dog without killing him. Of course one fourth of this dose would kill a man. The above mentioned authors state that carbolic acid is a powerful poison, which, very imprudently, is left in the hands of anybody, either in solution or in the solid state. The former is the most dangerous, as some weak solutions for internal use are sold, as well as very strong ones intended for external use. Thus mistakes may easily occur. MM. Bert and Jolyet find that carbolic acid acts like strychnine on the excitability of the spinal marrow. It increases its sensibility, like strychnine, at first; but it diminishes that sensibility, or completely abolishes it, when the convulsive stage has exhausted the medulla. The phenomena resulting from carbolic acid are said by our authors to be quite similar to those produced by chloroform, chloral, ether, woorara, and the section of a motor nerve.

Importance of Truth in the Cultivation of the Memory.

When we reproduce what we have seen or otherwise experienced, it must be with scrupulous fidelity. No details must be filled in by the imagination. It is one of the most difficult things in the world to speak the exact truth, or even to represent to ourselves the exact truth. If we hear an event frequently related, we soon begin to confuse it with our own recollections. In this way, honorable and conscientious persons have testified to witnessing occurrences which really took place before they were born, but which had been often repeated to them in childhood. The imagination is an active and deceitful faculty, often putting on the guise of recollection. Without the most vigilant care to distinguish the two, men may come to utter the most absurd falsehoods, without any suspicion that they are not telling the truth. Imagination is but a rearrangement of our experiences, and the faculty of taking note of this rearrangement gets untrustworthy without a persistent and conscientious exercise of it. Hence, though, as the proverb says, liars have need of good memories, they are of all men the least likely to have them. The best cultivation of the memory, therefore, forbids us even to highten the color of a narrative, or sharpen the edge of a witticism, when professing to narrate what has occurred, but to accept dulness rather than admit inaccuracy.—*American Exchange and Review.*

The Reffye Cannon.

This piece, so called the Reffye, after its inventor, is a gun recently employed in the French artillery; it is a breechloader, and can throw a projectile weighing 7 kilogrammes (15·4 lb.) for a distance of 5,500 yards.

This gun combines the lightness and portability of field pieces with the accuracy and range of siege guns of average caliber. The grooves are numerous, in order that an equal action may be imparted to the whole surface of the lead-covered projectile. The gun is of bronze, made of 100 parts of copper to 11 of tin. The total length of the piece is 6ft. 8½ inches, the diameter of the bore is 3 5/16 inches, and the weight of the complete weapon is 1,320 lb. The charge is divided into two parts, the cartridge and the projectile, their respective lengths not permitting of their being united. Forty-two ounces of compressed powder, arranged in disks, form the charge, which is placed in a metallic envelope, the net price of which, complete, is 1·10 francs. As to the projectile, it is cylindro conical, of cast iron, 9½ inches long, and covered with a zinc envelope. The shells are ignited by a percussion fuse. This type of ordnance, rendered celebrated during the defence of Paris, principally on the plateau of Avron, will play an important part in the future of French artillery.

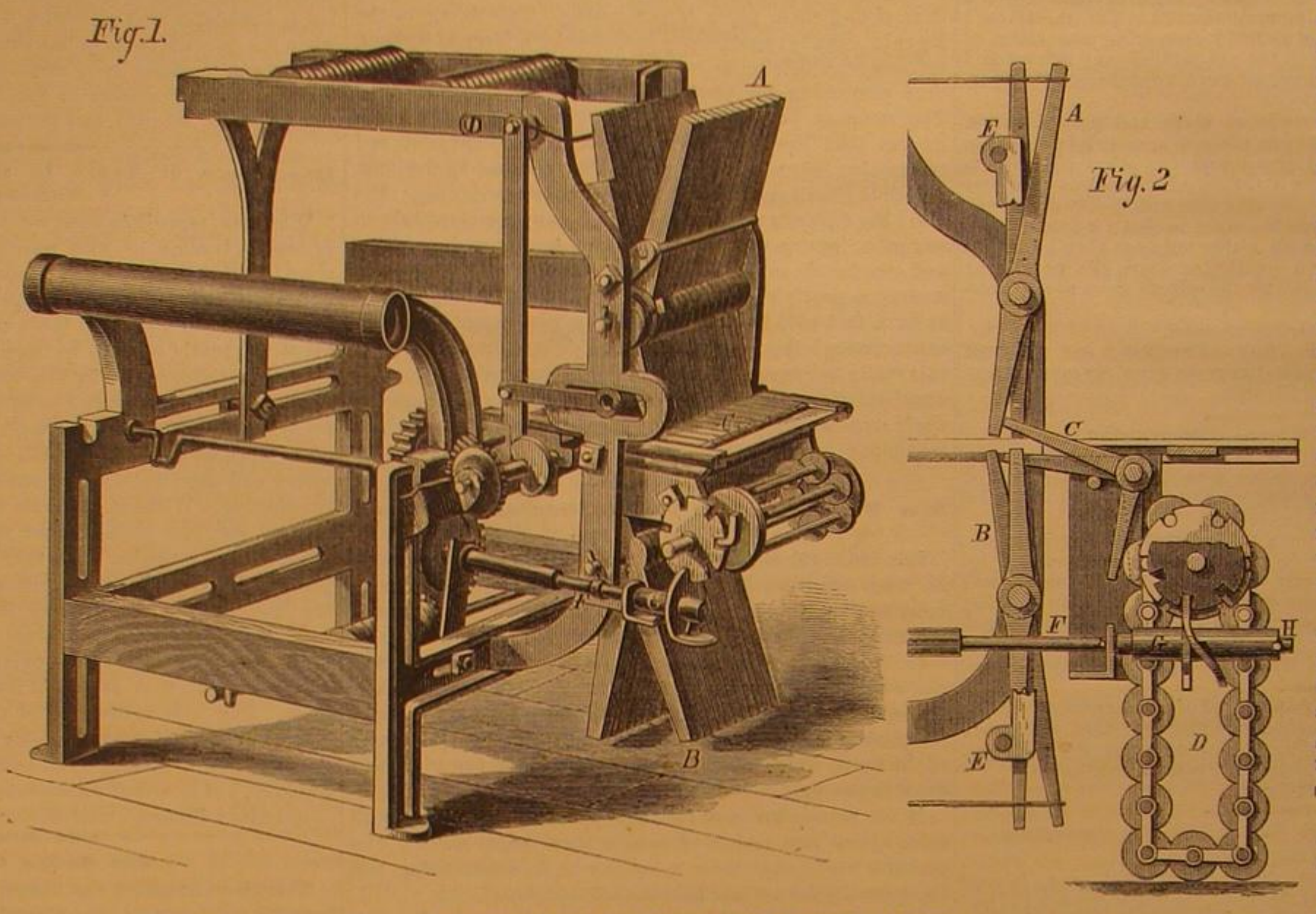
CERESINE.—Céresine is a new product destined to play an important part as a lighting material. It is obtained from ozokerit or fossil wax by the following process: Ozokerit is heated up to a temperature ranging from 250° degrees to 300° Cent. in order to separate, by volatilization and subsequent condensation, the liquid oils. The mass being cooled down to 60°, it is heated with from 10 to 20 per cent of the sulphuric acid of Nordhausen. The temperature is then raised to 100°, and care is taken to maintain this heat until the precipitation of the carbon takes place and forms a viscous residue, which is carefully separated from the supernatant oils, heated and then treated with about ten per cent of diluted sulphuric acid, afterwards neutralized by aid of an alkali. The mass is then heated to about 180°, poured upon plates and pressed through linen cloths in order to separate the greasy matters; this residue of wax can then be melted and filtered. The product is céresine, which is employed in the manufacture of candles.

LEE, THE LEARNED CARPENTER.—Samuel Lee, Professor of Hebrew at the University of Cambridge, England, was seventeen years of age before he conceived the idea of learning a foreign language. Out of the scanty pittance of his weekly earnings as a carpenter, he purchased a book, and when this was read, he exchanged it for another, and thus he advanced in knowledge. He had not even the privilege of balancing between reading and relaxation, but was obliged to pass directly from bodily fatigue to mental exertion. During the six years previous to his twenty fifth year, he omitted none of the hours usually appropriated to manual labor, and he retired to rest regularly at ten o'clock in the evening, and yet at the age of thirty-one years he had actually taught seventeen languages. This illustrates that "where there is a will, there is a way."

FANCY WEAVING LOOM.

The invention we illustrate relates to a new arrangement of mechanism for producing the harness motion in fancy looms. Mr. John Crawshaw, of Coburg, Ontario, the inventor, is a practical weaver, and has devoted years to bringing these improvements to perfection.

Fig. 1 gives a perspective view of the machinery employed, unincumbered by the harness, heddles, etc. Its more essential parts are shown in detail at Fig. 2, and their mode of operation will now be explained. At A are levers whose upper ends are connected by lines with their respective heddles in such manner that the heddles are raised when the upper ends of the levers are forced outward. B are levers connected similarly with the lower sides of the heddles, so as to pull them down, when their lower ends are forced outward. At C are elbows which operate these levers, and which are themselves worked by the chain, D (shown only in Fig. 2; its reel is seen in Fig. 1). The normal position of the elbows is that of rest against the upper part of the levers, B, under which conditions the heddles also are at rest, and the warp remains unopened. Upon the chain pressing in the ends of the elbows next to it, the other ends are raised so as to release the levers, B, and to press back the lower ends of the levers, A. The effect of this is to raise the heddles connected with the levers and to open the warp so that the shuttle may be thrown. A cam is now made to operate through levers upon the rods shown at E, in such a way as to bring the levers, A and B, all into line in a neutral position, thereby closing the warp. The inner ends of the levers are now clear of the elbows, which, being released by the chain, fall into their normal position.



CRAWSHAW'S FANCY WEAVING LOOM.

Another prominent feature is the mode of driving the wheel that carries the chain. F is the driving shaft, upon which is placed the sleeve, G. This sleeve carries a cam of peculiar form, shown in the engravings, by which the reel is rotated. The shaft admits of being easily shifted in the direction of its length, and the sleeve and it are only held together by the pin and notch shown at H, which are brought together by a concealed spring. This spring is made to adjust the hold taken by the pin so nicely as to allow of the rotation of the sleeve only while the loom is working properly and smoothly. When, by reason of any accident happening, extra work in turning the reel is thrown upon the sleeve, the tension of the spring is overcome, the pin is disengaged from the notch, and the shaft continues to rotate without carrying the sleeve with it. Thus all chance of damage is effectually prevented.

The improvements described are of a very important nature. In the usual construction of fancy looms, the warp is opened by a combined up and down movement of the heddles, which is effected only by very complicated machinery governed indirectly by the Jacquard chain. In Mr. Crawshaw's loom, the warp is opened by a simple upward movement of the heddle, to effect which requires considerably less power than the usual movement. This allows of the direct use of the chain in producing the motion, and does away with a long train of intricate mechanism.

A patent for this loom was obtained through the Scientific American Patent Agency, July 23, 1872, and further information in regard to the invention can be obtained of Mr. Crawshaw, as above.

Architectural Millinery.

