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Improved Adjustable-Jaw Vise.

The machinist, the blacksmith, the jeweler, and the workers at some other trades, know the value of a good vise. The vise-man in the machine shop who has a clean, well-ordered bench, a drawer of well-assorted files, gages, straightedges, etc., and above all, a reliable vise, ought to be satisfied with his means of working or—ought to quit the business. Yet, although each variety of vise with which we are acquainted possesses some advantage peculiar to itself, we have never seen one that appears to combine them all so completely as the one herewith represented.

The inventor cites these as the principal objections to the parallel vises now in use: "So constructed that a loss of squeezing power of about twenty per cent is sustained; not adapted to the same hight in all vises, while the rule for the elevation of the top of jaws is the level of the bend of the workman's elbow; the strain, concentrated at one point, increasing the possibility of easy breakage by hard use, having no elasticity, too much rigidity, and considerable wear to screw and nut; having nothing to receive the concussion of a blow; loss of motion, the screw sometimes making an entire revolution or more, before the jaws answer."

It is a leg or post vise, sustained both by the bench and floor, making it solid and firm, by which the full force of the blow is obtained, while it is adjustable in every direction required by the necessities of the work. The foot pivots in a step screwed to the floor, and the rear jaw has a semi-circular ear through which passes a screw bolt, the head of which moves in the segmental slot of a plate screwed to the top of the bench. This permits the whole vise to be swung in a horizontal plane, so as to present the jaws to the edge of the bench at any angle desired, when it may be held firmly by the bolt. The advantage of this is too apparent to the workman to require more than a reference to it.

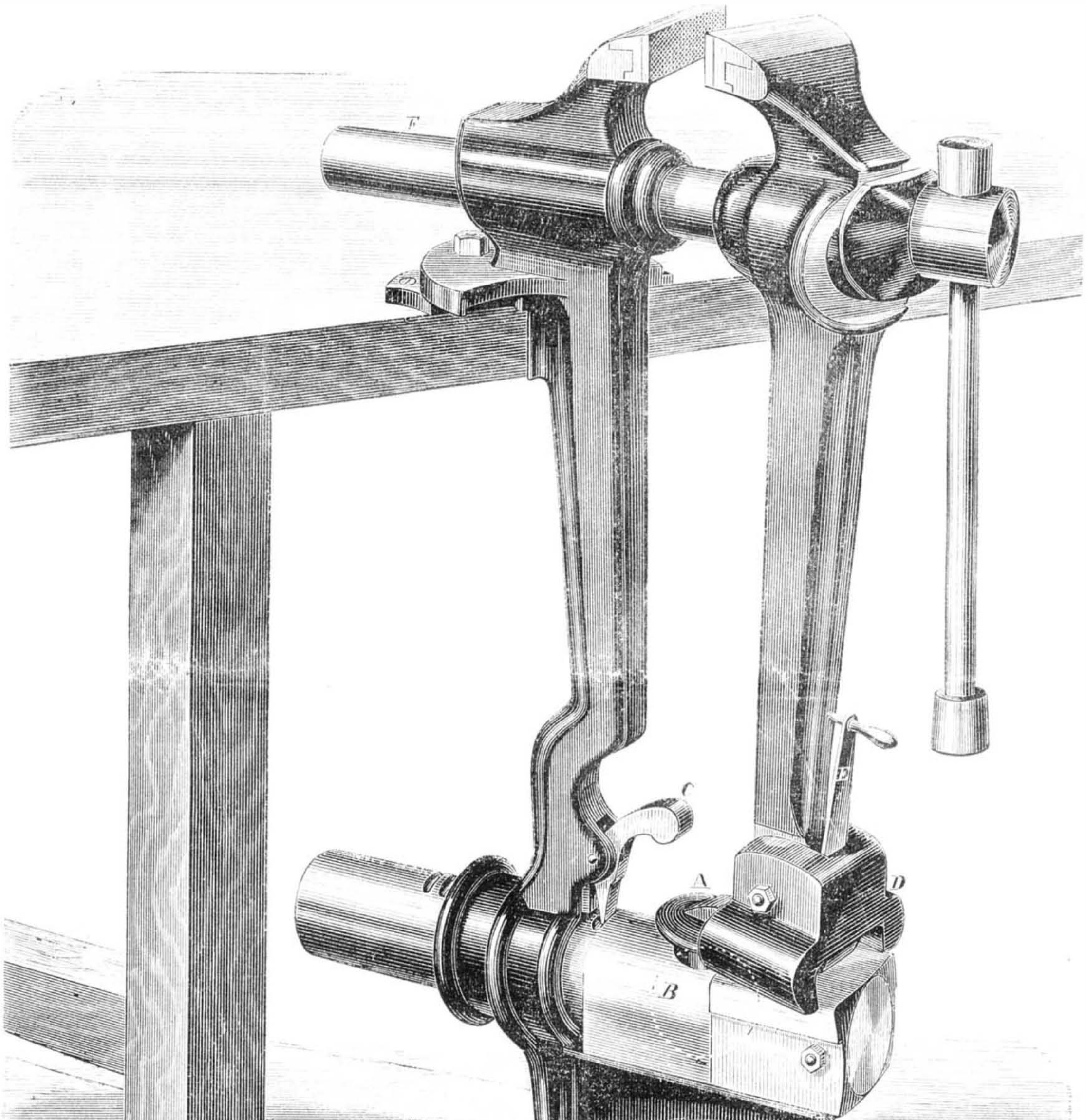
The front jaw has an offset, A, carrying a ball and socket joint inside the hollow sliding bar, B, that permits the jaw to swing in the usual manner, and also to be turned at an angle to the back or fixed jaw, this latter movement being intended for holding work, the sides of which are not parallel, as a key, etc. To permit this motion, the eye of the front jaw through which the screw sheath passes is made flaring, or trump-shaped, at the front. On the front jaw, encircling the screw, is a saddle washer, the inside of which is made to conform to the outside of the jaw face, so that in whatever position the jaw may be placed, this washer has a perfect bearing.

The sliding bar, B, may be moved in or out by sliding it through the collar in the lower part of the fixed jaw, and is held in position by a pivoted dog, C, the point of which engages with notches cut on the top of the sliding bar. This allows the foot of the movable jaw to be kept parallel with the faces of the jaws, and to be accommodated to the diameter of the work to be held. The spring that throws this jaw out is concealed in the hollow bar, B, and it acts in whatever position the jaw may be. The bar is sustained by a projecting shelf forming a portion of the fixed jaw, strengthened, as seen, by a flange underneath.

When the jaws are parallel they are held in that position by a clutch, D, on the front jaw that slides down and embraces, with its side projections, the squared portion of the sliding bar. When raised to permit the jaw to be set at an angle, it is held by a spring catch, E. The screw is at all times protected from chips, filings, or dirt, by the sheath, F, which is rigidly secured in the back jaw. The offset, A, does away with lost motion, the instant the screw is started the jaws moving simultaneously

The jaws proper are of the best cast steel, reinforced with Swedish iron, and milled to a gage. They are fastened with tapering steel pins and are made interchangeable, so that if they break or wear out they may be replaced at half the cost of annealing, re-cutting, and re-tempering the old style.

It will readily be seen that the strain is equally distributed from the top to the bottom of the vise, and the friction in working is reduced to the minimum. In strength, durability, handiness, and elegance, this vise has certainly no superior. These vises are made of all sizes from eight-inch jaws to jewelers' size. They are made of a combination of Lake Superior, and other ores well known for their toughness, strength, and resistance to percussion. Every vise is put to a test, three times as much as it is intended for in use, before it is sold.



GARDNER'S PATENT "NEW YORK" VISE.

Patented by O. H. Gardner, and made by the Fulton Manufacturing Company, to whom all orders should be addressed at Fulton, N. Y.

ON THE THEORY OF THE LUMINOSITY OF FLAMES.

In 1817, Sir Humphrey Davy published his theory on the causes of the illuminating property of flames. He stated that this phenomenon was due to the presence in the midst of the flame of solid particles which, undergoing partial combustion only, were rendered incandescent. In a candle these were supposed to be solid particles of carbon.

Recent experiments made by Dr. Edward Frankland seem to have entirely overthrown this theory. According to the researches of this eminent chemist many very brilliant flames exist in nature which cannot possibly contain any solid matter whatever.