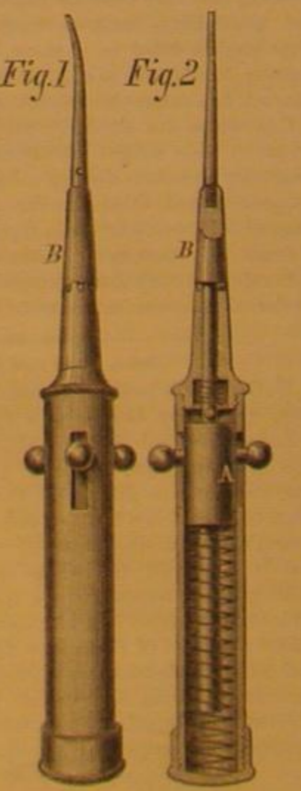
Architectural millinery is that class of unnecessary detail which is used simply because it is thought ornamental, and not because it in any way adds to the utility, comfort, or expression of a building. There is architectural millinery in all styles, and it might, if it would not lead to confusion of idea, be summed up as Flamboyant, as Mr. Ruskin employed that term. If we turn to the florid descriptions of the press, of the last reredos wrought for our own cathedrals at the price of a prince's ransom, twisted columns decked with glass mosaics, agate balls, and similar ladylike millinery, form the staple of the attractions dwelt upon. While we cannot but sigh over the waste in such trumpery of sums that might pay for real art, and by this have raised up the school of decorative artists we so much desiderate, we look with sterner eyes upon architectural millinery of the baser and more meretricious nature which flaunts itself before our eyes in the streets. If twisted columns are absurd, what is to be said of still more important features tortured, parodied, and misplaced, pediments cut in two, and the ends curled up: whole orders stuck on to facades, like false shirt fronts: poised upon brackets or monstrous nondescript corbels: wreaths and masks and heads of marine deities applied without rhyme or reason? Such is architectural millinery, which no fellow can understand, and considering its enormous cost, utter uselessness, and amazing ugliness, one wonders that hard headed citizens are to be found who consent to have their pockets so rifled as they are by the architects they affect.

If a few of the magnates of the profession could be made to pay themselves for all the rubbish they design, and forced, under such a penalty, to give good reason for the architectural faith that is in them, they would soon learn to dispense with such things as they certainly cannot believe in themselves, and for which there is no other epithet so appropriate as architectural millinery.—*Building News.*

GRISWOLD'S DENTAL PLUGGING INSTRUMENT.

The improved dentist's plugger illustrated in our engraving is the invention of Mr. White F. Griswold, of Leavenworth, Kansas, and was patented through the Scientific American Patent Agency, April 9, 1872.

Fig. 1 gives a perspective view of the instrument, and in the sectional view, Fig. 2, are shown all the parts in detail.



It will be seen to consist of a tubular case, within which is placed the sliding mallet, A. The mallet is drawn back by means of the studs shown, which pass through slots in the case; and is impelled forward by the spring seen in Fig. 2. B is the stock for holding the plugging tools, which are screwed into its forward end in the manner shown, and which are provided with holes for the introduction of a small lever when needed. The rod of the tool stock which passes into the case is connected therein, as in Fig. 2, with a spring, by which it is drawn back after being driven forward by the stroke of the mallet. On the end of the case are a number of radial notches, and on the opposed end of the tool stock are one or two radial pins, which are placed so that they fall into the notches that lie opposite and prevent the tool turning round while the instrument is being used. They further serve to keep the stock from turning while the tool is being screwed in or out, and thereby allow those operations to be performed by one hand only, which is a great advantage and sometimes a necessity. In so doing, the case is held against the palm of the hand by the third and fourth fingers, and the tool turned by the first finger and thumb. Heretofore instruments of this character have been made with but one stud for actuating the mallet. By attaching them at suitable intervals, as in this device, a stud is always presented for use when the instrument is rotated, which is often required to be done while the plugging is going on.

Further information may be obtained of the inventor at the foregoing address.

The Electrical Season.

The atmosphere seems to be surcharged with electricity at the present time, as is evidenced by the brilliant auroral displays, and the constant and violent thunderstorms which are of daily and nightly occurrence in different sections of the country. Telegraphic working is considerably impeded by this excess of atmospheric electricity, and telegraphers are having some lively and exciting experiences in their attempts to operate their instruments, though as yet we have heard of no serious injuries from this cause. It behoves all those having charge of telegraphic apparatus to be very careful how they handle them at such times, and to exercise more than usual caution and diligence in seeing that their lightning arresters are in good order and properly attached to the wires. They should also be careful to cut out of circuit their instruments, when left for the night or for any length of time unattended or unwatched.

We notice that the same electrical condition of the atmosphere exists in England, and much damage has been done to telegraph lines and instruments by violent electrical storms.

There have been recently some very brilliant displays of aurora borealis or northern lights, which are rather unusual at this season of the year. On Thursday evening, August 1st, the skies were lit up for some hours with a most magnificent exhibition of celestial fireworks, and again on Saturday, August 3d—both of which continued for some hours, and were visible over a great extent of country. The electrical character of these exhibitions is now generally known and conceded, though one of the great morning newspapers of this city, which is noted for its scientific information and accuracy, gravely argues that they are caused by the refraction of the sun's light from the great polar ice fields!

On the evening of August 15th, one of the northern wires of the Western Union Telegraph Company was worked from this city for some time with the auroral current, the batteries being disconnected; and on the evening of the 18th, one of the eastern wires of the same company was worked successfully from this city to Boston for half an hour with the auroral current. This was doing pretty well for the refraction of light from polar ice fields.—*Telegrapher.*

Cleaning off Panels.

In cleaning off, the different panels on heavy or light work requires close attention of the body maker. When the job is finished by the painter, all uneven places will show when exposed to the light. The body maker should have certain planes for cleaning off swelled and concave panels. Planes that are used upon coach quarters should be concaved from 1-6 to ¼ inch, so that they would remove all flat places; for concave panels on coaches when cleaned off, care should be taken that no short sweeps or concave are left. A few days ago we noticed a very fine finished coach in the street, but when the sun shone upon the concave, it showed a number of wrinkles, which were caused by the unevenness of the panel, and the quarters were the same. The generality of body makers can detect all uneven places by rubbing the hands over the panels while finishing; by constant practice the hand becomes sensitive to the least unevenness. In light bodies where the panel is plain or flat, the panel should always have a little fulness when cleaned off, for if not, when painted it looks as if it was sunk or concaved; a panel that is full shows the painting to a much better advantage. In sand papering off panels, a large block should be used; cork blocks are the best, as they can be used in almost any sweep, some use leather of two or three thicknesses for small concaves.—*Coachmakers' Journal.*

THE length of tacks, as understood and given by the manufacturers, is by the "ounce," which is printed on the label, and stenciled on the box or package in which the goods are placed for transportation. "Three ounce" means that the package so labeled contains tacks three eighths of an inch long, and that *for every three ounces of tacks of that length* there should be 1,000 tacks. Four ounce would be seven sixteenths inch long; six ounce, eight sixteenths; eight ounce, nine sixteenths; and for each "full weight" package thus labeled, there should be 1,000 tacks, and so on up to twenty-four ounce, which likewise is equivalent to one and a quarter inches long, and 1,000 tacks.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW, NEW YORK.

O. D. MUNN. A. E. BEACH.

TERMS.

One copy, one year $3 00
One copy, six months 1 50
CLUB RATES { Ten copies, one year, each $2 50 . . . 25 00
Over ten copies, same rate, each . . . 2 50 }

TO BE HAD AT ALL THE NEWS DEPOTS.

VOL. XXVII., No. 10. [NEW SERIES.] *Twenty-seventh Year.*

NEW YORK, SATURDAY, SEPTEMBER 7, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

SCIENCE AND THEOLOGY.

One of our late semi-religious exchanges contains an editorial, in which the modern scientists, Huxley, Spencer, Darwin, *cum suis*, are taken to task for not being the same orthodox believers in the different dogmas of Christian theology as were Isaac Newton and the scientists of his time. The question is asked if the fame of the modern *savants* would not be just as great if, in religious matters, they had the faith of Newton; as if the opinion of a thinking being concerning such subjects was a matter of choice. The simple reason why men like Huxley are not as orthodox as similar men in the time of Newton is that we live now in the end of the nineteenth century, and that the world has progressed since Newton's time. The best half of the present civilized population of this earth has commenced to see that blind faith in matters of religion is by no means a virtue, as was formerly believed, but that reason is a Divine gift to mankind, the use of which it is highly sinful to despise.

We may as well ask why so many prominent modern theologians, and even laymen (we will not mention names), are now-a-days not so orthodox, and why they have not the same views on many important points of doctrine as those of a few centuries ago. We may as well point to the fact that the blind faith of the middle ages is no more to be found in the Christian world, except perhaps in the Leontine city of Rome; and even there the motives of that faith are open to strong suspicion that it is not a faith adhered to for its own sake, but instigated by self interest.

The effect, of the whole editorial referred to, does not amount to anything, as in place of giving a single argument against the tendency of modern science, it consists of a long winded lamentation that religion is not made as much of, by the modern scientists, as it used to be in olden times; and that science in place of being the handmaid of theology, has since those times frequently arrogated itself to contradict its teachings. And this is true.

THEOLOGICAL ERRORS CORRECTED BY SCIENCE.

Theology taught that the earth was flat, and supported on rocks, below which there were immense dark caves or spaces, the abode of evil spirits, while the firmament above was an arched vault supporting another immense space, full of light, the abode of the good spirits; science taught that the earth was round, in fact a sphere floating without support in space, and that the firmament was not an arched vault but surrounded the whole earth, and was an infinite space, full of suns and worlds.

Theology maintained that the earth was a stationary center around which the whole universe revolved; science took the conceit out of theology and mankind in general by proving that the earth was a comparatively insignificant globe, floating in the immensity of space, and revolving like a small inferior wheel in an immense piece of highly complicated machinery. Theology maintained, on the authority of a translated, mutilated, and obscure tradition, that the whole universe was created in six literal days; in fact theology made the absurd assertion that the Unchangeable Divine Being could have existed for all eternity without doing anything, and then suddenly changed his mind and in less than a week created a universe, set it all going, and then needed rest like a frail human body, suggesting the blasphemous idea that the Divine Creator was tired out. Science proved that, as far as concerns this earth, it was formed many millions of centuries ago, and went through different stages of transformation, each lasting immense periods of time, and that the Divine power was active all the time as it is now, and will be for ever. Theologians maintained, on the ground of the same tradition, which they continually have been misunderstanding and misinterpreting, that this single creative act took place six thousand years ago; but science produced relics of plants and animals which must have lived millions of years ago, while the circumstances and localities in which they were found proved that other millions of years preceded them.

In all these, as in every other instance, science has been triumphant, while theologians had to give in and acknowledge, however reluctantly, these triumphs; and notwithstanding they at first cried that religion was in danger, that they accused the scientists of Radicalism, Deism, Atheism, and hurled at their heads other accusations of the same sort, the only activity they exercise now, consists of attempts at reconciliation between science and theology: and this indeed is their legitimate calling.

In all the tumult created by this antagonism, which is unwisely kept up by a certain class of theologians, there is one great consolation. It is the consideration that the relative positions of theology and science have been changed since the time of Newton. Then the spirit of the tribunal which condemned Galileo still prevailed; every new scientific theory was tested by the teachings of the theologians of the day, and if these men decided that it was contrary to their doctrines, it was condemned; this being the spirit of the society which was under the tutelage of the clergy, no man, not even Newton, dared to be anything but orthodox. No doubt this had a great deal to do with the difference in the apparent theological opinions of the scientists of that time and of the present day, when science, by experience made conscious of her superiority, has lifted up her head, and in place of being the handmaid of theology, and being judged by theologians, has placed herself in position to judge the teachings of theology, and to decide which are true and which are erroneous. Let the reader keep in mind that we speak of theology and not of religion.

We maintain that a scientist who devotes his life to the study of God's own handiwork has more true religion and a more exalted idea of that mysterious Divine Being, who, with such wisdom, power, and superior conception of the truly beautiful, presides in the management of the infinite Universe, than the so-called theologian who, neglecting the study of God's own handiwork, confines himself to the discussion of old obscure literary traditions. For our part, at least, we must confess that our religious feelings of awe for the Creator have often been severely shocked by visits to a certain theological seminary, on hearing the professor expatiate before his class of theological students, on the classified properties of God, what He is, and what He is not. To the scientist such a lecture is nothing but arrogance and blasphemy, and such lectures are, alas, occasionally propounded in some of our orthodox churches.

PROGRESS OF AMERICAN INDUSTRY---INAUGURATION OF FIVE GRAND INDUSTRIAL EXPOSITIONS.

If we may judge from the magnitude of several expositions that have lately been inaugurated in different parts of the land, it is very evident that our country is now making the most gratifying industrial progress. Besides the usual town, county and State agricultural exhibitions, where the best products of local industry are always brought forward, we are favored this year with several extraordinary expositions, very comprehensive in their nature and highly creditable to the nation.

In New York city, the grand industrial exhibition of the American Institute, now about to open, will doubtless form a marked attraction. All the prominent industries are to be represented, while a series of remarkable experiments, new products and new inventions, for the first time made public, will lend interest to the occasion. The American Institute has purchased the buildings on Third avenue at 63d street, and they have been fitted up with special reference to the convenience of the public and the various exhibitors. The buildings cover some three acres of ground. Ample provision has been made for the operating machinery, a department which interests every visitor.

At Newark, N. J. the grand exhibition so long in preparation has lately been inaugurated with much enthusiasm, and its success is a matter of just pride to all the inhabitants of New Jersey. This State, although small, is remarkable for the wealth of its natural resources. A fertile soil covers its surface, beneath which are found rich and inexhaustible stores of iron, copper, zinc, and other valuable minerals. The wonderful growth of the city of Newark is itself an indication that these natural advantages are duly appreciated. Its population now exceeds one hundred thousand. Over a thousand railway trains daily connect it with New York. Newark is rapidly becoming the Birmingham of America. Every sort of manufacturing industry is carried on here in the most approved manner, and all are beautifully exemplified in the present exhibition. The building is very large and the display exceedingly good.

The exhibition of the Maryland Institute just opened at Baltimore is a splendid affair, and is attracting hosts of visitors. The display is very fine, and reflects great credit upon the abilities of its managers. The Institute building is large and commodious.

The Cincinnati National Exposition, open from Sept. 4th to Oct. 5th, is arranged in sixteen grand departments and is undoubtedly the most extensive exhibition that has taken place in the Northwest.

The Grand National Industrial Exposition, just opened at Louisville, Ky., marks a new era in the history of the southwestern States. An immense fireproof structure, of elegant design, has been erected at public expense in the heart of the city, for the special purposes of the exhibition. The building is said to be the largest ever erected in this country, and in it are collected all the noblest examples of American genius and industry.

PROGRESS OF THE NEW DOCKS IN THIS CITY.--ARTIFICIAL STONE BLOCKS WEIGHING SEVENTY-NINE TUNS.

We do not propose to consider at length the system of dock construction adopted by the Department two or three years since, which was in the main a composite plan, made up from scores of projects duly elaborated in drawings and specifications, and laid before the authorities in answer to their invitation. (This plan was illustrated in our issue of August 24, ult.) The fact that the famous European models of dock construction, those of Liverpool, for example, afforded no guide in selecting a system for New York, our tide rising but five feet instead of twenty five, left the field open for, and even demanded, considerable originality in providing a practical method. This last is now being put under way although it will doubtless be some years before it is completed. The improvements contemplated will, when finished give the city a wharfage of thirty-seven miles. The Commissioners seem disposed to employ, in their work, the means that experience has shown to be the most efficient, as for instance, in a trial of *Béton Coignet*, which, by the way depends rather upon the peculiarity of its making than upon any special novelty in its composition. On the dock at the foot of Little 12th street, two large blocks of this material are now lying, each weighing seventy-nine tuns, while two others of the same kind and weight are lying on the dock at foot of West 17th street. Each block is seven feet high, twelve long, and ten wide, but instead of being cast in molds of these internal dimensions, they are formed, as it were, in a succession of layers. A rectangular box, like the "cope" of an ironmolder's flask, ten by twelve feet internal area, is laid on a suitable flooring; the plastic material is then poured in and rammed until all the superfluous water is driven out; after which it is allowed to remain until tolerably hard. The mold or frame is then lifted up nearly but not quite clear of the mass. More material is then poured into the mold, above the other, and treated in the same way, and so on until the block is brought to the requisite hight. In building piers, bulk heads, etc., those blocks are laid on a "rip-rap" or foundation of broken stone.

The commencement on the west side, of the bulkhead that in time will surround the city, may be seen jutting out from the edge of the Battery, and the mode adopted in laying its foundations is the type of that to be employed in all similar cases in the dock improvements. A "rip-rap" foundation, formed by dumping broken stone upon the bottom, is first made. Into this, vertical piles are driven around the space to be occupied by the superstructure, this space being further enclosed by timbers laid on the broken stone and secured to the piles. Concrete in a plastic condition is then poured in, and two divers in armor take a mighty straight-edge and move it across to level off the top. When the concrete hardens, the piles and timbers are taken out of the way and the blocks of stone, natural or artificial, are laid upon the concrete in regular courses.

THE DERRICK FOR LAYING THE BLOCKS.

For laying the blocks and for other analogous purposes, a new floating derrick has just been completed. It draws ordinarily about five feet nine inches of water, and when engaged in very heavy hoisting, from eight to nine feet. The scow upon which the tower mast and boom are supported is about sixty feet square, and the arrangement is such that usually the weight on the deck of the scow is sufficient to balance or counterpoise that lifted when the derrick is in operation. The lifting power exceeds somewhat one hundred tuns, and the load can be lifted to a hight of sixty-four feet. The boom and mast are both of wrought iron, while the tower is of wood, strapped and bolted with iron. The mast is made hollow and the hoisting ropes pass up through it from the winding drums of the engines. Of these last, one is for lifting light and the other heavy weights. Each engine has two cylinders, one at each end of its drum shaft. Their cylinders are twelve inches in diameter, and fourteen inches piston stroke. The boiler is of the vertical tubular type, has two hundred tubes, is five feet six inches in diameter and eleven feet six inches high, and rated rather loosely at from fifty to one hundred horse power. It has eighteen feet of grate surface, and the tanks from which it is supplied with fresh water are located beneath the deck of the scow. We may further mention that the hight of the derrick from the deck to the top of the mast is one hundred and sixteen feet, and that the boom has a length of fifty feet one way and sixty the other, or one hundred and ten in all.

We note no unusual activity in the work of the department, but that there is some progress is shown by the items we have mentioned. The fact that changes are made at these points where the owners of water front property desire them, instead of continuously from any given locality renders any analysis of the advancement made extremely difficult, but as these changes are all in accordance with the comprehensive plan alluded to at the commencement of this article, every day's work is so much accomplished toward making our city docks and wharves somewhat in accordance with the magnitude of our commerce and the wealth and prosperity of our people.

IRIDESCENT ENGRAVINGS.

The beautiful iridiscence of the pearl has been ascertained by microscopic investigation to be due to the presence upon its surface of exceedingly fine ridges or lines, the edges of which unequally refract the rays of light and produce many shades of color of marvelous delicacy. This effect may be artificially produced upon glass and other substances, by cutting lines thereon of sufficient fineness. Mr. Rutherford, the well known scientist of this city was, we believe, one of the first to construct a machine capable of engraving these iridescent lines. These he produced upon glass, as test objects for microscopes. The cutter was worked by an electro-magnetic machine. Another of these instruments is now to be seen at Harvard University, and is thus described in the Boston *Globe*:

Among the many curious inventions existing beneath the dome of the Cambridge observatory, there is a machine which is used to delineate upon glass the figure of a circle or square, by means of finely drawn lines. This machine, which is the invention of Mr. Rogers, who is connected with the observatory, is very simple in its operation, and draws each line with an accuracy which is very surprising. This is done by means of a graduated plate of metal, which acts upon a very sharply and very finely pointed needle, so that it may be set at any distance from a line already drawn. By actual trial, the skillful inventor drew upon a small piece of glass twenty-four lines, separated by a distance of a 2400th of an inch, in about a minute's time. These wonderful lines could be easily counted through a microscope, but viewed with the naked eye they formed a single, but somewhat imperceptible, line. It was nearly impossible to imagine the exceedingly minute distance which separated them. Parallel lines had been drawn upon other plates of glass, which, though apparently single, were found, when placed beneath the microscope, each to be composed of several distinct lines. A circle, also, which was about a quarter of an inch in diameter, contained sixteen hundred lines. The light was very beautifully reflected from their minute sides, and the circle glistened and sparkled with all the colors of the rainbow. Upon one plate of glass had been traced circles within circles, the lines of which they were composed being scarcely discernible; but when perceived through the microscope each line assumed a perfect precision, and the delicate symmetry of each circle came out in exquisite relief. The extremely minute space in which this immense number of circular lines was contained appeared to be very wonderful. There were many other drawings, which were equally astonishing, and which showed equally well the fine skill of Mr. Rogers. It was curious to find among the great instruments of the observatory, which sweep every portion of the heavens and travel along the great equatorial circle, this little machine, capable of producing lines which hid themselves in their minuteness from the unaided eye of the observer.

THE LAKE SUPERIOR COPPER REGIONS.

It will be perceived from the letter of our esteemed correspondent, Professor Thurston, which we elsewhere publish, that he has reached the heart of the wonderful mining regions of Lake Superior, where he is busily engaged in the examination of the most important localities. He gives us the details of the methods now practiced there in mining copper, which will be read with much interest.

REMARKABLE THUNDERSTORMS.

Portions of New York State and the New England States were visited on August 14, 15, and 16 by some of the most terrific thunderstorms ever experienced. In a newspaper account of the results of one of these storms at Boston, Mass., and vicinity, the names of twenty-seven persons are given who were more or less injured by the lightning, while at least one hundred more individual cases are referred to whose names were not ascertained. Over fifty buildings are also particularly designated as having been struck and damaged, while many others are referred to as having been struck but not injured. In various other parts of the States mentioned, extensive damages were occasioned and some lives lost. The poet Whittier, at Amesbury, Mass., was struck, but not seriously hurt. His dwelling was somewhat broken. The aggregates reported, as near as we can estimate, indicate that some two hundred buildings were struck and damaged, over one hundred and fifty persons were struck, and some ten individuals were instantly killed. Quite a number of barns, with their contents, hay and cattle, were fired and consumed.

An intelligent observer at Arlington, Mass., writes to the *Boston Transcript*, describing a midnight thunderstorm at that place, August 14:

"Brilliant streams of the electric fluid darted athwart the sky in every direction, and the thunder which followed was constant for a period of thirteen minutes, without the intermission of an instant of silence. One flash of lightning followed another in such rapid succession as to excite curiosity to know how many occurred in a minute. With watch in hand, I counted them for seven minutes:

1st	minute	there were	51	vivid flashes,
2d	"	"	42	"
3d	"	"	39	"
4th	"	"	47	"
5th	"	"	37	"
6th	"	"	61	"
7th	"	"	54	"

making three hundred and thirty-one discharges of electricity in seven minutes, distinctly visible from one point; and each discharge was followed by loud and sometimes rattling reports, whose reverberations rolled through the heavens in an endless procession of majestic and terrific sounds.

"During this scene the moon, which was about half an hour above the western horizon, was visible, but so magnified through the haze and vapor as to appear like a brilliant flame suspended in the sky. For a period of twenty minutes, the scene was one of grandeur and sublimity rarely witnessed in a lifetime."

Nearly all of the church spires and dwellings that were provided with rods escaped injury, though heavy charges of electricity were observed to pass down the rods. Cars while running on some of the railroads were surrounded by the electric fluid, but no passengers were injured, although many were greatly alarmed. Telegraph wires were melted by the half mile, poles shattered in all directions, telegraph instruments in some cases broken, while the fingers of a number of telegraph operators were singed and temporarily paralyzed.