If, says he, metallic arsenic be burned in oxygen gas it produces a most intense white light. It is, however, well known that metallic arsenic is volatilized at a temperature of 180° C., and that the product of its combustion itself, arsenious acid, is also vaporized at 218° C., while the temperature of incandescence of all solids has been proved to exceed 500° C., so that in this instance no solid particles could possibly exist in the flame.

The vapor of sulphide of carbon burned in oxygen gas or oxygen burned in sulphide of carbon produces a light so intense that the eye can scarcely bear it, and yet we are certain that no solid particles of matter are to be found here. The temperature of ebullition of sulphur, 440° C. is much below that of the flame produced in the above case.

If protoxide of nitrogen be substituted for oxygen in this experiment the result is identical; the light created possessing sufficient intensity for the taking of instantaneous photographs or for producing the phenomena of fluorescence.

Few bodies ignited in oxygen gas emit a more powerful light than phosphorus. The product of this combustion is phosphoric acid, which is gaseous at a red heat, and which could not possibly have contained solid particles at the temperature of a flame which is capable of melting platinum.

The conclusions arrived at by Dr. Frankland are that it is not solid particles which produce luminosity, but that the intensity of a flame depends on the radiation of dense but transparent hydrocarbon or other vapors. As a corollary to this theory he expresses his opinion, based on experimental researches, that a flame becomes luminous at a lower degree of temperature the denser the gases which enter into its composition, and he further infers that this luminosity is to a great extent independent of the nature of the vapor or gas, so that a gas which would burn without producing light at the pressure of the atmosphere, would become luminous, if submitted to a sufficient degree of compression.

In order to prove these facts, Dr. Frankland caused the combustion of jets of hydrogen gas and of carbonic oxide gas to take place in oxygen gas under gradually increasing tensions up to twenty times that of the atmosphere. This he did in very strong iron vessels furnished with thick glass windows which allowed him to witness what occurred in their interior.

Hydrogen gas, when burned in oxygen at the pressure of the atmosphere, gives a very feeble light. Under a pressure of two atmospheres this light is very noticeably increased, and at ten atmospheres a newspaper can be read at a distance of two feet without a reflector. Examined with the spectroscope the spectrum of this flame was bright, perfect, and continuous, from the red to the violet.

The intensity of an electrical spark sent through a gaseous medium is also proportional to the density of the gases, being weak in hydrogen gas, greater in oxygen, and very considerable in chlorine, sulphurous acid gas, etc.

A series of sparks from a powerful induction apparatus passing through air confined in a closed glass tube connected to a force pump, becomes brighter and brighter as the compression of the air is increased, and diminishes gradually in brilliancy as the air is allowed to escape.

The electrical arch, produced by fifty couples of a Grove battery, is much increased when the vapor of mercury is allowed to intervene between the points of carbon of the electric lamp.

The experiments of Frankland have elicited great attention from men of science, and a controversy is at present taking place on the subject at the Academy of Sciences, in Paris, where M. Sainte-Claire Deville affirms that H. Davy's theory is not subverted by the new discoveries, but that the facts observed may be satisfactorily explained if we admit, as he believes to be the case, that the temperature of a flame is increased in the same ratio as the increased pressure or density under which the gas is ignited.

The final verification of this physical law will need further elaborate and dangerous experiments, for the purpose of determining the temperature of combustion of various gases in oxygen, under various conditions of pressure higher than the atmospheric.

These conclusive experiments will soon be begun in France at the Ecole Normale, by order of the Emperor Napoleon III. The operators will be placed within a strong cylindrical iron chamber, where they will be surrounded by air, compressed to at least three times the weight of the atmosphere. Let us here remark that this pressure has been shown by the experiments of the bridge at Kehl to be harmless to the human organization.

The results of these experiments may eventually have a very important practical bearing on the use of gas and of liquid fuels in our furnaces and under our boilers, the heating surfaces of which they may tend to diminish. They may also furnish us with an easy means of working platinum and of producing an indefinite amount of heat, and will probably be the means of suggesting some useful hints for the increase of the illuminating power of our ordinary lighting materials.

EXPLOSIVE COMPOUNDS FOR ENGINEERING PURPOSES.

NO. II.

On page 167, we quoted from Mr. Nursey's paper on the above subject, read before the Society of Engineers, of London. The facts therein stated are so valuable for reference, and withal so interesting, that we continue our extracts. Mr. Nursey describes, by the aid of an engraving, a simple apparatus for determining the ignition point of explosives, by which their absolute and relative temperatures are ascertained at the instant of explosion. It is simply a contrivance similar to a portable retort stand. An upright fixed in a weighted base, to stand upon a bench or table, sustains two transverse adjustable sliding bars, secured at any point desired by set screws. From the upper one depends a thermometer graduated to 650° Fah. The lower arm holds a cup of oil into which the bulb of the thermometer dips. A miniature cup containing a small quantity of the explosive mixture, floats on the surface of the oil. Heat is applied by a gas jet under the oil bath, or by a spirit lamp. By this apparatus, Mr. Horsley has ascertained the ignition point of various explosives, and the following are among some of his results: Gunpowder ignites at a temperature of 600° Fah. A sample of Horsley's powder gave 430° as the ignition point. Gun cotton of a powerful character, prepared by Horsley, ignited at 325°, while some of Prentice's sporting gun cotton exploded at 410°. Trials of Schultze's sporting powder gave 385° as the ignition point. It is as well, at a time like the present, when new explosive compounds are constantly being brought under notice, that experimenters should know the character of the material they are dealing with, and which they will be enabled to ascertain by means of the above simple apparatus.

Another, and perhaps safer, application of chlorate of potash to the purpose in question was made some nine years since by M. Hochstädter, a German chemist. Unsized paper was thoroughly soaked in, and coated with a thin paste consisting of chlorate of potash, finely-divided charcoal, a small quantity of sulphide of antimony, and a little starch, gum, or some similar binding material, water being used as the solvent and mixing agent. The paper was rolled up very compactly and dried in that form. In this manner, very firm rolls of an explosive material are obtained, which burns with considerable violence in open air, and the propelling effect of which, in small arms, has occasionally been found greater than that of a corresponding charge of rifle powder. Moreover, the material, if submitted in small portions to violent percussion, exhibits but little tendency to detonation. But, as no reliance can be placed on a sufficient uniformity of action, in a firearm, of these explosive rolls, this alone sufficed to prevent their competing with gunpowder. The same description of explosive preparation, differing only from that of M. Hochstädter in a trifling modification of its composition, was again brought before the public in this country in the early part of 1866, having been patented by M. Reichen. The author has used this gun paper with very good results in rifle shooting, but nothing practical appears to have been done with the material.

The mixture previously referred to as German, or white gunpowder, consists of chlorate of potash, ferrocyanide of potassium, and sugar. Many years since it was proposed and tried without success as a substitute for gunpowder. Since then various preparations of similar character have been suggested for employment, either as blasting and mining agents, or for use in shells, or even for all the purposes to which gunpowder is applied. The most recent of these mixtures with which the author is acquainted, is a white gunpowder made by H. W. Reveley, of Reading. This mixture is a perfectly white impalpable powder resembling flour, powdered chalk, or magnesia in appearance. Reveley recently informed the author that he has constantly made and used it in preference to the ordinary gunpowder, both on account of its superior propelling power—which is at least one-third greater—and its perfect cleanliness. It produces neither smoke nor flash of flame at the muzzle on discharge, and can be used in a casemate with perfect comfort to the gunners. Mr. Reveley has used it for every purpose to which ordinary gunpowder is applicable, and invariably with the most perfect success. He has made many parcels of the white gunpowder during the last ten years, and has always found them uniform, both as regards strength and other properties, and he has never met with the slightest accident, although he has tested it very severely. The composition of white gunpowder is as follows:

Chlorate of potash	48
Yellow prussiate ditto	29
Finest loaf sugar	23
Parts by weight	100

In manufacturing this powder the yellow prussiate is dried in an iron ladle until it is as white as the chlorate. The ingredients are ground separately to very fine powder, and are then mixed by means of a conical sieve until they are thoroughly incorporated, but not by trituration. For small quantities, Reveley uses a common Wedgewood mortar and pestle, which must be perfectly dry and clean. The operation does not take many minutes, and with the above precautions, its manufacture is free from danger. In loading, it is treated in the same way as ordinary gunpowder, being pressed down by hand solid, but not hard. The charge is ignited in the usual way, with a common cap and nipple. In actual use, it does not appear to possess a bursting so much as a propulsive power, and Mr. Reveley has obtained some of the highest penetrative results in his rifle practice with it. The economy of this powder will at once be apparent, when it is stated that its wholesale cost is about 86s. per cwt., but as its strength is at least one-third greater than that of ordinary powder, its cost may be comparatively estimated at about 60s. per cwt. One important feature in the manufacture of white gunpowder is that it does not require to be—indeed, it cannot be—granulated, which process is the great source of danger in powder mills. The universal use of the cartridge entirely obviates any objection that may be made to white gunpowder on that score, or on the score of similarity in appearance to other substances, and, owing to its compact form, it only occupies half the usual space. Beside the foregoing, there have been several cruder applications of chlorate of potash in the production of explosive compounds, which it is unnecessary here to notice more particularly.