At Poughkeepsie, N. Y., during the storm on August 14, the following phenomena were observed, as reported in the New York *Herald*: "The lightning flashed from horizon to horizon incessantly in forked tongues and jagged chains, and it really seemed as if every flash struck something, because they were instantaneously followed by rattling and stunning thunderclaps. Looking up Main street from the Post Office, balls of fire were seen shooting into the Atlantic and Pacific Telegraph office, and explosion after explosion followed, like the rattle of musketry, as the electric fluid struck the telegraph instruments, creating terror in the hearts of everybody in the vicinity. At the Western Union Telegraph office, a ball of fire entered the window and exploded on the desk of the operator, and was followed by other electric explosions driving the operators away from their business.

"At the depot the effect was also startling. In the telegraph office, the Superintendent, J. M. Toucey, of the Hudson River Railroad, and Robert Wilkinson, the night operator, were seated at the instruments, and the operator was working the wires during the storm, because of the washing away of a culvert near Catskill making telegraphing necessary. While they were busily engaged, there came a blinding flash of lightning, and at the same instant a ball of fire dropped from the Poughkeepsie and Eastern Railroad wire and exploded on the desk between Mr. Toucey and Mr. Wilkinson. Both were affected, Mr. Wilkinson's ears and fingers tingling with electricity. Further work ceased at once till the storm subsided. The engineer of the down train witnessed fearful scenes along the railroad while his train was in motion. Streaks of lightning ran around his engine and over it, and down upon the railroad track, shooting far ahead of the advancing train, and the air seemed to be impregnated with sulphur.

"The steamer Mary Powell landed her passengers here while the storm was in progress. Captain Anderson took hold of the bell wire to ring the engineer's bell, and received a shock that came near knocking him down.

"Strange to say not a building in this city was struck. The lightning was of various colors—pale green, violet, and crimson. The people generally were much alarmed."

MANUFACTURE OF VINEGAR.

There is perhaps no process in the arts which proves more clearly the value of theoretical knowledge, when properly applied, than the manufacture of acetic acid or vinegar from wine, cider, spirits, malt, etc. Even the details of this process show how the apparently useless discoveries of the theoretical chemist may be made available to the manufacturer. So it was often a subject of wonder how some vinegar establishments, apparently conducted in a proper manner, could never obtain the quantity of acetic acid obtained by others, and requisite according to correct theory. This became all clear when Liebig discovered aldehyde, referred it to a low oxidation of alcohol, which by a large supply of oxygen would have become acetic acid. With his characteristic practical common sense, he applied this at once to the vinegar manufacture, and showed that the losses observed were solely due to the formation of aldehyde, from an insufficient supply of air, and that when admitting more air, by increasing the openings or by any other means, this difficulty would be entirely obviated.

We have received an interesting letter from one of our subscribers, a vinegar manufacturer in this State, extracts from which we publish in another column, which illustrates another point of a similar kind in the same business. He complains that his large stock of good cider vinegar on hand became weaker and weaker in the vats, and at last so tasteless that he had to run it in the canal. The loss was nearly his ruination, as there were several thousand gallons; it appeared to be contagious, as one vat after the other became thus contaminated. He gives us an elaborate account of the locality, the circumstances, manipulation, temperature, etc., so as to put us in a condition to judge about the causes and suggest preventives of its re-occurrence, and, thanks to the pains taken in this respect, we think we are able to point them out.

The whole cause of the trouble experienced, which is well known to practical chemists, is the so called mother of vinegar, a mold which, investigated by naturalists, has proved to be a vegetable parasite of great vitality, and is called *micoderma aceti* or *ulvina aceti*. It grows at the expense of the acid in the vinegar, and destroys it at last totally. It forms also on the beech shavings of the vats, but is then beneficial, as it assists in the change of the alcoholic into the acetic principle; but if once this change is totally accomplished, it is an enemy of the manufacturer, as its continued growth is at the expense of the acetic acid. Mulder, in Utrecht, Holland, investigated this subject minutely, and found that, when he removed the fine floating skin of this vegetable parasite with the utmost care, it always reappeared again, while the vinegar became weaker and weaker.

It is, of course, difficult to prevent the passage of the germs of this plant from the vat with the shavings into the storage vats. Heat will kill it, and therefore we would recommend the method followed in France for the improvement of some kinds of wines, namely, the passage of the liquid through a coil heated to 212° Fah., which destroys all vegetable life, and which we may describe more in detail in the future. It must also be observed that there is more danger of this deterioration taking place in weak vinegars than in strong ones, and that the presence of a little alcohol will prevent it for a time, as then the action of the vegetable parasite will be first expended to change this alcohol into acetic acid, and will not attack the latter before the former is all consumed. There is still another point: It is well to clean the vats with hot water, but it is advised by many writers on this subject to wash them afterwards with quite strong vinegar, so as to saturate the pores of the wood with this in place of with water, before introducing the vinegar. Still another point: As cider vinegar contains many other vegetable ingredients besides acetic acid, it is advisable to filter it when the fermentation has ceased. A deposit, near the bottom of the storage vats, of these vegetable matters is very apt to cause a putrefactive fermentation, which will also injure and at last destroy the acetic acid formed.

SCIENTIFIC AND PRACTICAL INFORMATION.

ORNAMENTAL WOODWORK.

C. Muratori, of London, makes wood ornaments by kneading alum, glue, and sawdust, with boiling water, into a dough which is pressed into molds. When dry, it is hard and capable of taking a high polish. Similar ornaments, of greater beauty and resembling carved woodwork very closely, are being made in this city by pressing veneers between steel or copper dyes.

GLYCERIN AND THE COAL TAR COLORS.

It may not be generally known to all our readers that the aniline colors are quite as soluble in glycerin as they are in water or alcohol. It has recently been suggested to use the glycerin bath for dyeing, and F. Springmühl has instituted a series of experiments with woolens, silks, and cottons, and has obtained very good results with all the coal tar colors. Whether glycerin will not prove too expensive is as yet doubtful. Some of the glycerin is of course lost when the goods are rinsed after being dyed, if no mordant is used, and it is seldom required when glycerin is employed. The glycerin of the bath itself can be used indefinitely by adding a fresh quantity of the dye stuff, which very readily dissolves in it.

Comparative experiments were made with wool and silk dyed in equal quantities of the same dyes dissolved in glycerin and in water, the temperature of the baths being the same. It was found that those dyed in the glycerin bath always had a livelier color, and the silks especially were more glossy than those dyed in aqueous solutions. If the temperature of the glycerin bath is raised above the boiling point of water, the colors are still better and faster.

If glycerin is too expensive, it could at least replace alcohol as the solvent. The addition of glycerin to a water bath raises its boiling point, which is of great use with iodine green, and makes it attach itself more readily to the fiber; this is strikingly noticeable in the case of cottons. The action of mordants is in no wise injured, but rather improved, by the dye bath containing glycerin. When alcohol is used as solvent for the dye stuff, a portion of it is lost by evaporation, while all the glycerin remains in the bath, even at the temperature of boiling water, and hence none of the dye stuff is precipitated.

PARIS GREEN AND POTATO BUGS.

A correspondent, Mr. E. Wolff, has experimented on this question, and thus describes the results:

"I filled two flower pots with garden earth, mixing in the top soil of one of them a pinch of Paris green; and I sowed in each about one hundred of canary and rape seeds, and plunged the pots side by side to the rim in the garden. The fourth and fifth day, all the seeds in the pure earth came up and are now growing lustily, while after the tenth day the seeds that had the Paris green with them show no sign of life, and are probably rotten. I am now making experiments with potatoes and other plants, but have not the slightest doubt that they will show the same results."

ANTIDOTE FOR ARSENIC.

Arsenic may be rendered inactive in the stomach by a dose of hydrated peroxide of iron, which is prepared by pouring a solution of green vitriol boiled with nitric acid, or of chloride of iron, into ammonia or soda, and washing the precipitate. Both arsenic and peroxide of iron can then be removed by the stomach pump or an emetic.

CONFLAGRATION OF COAL OIL.

To lessen the damage and save the oil, a correspondent, H. M. S., says: Let each floor where it is stored be divided into squares, sloping downward to the center so that, as each barrel bursts, its contents will run to the center, where they will be immediately extinguished and conducted to a place of safety by means of a siphon or S trap and pipe. That place of safety might be a large tank or cistern, even under the ground beneath the fire; but care should be taken that a pipe should lead off the air from the tank as it fills, which air, having become explosive, should be passed out through a gasometer, to prevent the fire from communicating with the air or gas in the tank. The amount which might be saved in insurance ought to provide the arrangement.

OZONE.—Houzeau, from a series of quantitative experiments, has come to the conclusion that country air contains one 450,000th of its weight, or one 700,000th of its volume, of ozone. He believes that its production is due to the continuous electrical discharges taking place between the earth and the clouds.

[Special Correspondence of the Scientific American.]

LETTER FROM PROFESSOR R. H. THURSTON.

Lake Superior.—Its wonderful mineral shores.—The Portage Lake.—The discovery of copper.—The Calumet and Hecla mines.—Interesting particulars concerning the process of mining copper.

MARQUETTE, Mich., July 20th, 1872.

Lake Superior, the largest of the great inland seas, has an area estimated at nearly 32,000 square miles and a length of shore line certainly not less than 1 200 miles.

This great body of water is becoming well known to tourists, who are attracted here by the magnificent scenery of its shores and its islands, by the wholesome climate, and by the excellent fishing to be found in the hundred rivers and creeks that feed it and in the lake itself.

LAKE SUPERIOR MINERAL RESOURCES.

To the geologist and to the engineer, it is no less interesting, as one of the most extensive and remarkable known mineral regions of the world. All along the north shore are deposits of copper and silver, some of which are opened and productive. One of these silver mines is at Silver Islet, a little rock lying near the Canadian shore and just opposite Isle Royale; and so small and low is it that it became necessary to partially enclose it by coffer dams and "crib work" before much work could be done on the wave washed veins. It is stated that the first 22 days' work on the island produced $100,000 worth of native silver, and the amount mined from the 1st September, 1870, to date was recently stated (*Duluth Herald*) as of such value as to give this little rock an estimated present value of $100,000,000. Silver has also been found and mines opened at several points on the main land.

Copper has been found at Pigeon river, the boundary between the United States and Canada at its junction with the lake,—on Isle Royale and Michipicoten Island, and on the main at the eastern end of the lake.

Houghton, the little town from which my last letter was written, lies near the middle of Keweenan Point, and is the principal town in the copper range on the south shore of Lake Superior. Keweenan Point extends some 60 miles out into the lake, and is traversed by a range of high hills, which yield, at many points, large quantities of native copper. At the Ontonagon mines, which are situated a few miles from the coast and behind the point, the copper is found in masses, which are frequently of great size, imbedded in the solid vein rock and almost absolutely pure; the "impurities" are, generally, merely a small percentage of iron and silver, alloyed with the copper. Occasionally a beautifully crystallized mass of silver is found attached to the copper and cemented to it by a slight film of alloy at the surfaces of contact, and instances have occurred in which masses of silver of considerable size and great value have been thus found.

As the Keweenan deposits are followed out toward the extremity of the Point, fewer large masses are found and the copper is more uniformly and finely diffused through the vein rock, until at some places it occurs in such extremely minute particles that they are quite invisible to the unaided eye, although they may form a very considerable percentage of the total weight of the mineral.

PORTAGE LAKE.

Portage Lake is situated near the middle of Keweenan Point, and, extending from the eastern to within about three miles of the western side, nearly makes an island of the outer portion. It thus happens that Houghton and its opposite neighbor, the village of Hancock, form excellent shipping ports for a large portion of this copper district. Several mines, the Quincy, the Pewabic, the Franklin and the Huron, among others, are within gunshot, almost, of the two villages. All vessels loading there pass out on the eastern side of the Point, but the Portage and Lake Superior Ship Canal Company is expected to cut a ship canal from Portage Lake to Lake Superior at the western side of the Point, and thus allow shipments to be made toward that end of Lake Superior; and also, by enabling vessels to cross through Portage Lake, instead of rounding Keweenan Point, to lessen the distance between ports on either side by at least 150 miles.

THE DISCOVERY OF COPPER.

The discovery of copper here, and probably at all other points where it exists in considerable quantity, was made years before the white man came across the Atlantic from the Eastern world. The Indians were familiar with the principal deposits of native copper and often picked up surface masses and slabs. Xavier, who explored a portion of North America in 1720 or 1721, states that they regarded them as divinities or as gifts from the water gods, and preserved them with the utmost care. These masses weighed from a few pounds up to several tuns. At several places, ancient mines have been discovered by modern explorers, and the stone tools—hammers and chisels—of the aboriginal miners are interesting specimens of primitive art.

At Hancock, we visited the works of the Detroit and Lake Superior Copper Company, where four reverberatory furnaces are at work melting down the mass copper and the copper from the stamps of the mines of the neighborhood. Very little refining is required, and after a little stirring of the melted metal with the rabble, it is poured into the ingot molds and is ready for the market. All of the copper shipped here is from deposits of native metal. No deposits of sulphurets are worked and but few are known in the Lake Superior districts, and it rarely happens that the copper here smelted is even slightly contaminated by sulphur.

Directly behind this village and at the top of the bank, 500 or 600 feet above the water, are the entrances to several mines, and at a similar altitude on the Houghton side are others. These mines are employing a large number of men and are producing large quantities of copper, but, to the stranger, the most interesting of all the mines of this section are, probably, the "Calumet" and the "Hecla," two mines situated side by side, formerly independent but now united under a single management. This is claimed to be the richest copper mine in the world, and an examination of the mine, as well as the market price of its stock, affords pretty strong evidence of the truth of the assertion. The Calumet and Hecla mine is about 14 miles distant from Houghton and Hancock, and we travelled over the road on a pleasant afternoon in a lumbering "stage," making the journey in two hours and a half.

At several points, we passed the deserted buildings and unused shafts of mines that were opened a few years ago, when the high price of copper stimulated production so wonderfully, but which have since—in consequence of the reduction in price at the close of our civil war, and partly perhaps in consequence of the "leanness" of the rock or of ignorance or recklessness in management—been deserted. In some of these mines, hundreds of thousands of dollars have been thrown away. Fine buildings and the best of machinery are immensely expensive, but yet cannot make a success of a mine which must compete with neighbors having richer ores or better management. There is, probably, little doubt that some of these mines, if now reopened, might be made to pay handsomely if properly worked, but good superintendents and skillful captains are not always readily obtained for even well established and long worked mines.

HOW THE COPPER IS MINED.

Arriving at the mine, we spent the evening with the superintendent, from whom we obtained a considerable amount of most valuable and interesting information, and whose fine cabinet of specimens from his own and other mines excited our vein of covetousness very seriously. Next morning we had an early breakfast and prepared to enter the mine.

At seven o'clock, we met the "Captains of the Mine" at the "Change House" and exchanged our travelling suits for the miner's uniform—a round crowned, narrow brimmed hat, a flannel shirt "converted" from a heavy blanket, a stiff canvas coat, strong linen trowsers, and clumsy cowhide boots; a candle enveloped in clay and stuck on the hat, and two others hung from the upper button, were to supply us with light during our underground journey. Thus equipped, we started down the ladders and were soon beyond the reach of daylight.

The Calumet and Hecla Mine extends, in the direction of the vein, nearly two miles, and has penetrated nearly 900 feet into the earth. The vein rock is a peculiar red "conglomerate," as the miners call it, penetrated in every direction, permeated by metallic copper. The "walls" of the mine are of hard trap rock, separated by the vein rock to a distance of, sometimes, fifteen feet or more. The mine is worked in a series of "levels," horizontal galleries or "drifts" being driven at intervals of about ninety feet, as the shafts are carried downward, and the "stopes" are opened out until all of the ore is worked out except a portion a few feet in thickness, which forms the floor of one level and the roof of the next level below. The rock is extremely hard and is all worked out by blasting. The drilling is principally done by hand, but two Burleigh drills, driven by compressed air, are on trial. We were much interested in their operations, and were pleased with their performance and by the ingenuity of their construction. They were said to be doing excellent work.

After the miner has done his work, under the careful supervision and direction of the captains of the mine, he is followed, if he has not been accompanied, by the "timbering party." The timbering of a mine is one of the most important branches of mining work, and is always directed by an experienced miner of unusually sound judgment. It is his duty to examine the walls of the mine with the captains, and, sometimes—consulting the superintendent—to support them, wherever necessary, by heavy timbers. At the Calumet and Hecla, we were particularly impressed with the care and the skill displayed in timbering, although, as a rule, the walls, both foot and hanging, are remarkably good. In a neighboring mine, but a few days since, the walls came together, crushing the timbering, and several miners, caught in the trap, perished at their work, victims of insufficient timbering. It seems remarkable, however, that the miners, who are more exposed to such dangers than other employees of the mine, are usually the most reckless in working under unsupported walls.

We spent a number of hours in the mine, exploring its several levels, sliding down "winzes," clambering over rocks and ore, climbing long ladders, and, now and then, warned by the cry of the miners, dodging into a cavity or behind a battery of timbers to escape the danger of being struck by flying masses of rock detached by a blast. In many places, the particles of copper were too minute to be detected by inexperienced explorers; at other places they glistened in the candle light and their sharp points tore the hand that was incautiously passed across them, while here and there, but very rarely, the metal in solid masses filled large chinks in the rock. After being dislodged by the blast, the ore is wheeled, on low cars, to the shaft, dumped into the iron "skip," and is hoisted rapidly up to the surface where it is thrown into cars and taken off to the stamps. At this mine, steam stamps are used, powerful steam hammers in fact, and under their tremendous blows the rock rapidly crumbles into dust; the copper is then readily washed clean and is next sent to the furnaces to be melted into ingots for the market. After exploring the mine to our satisfaction, watching the several methods employed in opening "shafts," "winzes," "stopes," etc., in securing the walls and in transporting material, a straight climb of 630 feet took us up to daylight once more, and we staggered to the nearest seat, decidedly "weak in the knees," but with an excellent appetite for the dinner which we found waiting for us at the house on our arrival there. This great mine employs about 600 people underground in its fifteen or eighteen miles of gallery and produces about 10,000 tuns of marketable copper per year.

We returned to Houghton, found the Atlantic in port and ready to sail, and took advantage of the opportunity to continue our journey. We entered the beautiful harbor of Marquette, the principal shipping port of the iron regions of Lake Superior, early next morning. The next letter will give you some account of the neighboring iron mines.

R. H. T.

Chances for Investment.

Many of our most successful business men invest their surplus capital entirely in railroad bonds. Such investments, when the securities are good, pay the best rate of interest with the least trouble to the holder of any class of investments that are made, and it is becoming usual for holders of Government securities which are selling at a high premium to exchange for railroad bonds at par or less, they paying the same or better rate of interest.

In this connection, we would refer to the advertisement of the Chicago and Canada Southern Railroad first mortgage seven per cent gold bonds, in another column. The names of the gentlemen connected with the road are among our best known citizens and capitalists, and the bankers through whom the loan is effected rank among the first in the city. By addressing either firm whose names appear in the advertisement, full information as to the character of the securities offered will be given.

Notes & Queries.

[We present herewith a series of inquiries embracing a variety of topics of greater or less general interest. The questions are simple, it is true, but we prefer to elicit practical answers from our readers.

1.—STAINS OF LEMON JUICE ON BLACK MARBLE.—The polished black marble case of my mantel clock is badly disfigured by white spots caused by drops of lemon juice. Will some one tell me how to restore the original black polish?—S. M. T.

2.—DEPILATORY.—Is there a compound that will remove the human hair without leaving a scar?—J. R. M.

3.—WORM EATEN BARREL STAVES.—Can you inform me of any sure method of keeping worms out of barrel staves? Sometimes, after having been long in use, when the danger is thought to be past, we suddenly find their depredations.—J. H. R.

4.—ICE HOUSE.—Will some one who knows give me the best plan in use for a family ice house?—C. C.

5.—PRUSSIATE OF POTASH PAPER.—How can this be prepared for use in Bain's telegraph instrument, and in the electric copying press recently illustrated in your journal?—F. H. H.

6.—FLEAS.—How can these pests be induced to entirely quit a house which they have succeeded in entering?—T. J. W.

7.—DESIGNS ON STEEL.—Will some one inform me how to make impressions on small steel articles? How long should the acid remain on? What acid should be used, and should it be diluted, or not?—J. K.

8.—GRATES FOR BURNING SAWDUST.—Can N. J., of N. Y., or any one else, inform me what kind of grates I need to burn sawdust in a common firebox?—B. W.

9.—NITRO-GLYCERIN.—Can nitro-glycerin be ignited by a common safety fuse?—O. J. K.

10.—BAITING FISH.—Will some of your readers inform me what is better than oil of aniseed to use on fish baits to cause the fish to bite?—W. H. O.

11.—MONKEY WRENCH.—Can you inform me, through your columns, the reason why a slide or screw wrench is called a "monkey wrench?"—H.

12.—THIN RUBBER GOODS.—I would like to know the manner in which thin rubber goods, such as hollow balls, shoes, etc., are formed.—G. C. D.

13.—POWER OF ENGINE.—What power should a double engine give, the cylinders being 2¼ inches by 5 inches, working under 50 pounds to the square inch, and the engine at 150 revolutions a minute?—W. H. P.

14.—BISULPHIDE OF CARBON.—Can bisulphide of carbon be used with safety in the place of water for running a small engine, the exhaust vapor to be condensed? Where can it be obtained, or how can it be made?—W. H. P.

15.—SPECIFIC GRAVITY.—Is the attraction greater at the poles than at the equator? If so, please give the reasons. Will a body weigh less at the equator than at the poles?—J. P.

16.—BLACK SURFACE ON BRASS.—How can the brass work around the lock of a Winchester repeating rifle be made black without heating or removing from the rifle? If it be necessary to remove the black stain, what should be used?—C. W. L.

17.—GUNPOWDER IN CARTRIDGES.—Does gunpowder deteriorate by being kept any length of time in paper cartridges?—C. W. L.

18.—CUTTING GLASS.—Will some one of your readers give me plain directions for cutting glass with a common glazier's diamond? I can cut in a straight line very well; how can I cut a round or oval glass? Is it necessary to cut on both sides? If an imperfect cut is made, can I cut in the same place again, or must I move the straight edge and take another cut?—J. W. A.

20.—CUTTING THE COGS OF MORTISE WHEELS.—Can any of your readers give me any information about cutting the above by machinery? What sort of cutters are used? At what speed should they run? How do they stand? And what kind of wood was used?—J. W

Business and Personal.

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

C. R. M. Wall, Professional Brewer—The correct address is No. 69 36th st., S. Brooklyn, N. Y. See advertisement on back page.

The Best Water Pipe, also the Cheapest, when strength and durability are considered, is the TIN-LINED LEAD PIPE manufactured by the Colwells, Shaw & Willard M'f'g Co., No. 213 Centre Street, New York. Price 16½ cents a pound for all sizes. Send for circular.

Peck's Patent Drop Press. Milo Peck & Co., New Haven, Ct.

The paper that meets the eye of manufacturers throughout the United States—Boston Bulletin, $4 00 a year. Advertisements 17c. a line.

Steel Castings to pattern, strong and tough. Can be forged and tempered. Address Collins & Co., 212 Water St., New York.

Wanted—A live man, acquainted with Turbine Wheels, to travel. Address Urbana Machine Works, Urbana, Ohio.

Gauge Lathes with attachment for turning Milled Rolls, Spindles, Moulding, &c., $30.00. Wm. Scott, Binghamton, N. Y.

Machinery, of all kinds. S. C. Hills, 32 Courtlandt St., N. Y.