Among other materials, wood has been pressed into service to aid in superseding gunpowder as a practical explosive. Soon after Schönbein's discovery of gun cotton, a Prussian artillery officer, Captain Schultze, while investigating the subject, conceived that a finely divided wood could be converted into a controllable explosive agent more readily than cotton. He produced the substance known as gun sawdust, the explosive properties of which are mainly due to its impregnation with a large proportion of an oxidizing agent. In preparing the gun sawdust, the wood is purified from all resinous substances, and is digested in a mixture of sulphuric and nitric acids. This gives a very feeble explosive material, which is further strengthened for ultimate use by impregnation with nitrates, by which it is made to acquire great explosive power. Here, then, is a powder which may be preserved in a comparatively harmless condition until required for use, when it may be rendered powerfully explosive by impregnation with the nitrates. Although its properties are somewhat similar to those of gun cotton, many of the advantages of which it possesses, it is open to one very fatal objection. To be within the limits of safety, the completion of its manufacture must be delayed until the moment it is required for use; and, moreover, the final ingredients are the most dangerous, and require refined manipulation. It is needless to point out how incompatible the conducting this completing process is with the ordinary details of mining; the care and nicety required in such a chemical operation, must be referred to the skilled operator, and not trusted to the rough-and-ready hand of the miner. Practical safety can only be attained by an explosive agent into which the stray spark may fall without producing more than a gush of flame, a gradual burning, or without causing ignition at all, but which, nevertheless, when properly rammed home and tamped, may be fired with results at least equal, if not superior to ordinary gunpowder.

Utilization of High Falls of Water.

Glynn's "Power of Water," contains the following in regard to the utilization of high falls of water:

"Attempts have been made to employ a high fall of water by placing one wheel above another; this was tried many years ago at Aberdare, in South Wales, where two wheels, each forty feet in diameter, were so placed, like the figure of 8, and were connected by teeth on their respective rims—the lower wheel receiving the water after it left the upper one, and revolving in the opposite or reverse way. The result was not satisfactory; but in another case, a drawing of which lies before the writer, wherein Messrs. Charles Wood and Brothers, of Macclesfield, had two overshot water wheels, each of twenty-six feet in diameter, and six feet wide, placed over each other, they succeeded in a somewhat different arrangement of the toothed-wheel work. The two wheels were not connected immediately with each other, but by means of *pinions*, which worked into teeth upon the rims of the two water wheels, causing them both to revolve in the *same* direction, so that the water, on leaving the buckets of the upper wheel, was more easily and readily received by the buckets of the lower wheel.

"In either of these cases, however, the employment of the turbine, or the *pressure engine*, would have been much less costly and more effective. The like may be said of all the contrivances to substitute endless chains with buckets applied to high falls instead of water wheels.

"Where the quantity of water is large and variable, and the fall such as may be termed an intermediate hight, but varying also with the supply, it is found advantageous not to lay the water upon the top of the wheel, so that it may work overshot, but to make the diameter of the wheel greater than the mean hight of the fall, and to lay the water, as it were, '*on the shoulder*' of the wheel, or at forty-five degrees from the perpendicular; that is, half way between the horizontal line and the perpendicular, or, as millwrights say, 'at nine o'clock.' Very little mechanical effect is produced in the upper eighth of the circle as compared with the next quarter, on which the descent of the water is nearly perpendicular, and when the wheel is fitted with toothed segments at or near its circumference, acting on a pinion placed on a level with the axle, the weight of the water is brought to bear at once upon the pinion teeth, the stress is taken off the arms of the wheel, and the axle becomes, as it were, merely a pivot on which the wheel turns. By this arrangement, the late Messrs. Hughes and Wren, of Manchester, were enabled to make the arms of their wheels of simple tension rods of bar iron, by which the rim of the wheel was tied and braced to the center, a plan which, with some modifications and improvements, is still in use, and sometimes the segments have interior teeth, which render the wheel-work more compact.

"In the best constructed wheels, the water is laid on in a thin sheet of no greater depth than will give it a somewhat greater velocity than that of the wheel, the difference being just sufficient to pour into the succeeding buckets the proper supply of water. The buckets should be so capacious that they need not be full when the wheel carries its maximum load, in order that no water may be wasted, and that they may retain the water in them till the last moment that its weight on the wheel is effective, and yet empty themselves as soon as it ceases to be so. It is also expedient in practice to make the width of the sheet of water less than that of the wheels; if the wheel be broad on the face, the stream may be four inches shorter than the length of the buckets; the air escaping at the ends is thus prevented from blowing out the water; and all these precautions, though small in themselves, tend to produce smoothness, regularity, and increased effect in the working of the machinery.

"There is, however, one mode of using water power—acting by its gravity—in buckets upon a chain, much employed in South Wales, which is found very useful in raising ore from the pits. An endless chain is passed over a wheel of sixteen feet in diameter, placed between two shafts. The chain passing down each shaft, and through an opening at the bottom between the two, two large buckets, or rather shallow tubs of wrought iron, are fixed upon the chain, so that the suspension is by the center of the tubs, and they are so placed that when one tub is at the top of its shaft, the other is at the bottom of its shaft. Each tub or bucket is covered by a strong platform, which fills and closes the pit's mouth when hoisted up, and carries the small wagon or tram containing the ore upon it; and each is also fitted with a valve at the bottom to discharge the water. A branched pipe, communicating with an elevated reservoir, is laid to the mouths of the shafts, and fitted with stop-cocks or valves. The tub at the surface being filled with water, overbalances the empty tub at the bottom, and raises it, with its tram load of ore, to the top. When the full bucket has descended the shaft, the valve is opened and the water discharged; the other being filled in like manner, descends, and thus alternately each raises the other with its load of oar. The water finds its way out of the mine by a drift or adit into the valley; the long loop or bight of slack chain below the buckets, and hanging to the center of each, equalizes the weight of chain at all times; and a brake applied to the large wheel regulates the speed of the descending bucket. In some places the two buckets work in one shaft of an oblong form; the diameter of the wheel is reduced to seven feet; it is fitted with toothed segments, working into a pinion, fixed upon a second axle, on which the brake wheel is placed, in order to gain the requisite power to control the descending weight. Drawings of both these plans lie before the writer, but the principle and construction are so simple that a description will probably suffice. It may be proper to mention that the buckets generally work in guides, that the discharging valves are opened by striking upon a point or projecting spike at the bottom of the shaft, and that upon the platforms which cover the buckets, there is a portion of the rail or tramway laid to match with the lines of way at the top and bottom of the shaft, so that the tram or carriage may run from the platform to its destination."

Dr. Mallet's Opinion of the Heaton Process.

The following is Dr. Mallet's opinion of the reality and commercial value of Heaton's process:

"This process for converting crude pig iron into wrought iron and into steel, by the employment of nitrate of soda in Heaton's patent converter, has been repeated at Langley Mills many times in my presence. I have examined minutely into its details as applicable in practice on a large scale, and its results; and I have also considered the chemical researches made as to the materials used and products obtained, by Professor Miller, of King's College, and I have been present at experiments, conducted by Mr. David Kirkaldy, at his Testing Works, at Southwark, as to the physical qualities of the products which were obtained by this process, in my own presence, at Langley Mills. In view of all the facts that have come before me, I can affirm the following as truths established beyond question:

"1st. That Heaton's patent process of conversion by means of nitrate of soda, is at all points in perfect accord with metallurgic theory. That it can be conducted upon the great scale with perfect safety, uniformity, and facility, and that it yields products of very high commercial value.

"2d. That in point of manufacturing economy or cost it can compete with advantage against every other known process for the production of wrought iron and steel from pig iron.