Wanted—A first class, energetic and capable man as Foreman in a foundry working 100 men. Address "Foundry," care W. Bingham & Co., Cleveland, Ohio.

Beautiful Patent in iron to exchange for one in wood. Box 909, Saratoga Springs, N. Y.

Walrus Leather for Polishing Steel, Brass, and Plated Ware. Greene, Tweed & Co., 18 Park Place, New York.

5,000 Tinners should manufacture and sell Wilcox Self-Sealing Fruit Cans, patented March 19, 1872. State and County Rights for Sale. For particulars, address A. A. Wilcox, 400 Chestnut St., Phila., Pa.

$100 Reward—For instructions and drawings for setting galvanizing kettles or tanks for galvanizing Iron in the most improved method, preparing necessary acids, etc. Address D. R. Noble, 220 Washington Street, New York.

Ashcroft's Original Steam Gauge, best and cheapest in the market. Address E. H. Ashcroft, Sudbury St., Boston, Mass.

Ashcroft's Self-Testing Steam Gauge can be tested without removing it from its position.

Brown's Pipe Tongs—Manufactured exclusively by Ashcroft, Sudbury St., Boston, Mass.

Wanted—A Machine to cut Veneers for Berry Baskets. I. H. Marvel, Laurel, Delaware.

Page's patent Belt Lacing, as made by J. H. & N. A. Williams, Utica, N. Y., is the best and cheapest.

An Engineer and first class mechanical draftsman is open to an engagement. Permanent situation preferred to high salary. Address W. L., P. O. Box 866, New York.

The undersigned is in need of a first-rate barrel-packer, and will be glad to hear from those having such a machine to sell, with all details as to working, cost, &c. Address B. R. Smith, 4717 Main St., Germantown, Philadelphia, Pa.

Flouring Mill near St. Louis, Mo., for Sale. See back page.

For Sale—Retiring Partner's interest in a Sash, Door and Moulding Mill, located at one of the best points in the Northwest, and doing a large trade. A good opening to a paying business. Address "Mill Co." care Cook, Coburn & Co., Chicago, Ill.

Diamond Carbon, of all sizes and shapes, furnished for drilling rock, sawing stone, and turning emery wheels or other hard substances also Glazier's Diamonds, by John Dickinson, 64 Nassau st., New York.

Valuable Invention for Sale, Pat'd. Box 116, Providence, R.I.

Turbine Water Wheels—Two twenty-four inch Reynolds Wheels—less than one year's wear and as good as new—for sale cheap. For further information, apply to J. G. Parker & Son, Poughkeepsie, N. Y.

American Boiler Powder Co., Box 797, Pittsburgh, Pa., make the only safe, sure, and cheap remedy for "Scaly Boilers." Orders solicited.

Pattern Letters and Figures, to put on patterns, for molding names, places and dates on castings, etc. H. W. Knight, Seneca Falls, N. Y.

Whitcher's Pat. Rotary Engine is the simplest, cheapest, and most economical. On exhibition at P. Fields & Son, North Point Foundry and Machine Works, Jersey City, N. J.

Platina Plating—Alb. Lovie, 729 N. 3d St., Philadelphia, Pa.

Windmills: Get the best. A. P. Brown & Co., 61 Park Place, N. Y.

Tested Machinery Oils—Kelley's Patent Sperm Oil, $1 gallon; Engine Oil, 75 cts.; Filtered Rock Lubricating Oil, 75 cts. Send for certificates. 116 Maiden Lane, New York.

Presses, Dies & all can tools. Ferracute Mch Wks, Bridgeton, N. J. Also 2-Spindle axial Drills, for Castors, Screw and Trunk Pulleys, &c.

New Pat. Perforated Metallic Graining Tools, do first class work, in less than half the usual time and makes every man a first class Grainer. Address J. J. Callow, Cleveland, Ohio.

Brick and Mortar Elevator and Distributor—Patent for Sale. See description in SCI. AMERICAN, July 20, 1872. T. Shanks, Lombard and Sharp Streets, Baltimore, Md.

Kelley's Chemical Metallic Paints, $1, $1·50, $2 per gallon, mixed ready for use. Send for cards of colors, &c., 116 Maiden Lane, N. Y.

Kelley's Pat. Petroleum Linseed Oil, 50c. gal., 116 Maiden Lane.

The Berryman Manf. Co. make a specialty of the economical feeding and safety in working Steam Boilers. Address I. B. Davis & Co. Hartford, Conn.

The Berryman Heater and Regulator for Steam Boilers—No one using Steam Boilers can afford to be without them. I. B. Davis & Co., Hartford, Conn.

Brown's Coalyard Quarry & Contractors' Apparatus for hoisting and conveying material by iron cable. W. D. Andrews & Bro, 414 Water st., N. Y.

For Machinists' Tools and Supplies of every description, address Kelly, Howell & Ludwig, 917 Market Street, Philadelphia, Pa.

Williamson's Road Steamer and Steam Plow, with Rubber Tires. Address D. D. Williamson, 32 Broadway, N. Y., or Box 1809.

Belting as is Belting—Best Philadelphia Oak Tanned. C. W. Arny, 301 and 303 Cherry Street, Philadelphia, Pa.

To Ascertain where there will be a demand for new Machinery, mechanics, or manufacturers' supplies see Manufacturing News of United States in Boston Commercial Bulletin. Terms $4.00 year.

Hand Lathes, (foot or power), Punching Presses, Small Engines and Boilers, by John Dane, Jr., 95 Liberty St., New York.

Boynton's Lightning Saws. The genuine $500 challenge. Will cut five times as fast as an ax. A 6 foot cross cut and buck saw, $6. E. M. Boynton, 80 Beekman Street, New York, Sole Proprietor.

Better than the Best—Davis' Patent Recording Steam Gauge Simple and Cheap. New York Steam Gauge Co., 46 Cortlandt St., N. Y.

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

For 2, 4, 6 & 8 H.P. Engines, address Twiss Bro., New Haven, Ct.

For hand fire engines, address Rumsey & Co., Sneca Falls, N.Y.

All kinds of Presses and Dies. Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth St., Brooklyn. Send for Catalogue.

The best recipes on all subjects in the National Recipe Book. Post paid, $2.00. Michigan Publishing Company, Battle Creek, Mich.

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

For Hydraulic Jacks and Presses, New or Second Hand, send for circular to E. Lyon, 470 Grand Street, New York.

For Marble Floor Tile, address G. Barney, Swanton, Vt.

Old Furniture Factory for Sale. A. B., care Jones Scale Works, Binghamton, N. Y.

Portable Baths. Address Portable Bath Co., Sag Harbor, N.Y.

For Steam Fire Engines, address R. J. Gould, Newark, N. J.

Answers to Correspondents.

SPECIAL NOTE.—This column is designed for the general interest and instruction of our readers, not for gratuitous replies to questions of a purely business or personal nature. We will publish such inquiries however, when paid for as advertisements at $1·00 a line, under the head of "Business and Personal."

ALL reference to back numbers must be by volume and page.

COINS.—M. S. is informed that the coin of which he sends impressions is a piece of 80 reis (=10 cents) of Portugal and Brazil. It bears the superscription of Joseph I., king of those countries from the year 1750 to 1770.

WATERWHEELS.—To W. D. W., of Pa.—The statement that any combination of wheels can utilize a fall of water so that each wheel will manifest the power that any one wheel would exert under the same fall is absurd.

RED ANTS.—C. E. G., of Conn., can try powdered borax, liberally spread around the places they frequent; but putting the legs of his refrigerator in water is the better way, although it is a little trouble.

A GOOD ENGINEER.—To S. B. H., of N. J.—The best method of acquiring the knowledge you seek is by reading good books. If you have a library near you, enquire for "Handbook of the Steam Engine" and "Catechism of the Steam Engine," both by John Bourne. Your practical daily acquaintance with the engine will help you to turn your reading to good account.

SKELETON LEAVES.—A. and D. will find good recipes on pages 267 and 314 of Vol. XXV. of the SCIENTIFIC AMERICAN.

FLOW OF WATER THROUGH SIPHON.—A. W., of Iowa, sends us a diagram of his water tank which is supplied by a ram through a half inch pipe. He employs an inch and a quarter overflow pipe, of considerable length, in which are two siphon turns or traps and eight elbows. The overflow pipe enters the tank very near the upper edge thereof. The water refuses to pass through the overflow pipe, but runs over the sides of the tank, and he desires to know the reason. Answer: You must increase the depth of water in the tank above the mouth of the escape pipe, until a flow is produced. It requires some little pressure to expel the air contained in the escape pipe; and this expulsion is made more difficult by the many elbows you have. As a temporary expedient, you can establish a current through the pipe by exhausting the air from the lower end.

SETTING SUN DIALS.—In answer to L. H., I will tell him how I set a sun dial. From a standard work on surveying, ascertain the time of night when the pole star is on the meridian; that is, 17 minutes after *Alioth* and the pole star are in the same vertical line; then with his compass (or, better, a transit) sight to the pole star over the point where the sun dial is to set, and mark the meridian line thus obtained; the meridian of the dial must then be made to coincide with the meridian line, and the dial is in position. Having obtained a meridian line, L. H. can ascertain the deviation of the needle of his compass by applying his compass to the line.—T. H. [*Alioth* is the star of smallest magnitude in the Great Bear, sometimes called the Great Dipper.—EDS.

FLY PAPER.—In answer to T. W. S., query 1, page 90, I have to say that I make a composition of rosin and lard, sperm, or some other non-drying oil by heating. When mixed, I spread a small quantity upon paper and throw a fly upon it; if it be too thick, a little more oil; if he can crawl off, more rosin. A small quantity of oil only is necessary; spread with a brush while hot.—W. A. B., of Conn.

THE MAGNETIC POLE AND THE MERIDIAN.—To L. H., query 3, page 106.—You can get your sun dial more perfect without a compass than with, unless you have a transit or its equivalent. The manner of working is this: The dial should have a good surface laid out in one or more circles about the right distance from the center; this can be determined by the length of the center, time of year, etc. The center should be a wire, about six inches long or more, or something, equivalent set perfectly true and at right angles with the surface; the whole must be set level upon a good foundation. To get the meridian: Upon a clear day, at or before 9 o'clock, watch till the shadow shortens and just strikes one of the circles, and mark the place. In the afternoon at the opposite hour, watch till the shadow lengthens and touches the same circle, mark as before; then with the dividers strike the point equidistant from the two which will be the true meridian. The two points should be taken as early in the day as convenient, and both on the same day.—W. A. B., of Conn.

MOUNTING CHROMOS.—To B. D. H., query 17, page 58, July 27.—Mount your picture on canvas stretched on a frame, using the same paste as that used by photographers, namely, starch. To mount your picture, have the canvas tightly stretched on the frame, cover the surface with the paste, rubbing it well into the cloth, using the palm of your hand for that purpose, leaving no lumps on the surface. Wet your picture on the under side, then lay it carefully on the pasted surface, pressing it well down with a soft dry cloth, but without straining the canvas; then reverse the frame, and lay it down with the face of the picture downwards on a level surface covered with a clean white sheet or cloth, and carefully press the canvas against the picture, so as to unite the two firmly; then set it away to dry. After the picture is thoroughly dry make a size by boiling parchment clippings, isinglass, or fish skins in clean water, and coat the face of the picture thoroughly. Let it dry; then prepare a varnish of one part Canada balsam, and two parts spirits of turpentine, mixed cold in a bottle, and varnish your picture with it, using a soft, broad, flat camel's hair brush. A second coat can be applied, if you think necessary, after the first is thoroughly dry. The varnish should be put on quickly and smoothly, and should the varnished surface not be even, take a clean brush and with clear spirits of turpentine wash the face of the picture until the lumps and streaked appearance disappear; then let your picture dry, and re-varnish with a varnish consisting of one part Canada balsam and three parts spirits of turpentine. Chromos covered by fly specks can be cleaned with a soft sponge and cold water. Any of the French or German colored engravings treated in the manner here before described will have the appearance of oil paintings, and can be framed without glass, and cleaned as easily as an oil painting, a soft sponge and cold water being all that is required.—W. T. H.

INCREASING THE POWER OF BOILERS.—Query 5, page 106.—As J. S. P. does not tell us how his boiler is set, it will be difficult to tell how to increase the power of it, but the way to get the best results from a boiler set horizontally is to heat as much of it as will be of any service. My plan is to allow the hot gases to reach the boiler as high up as the upper gage cock, leaving a space of about four inches between the boiler and brickwork. I make the bridge wall straight across and high enough to almost touch the boiler in the center at the bottom, and leave a large space or pit, behind the bridge wall, the entire length and width of the boiler and as deep as the ash pit floor. The opening at the rear end should be closed down to a level with the bottom of the boiler. In setting his boiler as above stated, he will get the best results with the greatest safety. If his engine is heavily loaded, he will do more work with the same amount of steam by running his shafting at the same speed he does now, and speeding up his engine to 75 or 85 revolutions per minute. His feed water apparatus is probably good enough.—A. L., of Mass.

POWER FOR STEAM YACHT.—In reply to W. S. B., query 17, page 90, I would say that he requires at least 50 actual horse power to drive his boat 15 miles per hour. The proportions of W. S. B.'s proposed yacht are bad for a screw steamer. If he will build his boat 37 feet long, 6 or 6½ feet beam, 3 feet 9 inches depth of hold, he will have a boat of equal tunnage and of much better proportions. Let him hollow the water lines at the stern so as to bring the water easily to the screw. Such a boat will draw about 2½ feet water at the stern, consequently he can use a 2½ foot wheel with 3½ feet pitch. With an engine of 12 actual horse power, running 300 revolutions per minute, such a boat will make 9 to 10 miles per hour. To double the speed requires four times the power and twice the number of revolutions per minute. A speed of 9 to 10 miles per hour will be found the most satisfactory. A very handy size of boat is one 25 feet long, 5 or 5½ feet beam, and 2½ feet depth of hold. For a speed of 9 or 10 miles per hour, it will require an engine of 5 or 6 actual horse power. The screw should be 21 to 24 inches diameter and 30 to 36 inch pitch, and be run about 400 revolutions per minute. Boilers for such boats must be as small and light as possible so as not to load down the boat; consequently they must work under a high pressure of steam—say from 70 to 100 pounds per square inch. The machinery for a 25 foot boat will cost about $609; for a 37 foot boat, $900 and upwards. These prices are at least double what they should be. If any manufacturer would make a specialty of machinery for such boats, making everything strong and substantial (working parts only polished) and sell it at a moderate price, hundreds of such boats would be built. At present prices, none but the rich can afford them.—J. T. B. S., of N. Y.

Recent American and Foreign Patents.

Under this heading we shall publish weekly notes of some of the more prominent home and foreign patents.

MODE OF ATTACHING SPRINGS TO WAGONS.—Jonathan H. Cornwell, of Corry, Pa., assignor to himself and Clarence G. Harmon, of same place.—This invention consists in using curved springs of flat metal, and in attaching them at one end to the axle and at the other to the under side of the wagon body or frame at the center, in such manner that as the weight of the load is increased the springs are proportionately stiffened by the box or frame settling down upon them from the point of their connection with it toward the other end, thus lessening the distance between the bearing points so that their elasticity is proportionately lessened.

BALING PRESS.—Andrew J. Hunt, of Walla Walla, Washington Territory.—This invention furnishes an improved press, for compressing hay, straw, and other materials required to be put up into bales, which is simple, convenient and powerful in operation, and takes up no more room than presses constructed in the ordinary manner; it consists more prominently in providing an opening in the lower side of the baling box for the removal of the bale when tied, and in closing the same by a hinged door, which is secured by a peculiar arrangement of bolts and bars by means of which all the bolts are moved simultaneously to fasten or unfasten the door by a single movement of a single lever.

CARRIAGE WHEEL.—Christian Anderegg, Lawrenceburg, Ind.—This invention consists in a peculiar construction of the spoke tenons, and in a certain arrangement of the mortises in the hub, whereby the inventor's wheel patented January 2, 1872, and illustrated in the SCIENTIFIC AMERICAN last spring, is considerably improved upon.

PLOW.—Andrew P. Barry, Ashland, Mississippi.—This invention relates to improvements in scraper attachments to plows for scraping or "barring" off at the same time that the cotton is plowed. It consists in a broad thin concave plate of metal attached to the mold board at the front and about midway betweeen the junction of the mold board with the land side and the rear edge; it extends from the share to the top of the mold board, and projects beyond the land side in the direction of the curvature of the mold board, or thereabout, so as to make a kind of prolongation of the same for a considerable distance, by means of which the sloping surface of the ridge on which the cotton is planted is scraped off at the same time that the mold board scrapes off the level surface over which it runs.

PROTECTING SAFES AGAINST FIRE.—Stephen Martin, Chillicothe, Ill.—This invention consists in suspending safes, by means of a hinged metal platform or metal bars and by wooden bars connected therewith, the whole being arranged in such a manner that when the latter burn the hinged metal platform or bars are released, and the safe is allowed to fall into the bottom of a vault where it may be protected from undue heat.

COLORING TIN, ZINC, ETC., TO RESEMBLE GILDING.—Joseph Kintz, West Meriden, Conn., assignor to himself and P. J. Clark, of same place.—This invention consists of an improved method of producing a fine gilt finish on zinc, tin, or analogous metals by polishing the metal between the coppering and lacquering processes, whereby the same effect is produced as by a gold gilding, and at less than one fifth of the cost.

ELEVATOR AND CONVEYER.—William F. Shanks, Louisville, Ky.—This invention relates to a new apparatus for the elevation and conveyance of buckets so as to remove the earth in making sewers and other excavations. The invention consists in a new arrangement of a movable trestle frame which contains the elevator tracks and a windlass for raising the buckets, as well as in a series of connected trucks on the elevator tracks for conveying the buckets horizontally.

BAIL TIE AND STRAINING LEVER.—James C. Coit, Cheraw, S. C.—This invention improves the construction of the bale tie and straining lever, for which letters patent were granted to the present inventor, January 16, 1872, so as to make them more convenient and satisfactory in use; it consists in providing the straining lever with beveled guide ways formed upon the curved branches of the same, in combination with notches in the eye attached to the bale band, so as to prevent all chance of slip.

WINDOW FASTENING.—Edward H. Sweetser, Hamburg, Iowa.—The invention consists in attaching to and near the edge of the sash a bifurcated reversible lever with an angular friction block pivoted between its prongs. When the sash is raised, the lever is reversed, and one of the sides of the block placed against the frame. The sash holds the lever and block by its weight, while the possibility of the sash taking a downward course is entirely prevented.

SPARK ARRESTER.—James L. Ferris, South Brunswick, N. J.—This invention furnishes an improved spark arrester for attachment to locomotive boilers, which is so constructed as to prevent the sparks passing out through the smoke stack and setting fire to combustible substances at the sides of the road, and which is so arranged that the waste heat passing off with the products of combustion is utilized for superheating the steam.

ANTI-FRICTION BUSH FOR PULLEYS.—Joseph Palmer, of St. Catherine's, Canada, assignor to himself and H. F. Leavenworth, of same place.—This invention relates to a new and useful improvement in bushes for sheaves of pulley blocks and for other purposes. It consists of an outer case and a core, with friction rollers confined in the core; or of an outer case and a core without friction rollers.

SAW SET.—Samuel H. Calligan, of Forest city, Maine.—This invention furnishes a simple implement for setting saws. It consists of a pair of handles and jaws which are pivoted together so as to work like pincers. One jaw forms a bed, and the other is pointed; between the two the saw tooth is griped. Two extra jaws extend from the bed jaw, between which the saw plate is held. One of the extra jaws is hinged at its inner end and is graduated by a set screw at its outer end to form more or less of an angle with the bed jaw. Upon this angle depends the amount of set given to the saw teeth.

GRINDING MILL.—George W. Loy and Francis C. Baker, of Jefferson, Texas.—This invention consists principally in making the spindle of the mill in as many sections as there are pairs of burrs, the lower section resting on a step and its upper end being squared and entering a socket in the section above; also in an improved manner of dressing the millstones so as to present the largest amount of grinding surface and prevent the too rapid escape of the material, and in an arrangement of a hopper, slides, etc., whereby the passage of the material is kept under control.

PLOW.—In this improved plow the standard which is bolted to the beam, is provided with a flange to receive the mold board and share, a brace to resist inward pressure, and a land slide; it is cast of malleable iron in one piece and forms a complete plow frame in itself. A double or branched brace is bolted by one branch to the land side and by the other to the mold board, the bolt in the latter case passing through a slot in the branch. The upper end of the brace, where the branches conjoin, has a slot to receive a bolt by which it is secured to the beam. By adjusting the beam to the standard so that its rear end is slightly raised, a large share of the draft strain is brought on the double brace and through it on the plow proper. By the construction described, the plow is readily adjustable to be run at any required depth. The handles are also arranged to be adjusted for convenient use. The plow, which is of very easy draft, is unusually durable, as the wear is taken off the mold board to such an extent as to render it almost impossible to wear a hole through its point. The improvement is the invention of Thomas E. Putnam, of Winneconne, Wis.

MACHINE FOR TURNING WOODEN AXLES.—Michael McMahon, of St. Peter, Minn.—This invention consists of certain combinations and arrangements of devices for rotating a cutter around the axle which is held in a clamp, and for feeding the cutter along the axle lengthwise in such a manner as to turn the bearing upon any taper; also for turning a part upon one taper and a part upon another, and one part in oval form; also, for turning for the right "gather" and "pitch."

VENTILATOR.—John H. Karnan, of Cambridgeport, Mass.—This invention consists of a combination of pipes with the exhaust pipe of a ventilator so that wind blowing against the side of the exhaust pipe is conducted into them and discharged up and through nozzles into, and also outwardly over, the top of the exhaust pipe, in such a manner as to increase the draft therein to a very great extent.

SAWING MACHINE.—August Scharnweber, of Davenport, Iowa.—This invention relates to improvements in sawing machines, more particularly those worked by manual power; it comprises the use of two driving levers which may be operated singly by one or simultaneously by two persons when greater power is required. One of the levers is so located that the person operating it can also feed the wood to the saw. The apparatus admits of various adjustments, and provision is made for the removal of the circular saw and the immediate introduction and throwing into gear of a straight saw.

MACHINE FOR DRIVING BRUSH HANDLES.—Peter Peartree, of Lansingburg, N. Y., assignor to John Ames, of same place.—This invention consists of several ingenious combinations of mechanism especially contrived for the following purposes: first, for holding the brush handle while being driven; second, for driving the brush handle, and third, for adjusting the driver of the machine so as to drive the handle exactly to the required point.

CLOTH MEASURING AND FOLDING MACHINE.—Leander Harvey, of New Castle, Ind., assignor to Leander Harvey and Co., of same place.—This invention relates to a new machine for measuring cloth that is being wound upon a beam or roller, and for folding it after it has been measured. It consists in the application to the winding up roller of a measuring friction wheel and spring snap, the latter serving to audibly announce every revolution of the measuring. After the cloth has been wound about the drum, one of the frame posts is disengaged and folded down. This liberates one end of the drum and allows the cloth thereon to be slipped off bodily, when it is properly folded for transportation or display.