"3d. Among its strong points, however, apart from and over and above any mere economy in the cost of production are these: It enables first-class wrought iron and excellent steel to be produced from coarse, low priced brands of crude pig iron, rich in phosphorus and sulphur, from which no other known process, not even Bessemer's, enables steel of commercial value to be produced at all, nor wrought iron, except such as is more or less either "cold short" or "red short." Thus, wrought iron and cast steel of very high qualities have been produced, in my presence, from Cleveland and Northamptonshire pig irons rich in phosphorus and sulphur, and every iron master, I presume, knows that first-class wrought iron has not previously been produced from pig iron of either of these districts, nor marketable steel from them at all.

"Heaton's process presents, therefore, an almost measureless future field in extending the manufacture of high class wrought iron and excellent steel into the great iron districts, as yet precluded from the production of such materials by the inferior nature of their raw products. It admits of the steel manufacture also being extended into districts and countries where fuel is so scarce and dear that it is otherwise impossible.

"I cannot, in this brief communication, point out the prospects which the employment of this system presents, of greatly diminishing the existing waste of material, fuel, time, and wages, in the puddling process, and of lessening difficulties in relation to labor questions which beset that process, injuriously to the British iron trade. Nor can I adequately point out the large reduction in the original outlay for plant which this system admits of as compared with any other for equal annual out-put of iron and steel.

"Dr. Miller has proved, incontrovertibly, that the Heaton process does eliminate from the crude pig iron almost the whole of the phosphorus and sulphur, the trace remaining being unobjectionable in the wrought iron and steel produced, even when they have been made from the pig irons known to be the richest in these injurious constituents of any make in Great Britain.

"The wrought iron made in my presence from Cleveland and Northampton pigs, and tested for tensile resistance, also before me, bore a rupturing strain of twenty-three tuns per square inch, and an elongation of nearly one-fourth of the original unit in length. It is therefore iron of great strength and toughness, and yet probably by no means the very best that this process is capable of producing hereafter. It possesses those qualities which best fit iron for artillery, armor plates, and iron ships or boilers.

"The tilted cast steel, also made in my presence, from the very same pig irons as the above, bore a tensile strain at rupture of above forty-two tuns per square inch with an elongation of one-twelfth of the unit of length. It is, therefore, a remarkably tough and fine quality of steel, well suited for rails, ship-building, and all other structural uses. In a word, steel suited for any purpose known to the arts can be produced by this system from inferior brands of pig iron."

The Electrical Machine at Trinity College.

It is not generally known, says the Hartford *Times*, that Trinity College in this city possesses what, if not the largest, is the most powerful electrical machine in this country. It was made in Vienna expressly for this college. We were present at an exhibition of the same, March 6th, and were as much pleased as we were astonished by the wonderful power of the machine.

It occupies a space on the floor of about 4½ by 5½ feet. The electricity is collected in large brass balls, supported by strong pillars of a peculiar glass, in which there is no metallic substance. The rubbers and the points upon which the axles of the plates work are also supported by the same kind of pillars. These balls are nine inches in diameter, having a smaller ball between them; and from a projecting point midway between the larger balls, the spark is drawn to a metallic surface mounted on glass. This is movable and connected with the rubber and the ground. The large balls are surmounted by two rings of light hollow wood, lined with metal which are thirty inches in diameter, and greatly increase the force of the spark. The whole apparatus, to the top of these rings is eight feet high. The plate is of heavy glass, very clear, 46½ inches in diameter and three-eights of an inch thick. The operator stands at a safe distance, and the handle of the machine is insulated by means of a rod of glass. The rubbers are covered with Bunsen's amalgam and the electricity when generated is taken from the plate by sharp points and conveyed to the above mentioned bath.

It is wonderful what an enormous amount of electricity can be obtained from this machine. A few revolutions of the wheel will cause a spark eight or ten inches long to fly off, and this length can be greatly increased by withdrawing the spark catcher, and pushing in the point from which the discaarge takes place. The peculiar odor which attends the generation of electricity is perceptible in all parts of the room, and persons are affected while standing several feet from the machine. On that evening—and the condition of the room, atmosphere, and other surroundings were not what they should have been for a perfect exhibition of the machine—a spark ten inches long was drawn twenty-one and a-half inches from the machine.

Among the different experiments shown by Professor Brocklesby, that evening, were, first, the charging and discharging of Leyden jars, around the interior of which bits of tin foil, diamond shaped were placed. The electricity would run from one to the other, filling the jar with rows of light. Another jar was lined with gold-leaf, and surrounded by brass filings. The electric fluid would run through this in lightning like streams. Tubes and globes similarly arranged were also shown. Then he showed the effect of electricity passing through vacuum. A hollow cylinder of glass, some five feet in length, was exhausted of air, and connected with the machine, the electricity passing through in streams of a light violet color, resembling the "Northern Lights." Then the effect of electricity on different gases was shown by means of tubes filled with gases. When passing through that filled with nitrogen gas, a yellow light was seen in vertical streams alternately light and dark. In going through carbonic gas, a green light was obtained, while a pale halo seemed to surround the tube. Through hydrogen there was a continuous flow of blue and yellow light, but the prettiest experiment was when the machine was connected with a cylinder filled with a combination of gases. Inside this cylinder was an arrangement of glass coils. As the electric fluid passed through these it gave the appearance of a slender vase of brilliant green, filled with pink, olive, violet, and yellow flowers. Large Leyden jars were then filled, and by means of a discharging rod, the electricity was carried off, passing on its way through a piece of card board on to a chain and wire connecting with the ground. A small hole was pierced through the card. This discharge would be sufficient to knock a man senseless, if not to kill him. Other experiments were tried, shocks administered to those who wished, a jar broken—our reporters hair made to stand on end "like quills upon a fretful porcupine," and an opportunity given to all to see the "long spark." The exhibition was an exceedingly interesting one, and we wish that Professor Brocklesby could be induced to repeat it in a larger hall, where our citizens might have an opportunity of witnessing the workings of the machine.

Solar Heat as a Motive Power.

A short time since we briefly referred to the experiments of M. Mouchot, made with a view to utilize solar heat as motive power. He, in a contribution to the *Comptes Rendus*, thus speaks of some of their results:

According to my experiments, it is easy to collect, at a cheap rate, more than three-fifths of the solar heat arriving at the surface of the globe. The intensity of this calorific source, so feeble in appearance, was revealed by Pouillet, more than thirty years ago. At Paris, a surface of one square meter, normally exposed to the sun's rays, receives, at least, whatever may be the season, during the greater part of a fine day, ten heat units (calories) per minute. [The unit of heat adopted by most physicists is the quantity necessary to raise one pound of water from 0° to 1° C. We suppose M. Mouchot adopts the same standard.] To appreciate such an amount of heat, it is sufficient to observe that it will boil, in ten minutes, one liter of water, taken at the temperature of melting ice, and it is almost equal to the theoretical power of a one-horse steam engine. Under the same conditions, a superficies of one "are" (119·603 square yards) would receive, during ten hours of insolation, as much heat as results from the combustion of 120 kilogrammes (321,507 lbs. troy) of ordinary oil. These numbers are eloquent: they should, if not dispel, at least weaken the serious fears entertained by some, in consequence of the rapid exhaustion of coal mines, and the necessity of going to increasingly greater depths, disputing with the subterranean water this precious combustible. The intensity of the calorific radiation of the sun is, moreover, much less at Paris than in intertropical regions, or upon the elevated plains. It is, therefore, probable, that the invention of "sun-receivers" will, some day, enable industry to establish works in the desert, where the sky remains very clear for a long time, just as the hydraulic engines have enabled them to be established by the side of water courses.

Although I have not been able to operate under very favorable circumstances, since my experiments have only been made with the sun of Alençon, Tours, and Paris, I proved, as far back as 1861, the possibility of maintaining a hot-air engine in motion, with the help of the sun's rays. More lately I have succeeded in boiling, tolerably quickly several liters of water submitted to insolation. In short, having satisfied myself that it was sufficient to have a silver reflector, with a surface of one square meter, to vaporize, in a hundred minutes, one liter of water (0·88 quart), taken at the ordinary temperature, or, in other words, to produce seventeen liters of vapor a minute, I tried to work a small steam engine by solar heat, and my efforts were crowned with success in June, 1866. In the meantime I have been able, by very simple apparatus, to obtain some remarkable effects from insolation, such as the distillation of alcohol, the fusion of sulphur, perfect cooking of meat, bread, etc. None of these experiments, particularly the application of the sun's heat to machinery, have been tried upon a sufficiently large scale. It would, therefore, be useful to repeat them in tropical countries, with "sun-receivers" of suitable dimensions. We would measure the volume and the tension of steam produced in an hour by a given insolated surface, the pressure developed by the sun in a considerable mass of confined air, and the temperature which might be obtained by vast reflectors, formed of a framework of wood covered with plates of silver, etc.

Tea Culture in this Country.

A correspondent of the New York *Times* writing from Knoxville, Tenn., gives some information, additional to that published on page 215, current volume, SCIENTIFIC AMERICAN, in relation to the culture of the tea plant in this country. Writing on this subject the correspondent says, in relation to Capt. Campbell's experiments, that his experience shows that tea can be successfully cultivated in East Tennessee, the climate of which is about the same as that in the tea-bearing regions of China and Japan. Frosts come late in the fall and leave early in the spring, and the winters are short and not severe. The writer says:

The plant can easily be protected, and the experience of Mr. Campbell shows that it can be cultivated here without doubt. His farm is some ten miles southeast of this city, on the rich bottoms of the French Broad River, and well situated for a fair test of culture. The plant is a deep evergreen shrub, and attains, at its full development, a hight of five feet. It is strong and compact, and needs but little protection from the frost. It bears well; it has a beautiful flower which develops about October. The next season produces a seed something resembling a hazel, which grows readily. Mr. Campbell has not attempted its culture to any extent. His idea was to prove fully its adaptedness to this climate rather than to embark in any enterprise in its cultivation. He has for some years raised all the tea he needed for his own family, and he feels quite well satisfied with its taste and the yield. It has been pronounced by several gentlemen fully equal to "Young Hyson." That he should have satisfied himself so long since of the adaptedness of this plant to this climate, and that such conclusions have not long since become known, and the enterprise been fairly tested on a larger scale, is a matter of surprise to me. It is a fact of great importance, as it seems to me, and it might be well for the Agricultural Bureau at Washington to encourage other and more extended experiments. If we can raise our own tea and our own beet-root sugar, we shall be relieved from a heavy expenditure which yearly inures to the benefit of the Chinese and Japanese.

Galvanising Iron--Drawing off the Offensive Vapors.

The application of zinc with tin as a coating for iron, says *Van Nostrand's Engineering Magazine*, has become a most important manufacture in and about Birmingham. The application of iron for every purpose of construction is practically only limited by the difficulty of preserving the surface from rust. No method has yet been adopted which is at once so cheap, so effectual, and so enduring as galvanizing, and the works in which that process is carried on have very rapidly increased. To galvanize iron it is immersed for a certain period in an acid to cleanse the surface, after which it is dipped into a bath containing zinc and tin melted. In this salts of ammonia are thrown, which operate on the metal as a solvent, and enable it to be more evenly distributed over the surface. From this bath is given off a dense, pungent, white-colored vapor, which is heavy, and, especially in damp weather, spreads and becomes offensive. Complaints have been made of these vapors, and various plans have been adopted for the purpose of preventing them from passing into the atmosphere, but heretofore without success. The Wolverhampton Corrugated Iron Company have adopted a plan which is found very effectual. The top of the bath is surrounded by a flue which forms a projecting lip, and from this, run one or more iron pipes communicating with a powerful fan. From the fan a large flue extends to an annealing furnace. The fan, by creating a vacuum in the pipes, causes a strong current of air to pass over the surface of the bath, which drives the vapor into the furnace, where it is entirely consumed. Experiments are in progress to condense the vapors so as to utilize them, instead of consuming them in fires.

Casting Steel Under Pressure by use of Gunpowder.

Casting steel under high pressure by means of gunpowder, is thus described by the inventor: It is well known that cast-steel run into molds is subject to blister, and is otherwise porous, which defect reduces considerably its toughness. In order to give this metal its requisite tenacity it is subsequently reheated and then rolled or hammered. As many articles, such as cannon, cannot be treated in this manner, I have devised to submit them to a high pressure while in a liquid state, inclosed in their same molds, maintained in iron flasks. For this purpose, immediately after running a cannon, I cover hermetically the head by a metallic cap, by means of bolts or other devices attached to the flask. This cap is fitted in its center with a vertical pipe, and provided with a cock at its lower extremity, while its upper extremity is closed by a washer pressed by a bolt in such a manner as to act as a safety valve. Before attaching the cap, at, supposing, one inch from the surface of the liquid metal, I introduce in the vertical pipe, and between the cock and the washer, a charge of about one quarter of an ounce of a powder, prepared in the proportions of eighty parts of saltpeter and twenty parts of charcoal. On opening the cock this powder falls on the metal, ignites and engenders about one-third of a cubic foot of gas at 3,000° Fah. These gases exert on the liquid metal a pressure which is transmitted throughout the entire mass, thereby condensing the same and expelling the blisters. The effect thus produced is equivalent to the pressure of a head of liquid metal ninety feet high, admitting that the capacity between the cap and the surface of the metal contains thirty cubic inches. By making the flasks sufficiently strong, the charges of the powder may be varied, so as to produce by its ignition a uniform and general pressure, which is preferable to the partial, irregular, and momentary action of a hammer.—*Engineering Magazine.*

Louisiana Sugar and Sirup.

An esteemed correspondent of Plaquemine, La., Mr. Evan Skelly, has sent us a barrel of sirup of fine quality, and some samples of sugar, made with his sulphur apparatus, for which he will please accept our thanks. He writes us that "the sirup was made direct from cane juice in common open iron kettles from six degree juice, plant and stubble cane mixed, with the use of three and a-half pounds of sulphur to the hogshead, limed 64 cubic inches to the grand, four grands to the hogshead of 1,000 pounds, made about the 25th November, 1868, (rather late in the season) on the Pecan plantation, in the Parish of Iberville, worked by Mr. David N. Barron, with one of my sulphur apparatus. I send also samples of sugar made with the apparatus on various places, that you may judge for yourself of the practical working thereof. It is well established in New Orleans, that a greater quantity of inferior sugar has been made in Louisiana this year than in any previous year in proportion to the crop, caused from the fact that most of the cane ground was plant, and generally planted in fresh land."

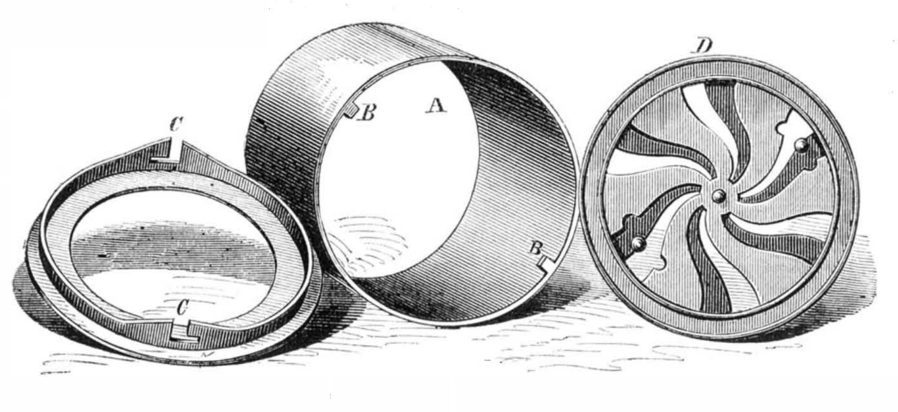
The quality of the samples sent is such as substantiate the efficiency of the apparatus. In the manufacture of neither the sugar nor sirup, he adds, no chemicals were used except sulphurous acid and lime.

THE sprouts of the potato contain an alkaloid termed by chemists *solanine*, which is very poisonous if taken into the system. This does not exist in the tubers, unless they are exposed to the light and air, which sometimes occurs from the accidental removal of the earth in cultivation.

Improvement in Thimbles and Ventilators for Funnel Flues.

Unsightly tin plates or guards to cover funnel holes of unnecessary size in the chimney are not very pleasant adjuncts to the arrangements of the kitchen, dining, or sitting room. A perfect fit of the stove funnel to the thimble or sleeve makes a neat appearance, whether the thimble is of tile clay, or of sheet or cast iron.

The engraving represents a method of making a neat fit to any size of pipe. A is the thimble or sleeve to be seated in masonry of the chimney. It has snugs, B, which engage with recesses, C, on the flange that is one of a set intended to fit each size of pipe or funnel down to four inches. The register, D, is to take the place of the flange or collar in summer, when the stove and pipe are removed. It is secured in the same way as the collar, by means of a projecting circular flange fitting the interior of the sleeve, A, and the snugs and recesses as seen. This device can be attached or detached instantly, and it makes a neat, safe, and handy contrivance.