CIGAR MACHINE.—Robert Neisch, of Allentown, Pa.—This invention relates to several improvements in the cigar machine for which letters patent were granted to the same party December 20, 1870. The present invention has for its object materially to simplify the devices shown in the former invention, and thereby to reduce the difficulty and expense of producing the machine and operating the same. It consists, first, in the use of a rotary serrated cutter hanging in spring bearings, and intended to cut off whatever may project beyond the top of the cigar; second, in the application, to the upper mold box lid, of a projecting arm, which serves to apply the aforesaid rotary cutter only while the mold is closed; third, in providing the frame which carries the knife for cutting the tip end of the wrapper with a weighted arm, whereby it is raised automatically off the platform unless when forced down for cutting, so that it will not interfere with the operation of the machine; finally, the invention consists of a new construction of paster, containing a spring plunger for forcing the gum through small apertures in the end.

MITER BOX.—John Hawkes, of New Brunswick, and Timothy Hawkes, of Jersey City, N. J.—The object of the present invention is to furnish an improved box for sawing a miter or any other desired bevel; it consists in a bed piece and back rest provided with one or more adjustable saw guides arranged on an adjustable slotted arch plate by means of vertical guides and screws; and also in a gage used in combination therewith.

LOZENGE MACHINE.—Ernest Greenfield, of New York city.—In this improved lozenge machine the type carrier consists of a vertically reciprocating gate working over the endless belt on which the paste to be printed, colored, or otherwise marked, is carried under the type and thence to the cutting devices; the gate is brought down at the proper time to print the paste while the belt is at rest by cams, and raised immediately afterwards by springs, and after it is raised an inking pad on a carriage above the belt is brought under the type and allowed to rest; the type is then brought down to the pad by other cams and again raised by the springs, after which the pad is moved back. This pad consists of an endless belt, working in a trough containing ink-over rollers, which are moved forward by a ratchet on the end of one roller striking a pawl as the pad moves under the inking type; and below the pad are rollers for delivering the ink up to the under side of it. The pad is considerably wider on the surface than the type, to adapt it to be shifted relatively to the type, so that it will not come down upon it always in the same place.

MODE OF MANUFACTURING WATERPROOF TUBING.—William H. Bates and Hugh Faulkner, of Leicester, England, assignors to Ezra Thomas Sawyer, of East Hampton, Mass.—This invention consists in providing an improved method of forming waterproof braiding or tubing by drawing a rubber tube over a flexible core, coating it with a rubber solution, then braiding the fabric thereon, and passing it through a heated cylinder; after which the core is easily removed from the braid by stretching the former lengthwise.

FLY TRAP.—Frederic Stengel, of New York city.—This invention furnishes an improved fly trap, which is composed of a transparent glass body raised on supports. It has a cone shaped bottom opening into the interior and is covered at the top. The bait is placed under the trap directly below the hole in the bottom, and the flies collected by it being disturbed fly up and enter the trap, from which they do not escape owing to their peculiar habit of not flying downward in a small chamber.

PIANOFORTE.—Paul Gmehlin, of New York city.—This invention relates to a new manner of sustaining the strings of a pianoforte, with the object of dispensing with the expensive agraffe and bridge systems heretofore in use. On the inner edge of the piano plate are formed projecting hooks, one between every pair of "cores" or set of strings; a bar of soft metal, ivory, or other material is placed against the under side of the hooks and extends along the inner side of the plate. The strings are drawn under the bar and then up over a projecting rib of the plate. The bar serves thus to define the length of the vibrating motion of each string.

WASHING MACHINE.—Thomas J. Wilkinson, of Highland, Kansas.—This invention furnishes an improved washing machine which consists of a rectangular box with a heating furnace attached. A cylinder is formed by attaching slats to three circular disks, one at each end and one at the center, and is revolved by a crank the shaft of which passes through the side of the box, through the end disks of the cylinder, and into or through a square hole in the central disk, so as to pivot the cylinder to the side of the box. To the end parts of the sides of the box are attached blocks which are so arranged as to receive the ends of spring bars, to the upper and lower ends of which are pivoted the ends of two small fluted rollers, which are held down upon the cylinder with sufficient force to squeeze out the water from the clothes operated upon; the elasticity of the spring bars allowing the rollers to adjust themselves to the varying thickness of the clothes.

CHURN.—David H. Gobin, of Springfield, Ill.—This invention furnishes an improved churning machine which is provided with a dasher in two parts driven by a crank shaft. An air pump is connected with the apparatus and is run by the crank shaft so that it may be used to force air into the churn. It is disconnected from the churn by the operation of a lever when desired.

PICTURE CASE.—Alvin R. Stone, of Baldwinsville, N. Y.—The object of this invention is to provide a convenient apparatus for holding, preserving, and exposing to view photographic and stereoscopic pictures; it consists in a cabinet constructed with two compartments for containing two tiers of pictures, and with straps or bars and heads, to which a vertical reciprocating motion is given, by which the position of the pictures is changed. Magnifying glasses may be applied to the apertures of the case, or a stereoscope may be attached thereto when it contains stereoscopic views.

LATHE CHUCK.—Cornelius Archer, of Nelsonville, Ohio.—This invention furnishes an improved lathe chuck for holding pieces having different sized holes formed through them, and for holding columns, half and quarter columns while being turned or polished, without the necessity of gluing. It consists of a holder, the stem of which is designed to be inserted in the lathe mandrel, and the head of which is made cylindrical to enter the hollow base of a cone attachment; it has inclined lugs formed upon its outer surface so as to interlock with corresponding lugs formed upon the inner surface of the hollow base of the cone, so that the cone is carried around with the holder in its revolution. The cone is designed to enter the hole in the piece to be turned or polished, whatever may be the size of the hole. To the side of the cone is attached a blade to prevent the piece from turning while being operated upon. The forward end or face of the holder is made with a flange around its edge to prevent the pieces from flying apart while being operated upon. The face of the holder is also provided with cross flanges or blades to adapt it for holding half and quarter columns.

CULTIVATOR.—William H. Griffith, of Lockhart, Texas, assignor to himself and Stokes Mincenhommer, of same place.—This invention furnishes an improved cultivator, which may be readily adjusted for cultivating plants, covering small grain, and breaking up the ground; it consists more particularly of a combination of three adjustable uprights and a cross bar, by means of which the plows are set more or less apart, and, through the operation of a lever, raised from the ground when required. Various kinds of plows may be used with the machine, which is adjustable in all respects, and it may be used for breaking up land by taking off the outer plows and standards.

DEVICE FOR CONVERTING MOTION.—Pelag Werni, of Elizabeth, N. J., assignor to himself and Henry Curtiss, of New York city.—This invention furnishes an improved device for converting rotary into reciprocating motion so as to move the reciprocating shaft in both directions with a positive movement, without the use of any separate device for shifting at the end of the stroke. To the driving shaft is attached a wheel, a segment of which is toothed, the plane part of the wheel being in the circle of the points of the teeth. The end of the reciprocating shaft is pivoted to the base of a fork upon the inner sides of the arms of which are formed teeth corresponding in form and number with the teeth of the segmental gear wheel. The arms of the fork are arranged at such a distance apart that when the teeth of the gear wheel are meshing into the teeth of either arm of the fork the plane part of the wheel is moving along the points of the teeth of the other arm. At the opposite ends of the two arms of the fork are formed projections which, as the last tooth of the gear wheel operates upon the last tooth of each arm of the fork, strike against the plane surface of the wheel and move the fork, so that the first tooth of the gear wheel meshes firmly with the first tooth of the other arm, and the fork and shaft are moved alternately in opposite directions with a positive movement by the continuous movement of the shaft.

SAW TEETH DRESSER.—Collin M. Cowardin, of Gardner, Tenn.—This invention consists of a pair of blocks of wood hinged together, and each provided with a spring plate and a file in the side fronting the other; the spring being next to the edge, and the file being between the spring and the hinge joint; behind the files is a screw for screwing the blocks together. It is employed for dressing off the outer corners of the teeth after the saw has been set, so as to equalize the width of the set throughout, and is applied by introducing the blade between the blocks, with the teeth between the files and with the spring behind the teeth so as to press on the blade; it is then moved along from end to end and files off all the points of the teeth alike.

BOAT DETACHING APPARATUS.—Thomas S. Seabury, of St. James, N. Y.—This invention relates to a new boat detaching apparatus which is so arranged that it operates automatically or only at the will of the occupants of the boat. It consists in constructing the link by which the boat is suspended from the davits of two pivoted claws, locking together, but so arranged that they uncouple as soon as the weight of the boat is no longer suspended from the davits, but is supported on the water. The invention also consists in combining with these claws a bolt by which they can be so connected as not to become automatically disengaged, but which can be drawn out whenever the detachment is to be effected.

SAWING MACHINE.—John C. Nelson, of Kingston, Tenn.—The object of this invention is to facilitate the operation of sawing timber across the grain; it consists in a bow spring for straining the saw, and in a vibrating lever with a slide attached to the shank of the saw. The saw is fed down by its own weight and that of the bow spring, while the reciprocating motion is given it by vibrating the lever by hand. In practice, the saw is started in a horizontal position, and as it works down it is kept in a nearly horizontal position by slipping the slide down on the lever.

WASHING MACHINE.—Ira Pratt, Jr., of Greenleaf, Minn.—This invention furnishes an improved washing machine, which is light, strong, durable, readily attached to an ordinary wash tub, and easily operated; it consists in a vertical corrugated wash board attached to a frame which is clamped to the side of the tub, and in an arrangement of levers, also attached to the frame, by the operation of which a corresponding corrugated board is moved towards and from the fixed one. Between them the clothes are squeezed and washed.

EXTENSION LOUNGE.—George H. Thomas, Quincy Point, Mass.—This invention furnishes an improved lounge which can be readily converted into a bed for two persons. It is so constructed that, when the extension is drawn out, the two parts of the bed are kept parallel with each other by means of certain bars which connect them. The back is made removable so as to facilitate the packing away of the combined article for storage or transportation.

DRYER.—William E. Wright, Rome, N. Y.—This invention relates to a new apparatus for drying peat, lumber, etc., by currents of heated air forced through a chamber that contains the matter to be dried, and afterwards ejected therefrom when charged with the moisture taken from such matter. By this arrangement the peat or other substance is exposed to the identical effect of hot wind and is thoroughly and rapidly dried.

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DISCLAIMER.

21,207.—HARVESTER.—C. W. and W. W. Marsh. August 13, 1872.

DESIGNS PATENTED.

6,017.—SMOKING PIPE CAP.—W. H. Blake, Waterbury, Conn.
6,018.—HEATING STOVE.—J. V. B. Carter, Detroit, Mich.
6,019.—DESK STANDARD.—J. D. Diffenderfer, East Lewisburg, Pa.

TRADE MARKS REGISTERED.

940.—STOMACH BITTERS.—J. Dreyfus, New Orleans, La.
941.—CRACKERS AND BISCUITS.—J. B. Kupfer, Kenosha, Wis.
942.—CIGARS.—M. J. Swank, Philadelphia, Pa.
943.—ALIMENTARY PREPARATIONS, ETC.—J. M. O. Tamin, New York city.

APPLICATIONS FOR EXTENSIONS.

Applications have been duly filed, and are now pending, for the extension of the following Letters Patent. Hearings upon the respective applications are appointed for the days hereinafter mentioned:

22,631.—RAILROAD CHAIR.—M. C. Cushman. Jan. 2, 1873.
22,071.—ELECTROMAGNETIC FIRE ALARM.—M. G. Farmer. Oct. 30, 1872.

EXTENSIONS GRANTED.

21,185.—STEAM HEATING APPARATUS.—H. G. Bulkley.
21,194.—MACHINE FOR CUTTING MITERS.—S. W. Hall.
21,207.—REAPING MACHINE.—C. W. and W. W. Marsh. Two divisions.
21,213.—NAIL FORGING MACHINE.—S. S. Putnam.

NEW BOOKS AND PUBLICATIONS.

REPORT OF THE COMMISSIONER OF AGRICULTURE FOR THE YEAR 1871. Washington: Government Printing Office. 1872.

This contains the reports of the various officers of the bureau for the past year, and includes, also, many papers of interest on topics connected with agriculture. The publication is one of much value.