LITTLE'S STOVE FUNNEL CAP AND VENTILATOR.

Patented, Nov, 3, 1868, by J. L. Little, who may be addressed for rights or for additional information at Atkinson, N. H.

PROGRESS OF THE VELOCIPEDE.

The interest in the velocipede continues unabated. A "Long Island rider" writes us a description of an improvement which strikes us as being novel at least. It is a device to enable velocipedestrians to use the ordinary horse-car tracks as a way for their machines. The attachment is a bar of iron or rather a rod about ⅝ of an inch in diameter with a small wheel at the end, remote from the velocipede proper, and having the other end attached to the "back-bone" of the machine. The small wheel bears on the opposite rail from the one in which the velocipede wheels run, and thus acts as a brace, and prevents running off the track. He says it has been tried with complete success; the machine being propelled with very little effort, and running up a grade with ease and rapidity. These attachments will soon be offered for sale.

The *Journal of the Telegraph* proposes that telegraph messengers be supplied with velocipedes for the more rapid delivery of messages. It says: "The messengers of a company perform a most important part of the telegraphic service. Their service demands a high degree of fidelity, sagacity, determination, beside the mere swiftness of foot necessary to perform their duty acceptably. But there is more practical skill and more persistant watchfulness needed to reduce the time which is even now expended between the reception of a message by the wire and its delivery into the hands of the party addressed, than in all the other parts of its progress. Anything which will reduce the time thus consumed, which will prevent the consumption of an hour or more to deliver a dispatch two miles from a central office which came a thousand miles over the wires in two minutes, must be hailed as an acquisition, and, if possible, made available.

"Well, 'we shall see what we shall see' by-and-by. We would like to see the experiment tried. Ponies were once tried in St. Louis, with what success we do not know. We want to see a good boy straddled across a velocipede and put on his honor and metal. We think there would be some quick time made."

An exhibition of a ladies' velocipede took place at Hanlon's Hall on Tenth St. on the evening of the 24th of March. It differs from the ordinary machine in having the perch lower, and in the arrangement of the spring, making it more convenient to mount and dismount. Instead of a saddle, there is a seat of wicker work neatly woven. The fore wheels are about thirty-two inches in diameter. Two of these machines were exhibited, ridden by two graceful young ladies, who drove the cranks with both feet, in the same manner as men. They were dressed in a very becoming costume of dark woolen stuff, their skirts being divided at the bottom, and buttoning around the ankles, not unlike the trowsers of a Zouave, and exposing the neatest foot and *Chaussure* that can be imagined. Their gloves were of the same hue as their dress; one wore ribbons and facings of blue and the other of pink.

They rode with much skill and elegance as well as strength, and, with the assistance of Mr. Pickering and Mr. Brady, went through with a number of intricate and pleasing figures, in the presence of a large number of ladies and gentlemen, who loudly testified their applause. We have no doubt that this velocipede will come into extensive use among the ladies, who will find it an attractive means of healthful exercise, in halls set apart for the purpose.

A Utica correspondent writes us as follows: "Your velocipede readers may like to have a ready means of determining their speed. The following method is nearly accurate, not varying from the fact more than two feet two inches in a mile. Divide 336, by the diameter in inches of the driving wheel; the quotient will be the number of revolutions per minute, which will produce a speed of one mile an hour. 336·135245, will give the result more exactly, but 336 is near enough for all practical purposes.

"Thus with a 4-foot wheel, 7 revolutions a minute give a speed of a mile an hour, 70, of ten miles an hour."

A correspondent of Toronto who subscribes himself "Unfortunate" makes some good suggestions He says:

"I have been watching the velocipede notes in your valuable Journal for some time past in the hope of learning that one of these marvelous machines had been invented especially adapted for the infirm and crippled portion of the community, but up to the present time of writing I have discovered nothing suitable. The late war has caused the loss of many a leg and in this age of machinery, the number of maimed persons is increasing. To lighten the lot of this unfortunate class is surely worthy of some thought; many of your ingenious contributors will I am sure, be glad to turn their attention to it, from motives of humanity and not profit. The loss of a leg, replaced by never so shapely an artificial one, incapacitates a man from almost every employment by reason of the difficulty he experiences in moving about. I am aware that there is at present a machine with a crank in the axle used by persons whose pedal extremities have become paralyzed but the effort required for propulsion is very great. I would suggest the construction of a velocipede that could be worked jointly by one foot and one hand or by the hands alone, or the motion might be taken from the shoulder perpendicularly with advantage, the one foot being used for steering. I am not a mechanician and merely throw this out as a hint to any good Samaritan who will take the matter up.

We give herewith an engraving of a two-seated bicycle which will interest our readers. This machine, designed by H. P. Butler, of Cambridge, Mass., seems entirely practicable. The engraving shows the parts so clearly that a detailed description is unnecessary. We may add, however, that the back

seat is intended to be used either as a side saddle for ladies, as shown in the engraving, or an ordinary saddle for gentlemen, both riders assisting in the propulsion. The inventor also has in view the placing of two side saddles over the rear wheel, to accommodate two ladies, who could then assist in propelling the machine.

Several leading firms in Newark, N. J., heretofore engaged exclusively in the manufacture of elegant carriages, have begun the manufacture of velocipedes for New York firms, while other establishments are rapidly turning off the wheels and iron works to supply the trade in other cities.

An inventor in New Albany, Ind., is making a new locomotive apparatus. It consists of a pair of skates on the bicycle order, the wheels being five inches in diameter and three-fourths of an inch wide, fastened to wood, which are to be strapped to the feet. The wheels are made large and broad, in order that the wearer may have no difficulty in passing over rough pavements at a rapid rate.

We understand that the prices are gradually coming down at the halls of instruction, the result of the competition that has arisen. As a counter influence, however, upon the rates demanded, the increasing number of those desiring instruction still enables the proprietors of these places to make large profits

Remarkable Millstone Explosion.

A correspondent from Leesburg, Mississippi, writes us an account of a remarkable explosion which occurred, March 2d, in an adjoining county under somewhat mysterious circum stances.

The millstone was a patent French burr of about 30 inches diameter, considerably worn, having been run for years. The burrs were encased in cast-iron beds and were driven by steam power. The mill had not been in operation more than ten minutes before the fatal accident occurred. The miller was regulating the mill, and finding that it was running too slow, he ordered the engineer to give it more speed; but before the order was complied with, the explosion took place with terrible effect, scattering the fragments of stone in every direction, killing the miller instantly, and wounding five other hands employed about the mill. The report of the explosion was heard at a distance of four miles.

We are requested to give our opinion of the cause of this explosion, which can be accounted for in no other way than either the accidental or malicious introduction of some explosive compound into the grain, which was exploded by the friction of the stones. The loud explosion points clearly to this conclusion, and as it is by no means probable that anything of the kind could have been the result of accident, an effort ought to be made to discover whether or not it was the work of some malicious fiend, in human shape, instigated by motives of revenge, or otherwise.

OBITUARY--LUTHER ATWOOD.

Among the scientific men of this country, and in connection with some of our most important discoveries in the department of natural wealth, the name which heads this article deserves to be perpetuated. The history of the manufacture of coal oils could hardly be written without frequent reference to the labors and inventions of Luther Atwood; and, indeed, in the manipulation of the hydro-carbons, there is no one who has performed such signal service, both to science and the arts, as he

Luther Atwood was born at Bristol, N. H., November 7, 1826, and remained in his native town until 1849. He received only such education as could be gained at the town school and a neighboring academy; but, having evident predilections for the acquirement of knowledge, commenced the study of medicine with Dr. Sawyer, of Bristol, when quite a lad. He, however, soon found that the bent of his desires and capacity was in another direction, and accordingly abandoned medicine for chemistry, to which science he devoted his entire life. He was a natural chemist; and component parts, under his manipulation, seemed to assume their proper correlation, almost by magic. His studies were now prosecuted under great difficulties, and in the face of many obstacles, and in 1849 he removed to Boston to avail himself of the advantages of a wider sphere.

There Mr. Atwood entered upon the manufacture of medicinal chemicals for Messrs. Philbrick & Trafton. The following year he commenced the series of original labors to which his life was to be devoted, by instituting some investigations into the nature of the products of coal tar, as well as the manufacture of benzole and naphtha therefrom. In 1853 Mr. Atwood obtained his first patent, being for a "process of preparing para-naphthaline oil from the distillate of coal tar, collecting the products at certain fixed temperatures;" the product being designated as "coup oil." At about the same time he obtained a patent for the use of manganate of potash for purifying alcohol, the alcohol purified by this process, being known in trade as "Atwood alcohol."

During the following year Mr. Atwood, associated with his brother, William Atwood, now superintendent of the Portland Kerosene Oil Company, and president of the Atwood Lead Company, of the same city, commenced experiments in the manufacture of oil from coal and bituminous products, and these investigations he pursued until his failing health incapacitated him from all mental labor. During the ten years between 1853 and 1864, Mr. Atwood took out no less than thirteen patents, nearly all of which related to distillation, and the manipulation of hydro-carbons. One of his most important discoveries was the process known as "cracking," by which a heavy oil is changed to a lighter grade. Another was the process of distilling coal in a tower, known as the "meerschaum" or "pipe" process. Indeed, the high standard of purity which has been reached by the oils, known under the trade mark of "kerosene," is owing in a very large degree to the original, scientific far-sightedness, and laborious efforts of Luther Atwood. Mr. Atwood was at one time superintendent of the New York Kerosene Oil Company's works at Hunter's Point, and within a few years of his death occupied a similar position in the works at Maysville, Ky. He died of consumption, at Cape Elizabeth, Me., November 5, 1868, after a lingering illness.

A SUCCESSFUL INVENTOR.—Nothing in the line of our professional duties gives us more pleasure than to hear of the success of inventors, and under this head publish the following from John W Case, of Worthington, Ohio:

From the patent you took out for me one year ago this March, I have realized about $10,000, and all of this I owe to the SCIENTIFIC AMERICAN. I have always been of an inventive turn of mind, and have originated a great many things, but have always neglected to patent them, owing to the cost and the necessary neglect of my other business, but on subscribing for your paper, I was induced by reading it to apply for a patent. Therefore I am truly indebted to the SCIENTIFIC AMERICAN for my success during the past year.

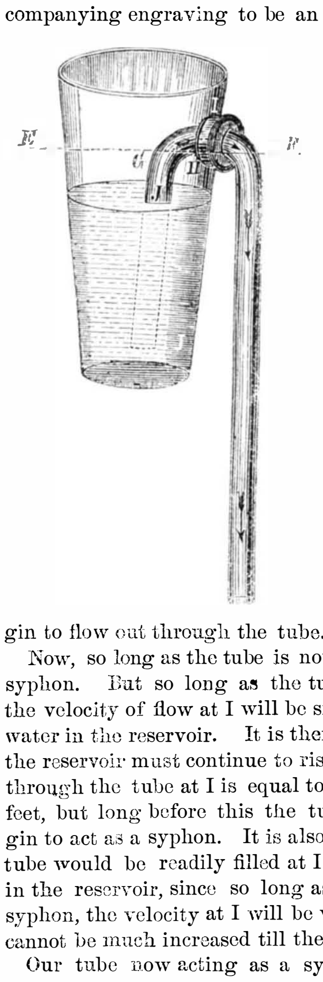
A PROLIFIC INVENTOR FROM TEXAS.—Mr. F. C. Richers, of Gilmer, Upshur county, Texas, arrived at the office of this paper a few days ago, with no less than sixty-two new inventions, on which he is making applications for letters patent. His subjects are quite varied, comprising improvements in nearly every department of mechanical and chemical science, from a steam engine and coffee mill to a process for roofing material, and mode of extracting saccharine juices from cane. All of the inventions exhibit a large degree of ingenuity, and many of them possess very much merit. Mr. Richers will remain in this city several weeks, and parties desirous of engaging in the manufacture or sale of good patented articles, can address him at Box 773 P. O., N. Y.

Correspondence.

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

Intermittent Springs---Silliman All Right.

MESSRS. EDITORS:—Your last number (March 27) contains an article, attempting to demonstrate that the generally received explanation of the working of intermittent springs is either insufficient or absurd. I think it can be shown to be adequate. Without stopping to discuss well-known general principles with regard to the syphon, let us at once take an example to illustrate the case. Suppose the vessel in the accompanying engraving to be an open reservoir receiving a constant supply of water. For simplicity, let the amount of water received each minute be the quantity which would flow through a two-inch pipe in that time under a pressure of ten feet head. Now let a syphon communicate with the reservoir as in the figure, and let its diameter be two inches or less, and then let us consider what results will follow.



Suppose first the water to be at the level, J, in the reservoir, and the syphon to be empty. As the water rises in the reservoir it will also rise correspondingly in the short leg of the syphon, and when it has reached the level of the bend it will begin to flow out through the tube.

Now, so long as the tube is not full at I it will not act as a syphon. But so long as the tube does not act as a syphon, the velocity of flow at I will be simply that due to the rising water in the reservoir. It is then evident that the water in the reservoir must continue to rise till the velocity of the flow through the tube at I is equal to that due to a head of ten feet, but long before this the tube will be full, and will begin to act as a syphon. It is also evident that a much larger tube would be readily filled at I by the action of the water in the reservoir, since so long as the tube does not act as a syphon, the velocity at I will be very small, and this velocity cannot be much increased till the tube is full.

Our tube now acting as a syphon, let us note what will happen. And first, we will suppose the syphon to be two inches in diameter, and the lower end of it to be ten feet below the point, I. When it begins to act as a syphon, the velocity of flow through it will be just the velocity due to a head of ten feet, and the water will therefore be drawn from the reservoir, at exactly the same rate as it is received by the reservoir, and hence the flow will be continuous. The same effect would evidently be produced if the same sized syphon were any shorter, since the water would rise in the reservoir above the point, I, till the velocity of discharge became equal to the velocity of influx. If, however, the syphon extends to a lower point, say to twenty feet below the point, I, the water will at first flow through the tube with a velocity due to a head of twenty feet, thus discharging from the reservoir much more rapidly than the water is received there, and reducing the level of the water to J, when the flow will cease, to begin again when the water rises to I, thus giving an intermittent syphon. It is easily seen that a tube smaller than two inches diameter would produce the same effect of extending to a sufficiently low level, or a larger tube of even less length than ten feet, the *capacity* of a syphon for emptying a reservoir depending on the comparative level of the water in the reservoir and the lower opening of the syphon, as well as on its size, a fact entirely overlooked by the previous writer.

There are thus many supposable circumstances under which intermittent springs might be produced by the action of a syphon. That these circumstances are not difficult to realize, is shown by the fact that in a hasty experiment made by myself on reading the article mentioned, the second trial adjusted the flow of water from a faucet into the reservoir so as to produce a complete intermitting syphon.

There is also no difficulty in supposing sufficient air to be admitted to a subterranean chamber, if we consider the extremely small quantity which could escape at each break in the flow. The moment that any air is admitted from the reservoir into the tube, the water in the short leg being relieved from pressure instantly flows back into the reservoir and the opening is closed. If the air in the reservoir is now prevented from escaping readily by other channels, it will simply act like the air in the chamber of a hydraulic ram, contracting and expanding with the rise and fall of the water, and sufficient air coming in with the water, or from any minute openings, when the air in the chamber is rarefied, to supply the waste, since, of course, if no air whatever be admitted to the chamber, the flow will finally become constant.

STUDENT.

New Haven, Conn.

[Before replying to our correspondent, we desire to say a word in regard to the practical value of this discussion. In no department of physics are there more points of subtle nicety than in hydraulics. Failure to take into account these nice points is the cause of frequent failures in hydraulic engineering. Many devices have been attempted having for their basis self-acting syphons, and many have been misled on precisely the point in question by the assumption that a syphon will commence to act as a syphon as soon as the fluid in the reservoir rises to the top of the bend, I. The fact is, that no syphon, so large that the flow is uninfluenced by capillarity, will so operate. We can recall many instances where inventors have been misled by the precise words of the text-book from which we quoted in our former article upon the subject, viz.: "*This cavity is gradually filled, until, at last, the water reaches the level, B, B* (see Fig. 1 in the article referred to), *when the syphon is filled, and the water escapes.*" Now, we assert that the water rising in the way described will not have filled the syphon until the level has risen to a point *above* I, a fact shown very clearly in our correspondents' communication.

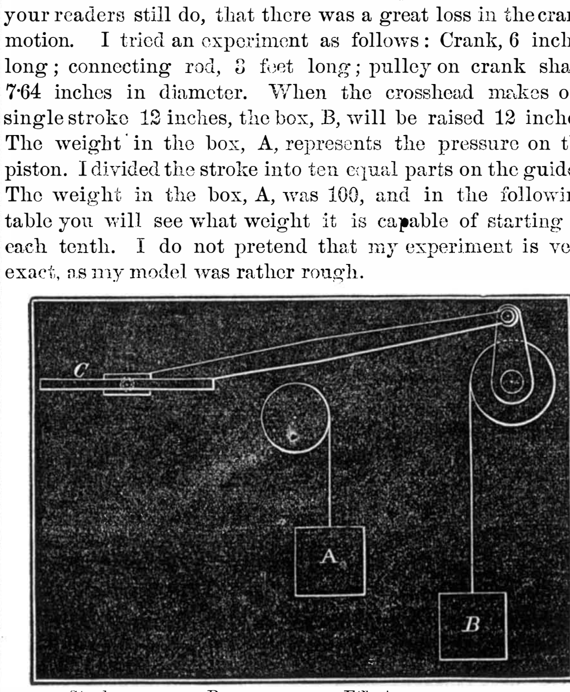
In reply to his statements, we say, first, that we have not claimed that an intermittent fountain cannot be made by the proper adjustment of supply to the capacity of a syphon. A constant supply, operating as he describes, would produce such a fountain, but his description of its action does not coincide with that of the books, as he assumes that the water would rise higher than the level, I, while they say the syphon will be filled when the level is raised to that point, a statement which, as we have shown, is only true of syphons possessing a sufficient amount of capillarity. Had our correspondent, in his experiment—which he states succeeded in the second attempt—observed the position of the level (presuming that the syphon used was not a capillary tube), he would have seen that the level previous to its fall by the action of the syphon rose some distance above I, thus confirming his reasoning. This reasoning is not identical with that of the books; but though written to controvert our proposition, exactly confirms it. Instead of overlooking the fact that the capacity of a syphon varies with the relative lengths of the columns in the longer and shorter legs, it was taken fully into account.

Now, if the circumstances of higher level than I, capillarity, and proper adjustment of supply in the reservoir are essential to the theory of intermittent springs, we submit that their omission renders that theory "*insufficient.*" If they are not essential to the theory, and therefore to be disregarded, we reassert that the theory is "*absurd,*" for, in the absence of these conditions, there will be no intermission of flow.

Assuming that they were considered unessential because not alluded to in the books, and because the general proposition that the syphon will be filled, when the level of the fluid in the reservoir reaches I, indicates that they must have been either overlooked or dismissed as unessential, we proceeded to state that the only condition that would make the theory of intermittent springs, as enunciated in the books, tenable, was capillarity. We added some hypotheses which would, in our opinion, account for intermittent springs, only one of which we deemed adequate to account for *all* the facts. It is quite possible we may, upon further reflection, discard that also, but of that more anon. The last part of the communication, pertaining to the inclosed volume of air, is equivalent to the hypothesis of a remittent supply, as the compression and subsequent rarefaction of the air in the chamber, reacting upon the columns of water entering the chamber, would produce a remitting action in their discharge. There are, however, objections to such a view, which those acquainted with the operation of air bulbs upon rams, pumps, etc., will readily discover.—EDS.

The Crank and its Powers.

MESSRS. EDITORS:—I at one time thought, as I see some of your readers still do, that there was a great loss in the crank motion. I tried an experiment as follows: Crank, 6 inches long; connecting rod, 3 feet long; pulley on crank shaft, 7·64 inches in diameter. When the crosshead makes one single stroke 12 inches, the box, B, will be raised 12 inches. The weight in the box, A, represents the pressure on the piston. I divided the stroke into ten equal parts on the guides. The weight in the box, A, was 100, and in the following table you will see what weight it is capable of starting at each tenth. I do not pretend that my experiment is very exact, as my model was rather rough.



Stroke.	Power.	Effects.	
0·1	100	55	
0·2	100	95	
0·3	100	115	
0·4	100	127	
0·5	100	133	(7·64 : 12 :: 100 : 155)
0·6	100	127	
0·7	100	115	
0·8	100	96	
0·9	100	76	
1·0	100	00	
	100	939	

Mean effect, 93·9 per cent

THOMAS PETHERICK, JR.

Easton, Pa.

NORTH CAROLINA makes more money from her peanut crop than from her cotton crop.

Cheap Gas.

MESSRS. EDITORS:—While the people of New York and its vicinity are loudly clamoring against the bad smell, poor quality, and high price of the gas supplied to them by irresponsible monopolies, it is my belief that all these evils will eventually be done away with, through a little sound legislation, and by the application of the co-operative system to the production of this necessity of our present civilization.

It has often been stated, but never proved, that a mode of cheapening gas would be to diminish its cost by saving the whole amount of freight on the coal used in its manufacture, and that this could be done by making it at the mouth of the coal pit and transmitting it, ready prepared, from thence to the centers of consumption.

Having been led accidentally to reflect on this matter, lately, after a conversation with some persons interested in our bituminous coal mines, I, from mere curiosity, have taken the trouble to investigate the practical feasibility or rather non-feasibility of such a project, and herewith forward you a summary of my calculations and deductions, which may, perhaps, interest some of your readers.

The cities of New York, Brooklyn, Jersey, Williamsburgh, Hoboken, and the whole neighborhood, as far as Newark and Elizabeth, consume annually about 500,000 tuns of coal for the production of 5,000,000,000 cubic feet of gas. The freight on this coal amounts to not less than $3,000,000 annually.

If gas could be made at the collieries and conveyed safely from thence to the metropolis in tight, well-laid pipes, the whole of these $3,000,000 would necessarily be economized. Obstacles, however, of a formidable nature stand in the way of such a desirable result, as we shall now attempt to show. Starting from a supposition that the nearest gas-coal colliery is situated at 200 miles, and is 600 feet above our level, and that the gas is admitted into the mains under a pressure of ten inches of water through mains 50 inches in diameter we find, by Hughes' formula, $A = D^2\sqrt{(HD \div LG)}$, in which $D =$ diameter of the main in inches (50 inches); $H =$ the pressure of water in inches (10 inches); $L =$ the length of the main in yards (352,000); $G =$ density of gas (supposed to be 0·42), that $A = 2{,}500\sqrt{0{\cdot}0034} = 145$, which, multiplied by 1350, Pole's coefficient, gives us 195,750 cubic feet delivered per hour. The pressure here would be 0·36 lb. per square inch of area.

The loss of pressure by passing through mains is, by d'Harcourt's formula, $LQ^2 \div D^5 \times 0{\cdot}611$, in which Q is the quantity of gas passing per hour, L the length of the main in yards, and D the diameter of the same. In our case we find it to be equal to 26,470,399 inches of water, or 13,485 inches per square inch of area of a 50-inch main. This multiplied by 0·036 lbs. the weight of an inch of water, indicates a loss of pressure of 485·38 lbs. per square inch, to which must be added the above 0·36 (or ten inches water), making a total of 485·74 lbs. of pressure needed per square inch of area at the initial point.

As the gas-works are supposed to be situated 600 feet above our level, we have another correction of $\frac{1}{100}$ of an inch of water to make for every foot of descent which adds another 6 lbs. per square inch to the above, and gives a grand total of 491·74 lbs. per square inch, equivalent to a pressure of more than 1,360 feet of water, the realization of which, practically, would amount to an impossibility or very nearly so.

Under such a pressure, could it be effected, no doubt can be entertained that, even with our modern improvements injoining pipes, etc., more than 50 per cent of the whole of the gas would be lost by leakage on the way, so that in reality not more than 95,875 cubic feet per hour would reach the consumers at the end of the 200 miles of mains.

To supply New York and vicinity would require sixteen such 50-inch mains as the above. Iron pipes of good quality, one-half inch thick, would support the pressure, and their weight would be, by the formula, $K = (D^2 - d^2)$, in which $K = 2{\cdot}45$; $D =$ external diameter of pipe in inches; $d =$ internal diameter in inches; 247·45 lbs. per running foot, or 116,678 tuns for 200 miles. Sixteen such mains would weigh 1,866,848 tuns, and at $45 per tun would cost $84,008,160. Adding to this the cost of transportation, the laying and joining of the mains, the hydraulic appliances, gasometers, etc.; we arrive in round numbers at $100,000,000, which would be needed to carry out a project of lighting New York and vicinity with gas manufactured in the coal regions, at a distance of 200 miles.

We do not believe that the above figures, exhibiting conditions of pressure, leakage, and cost of construction, are of such a nature as will induce capitalists, gas companies, or the public in general, to invest in any wild scheme, which might at any time be brought to their notice, having for its object the removal of the gas works from New York city to the Pennsylvania coal basin. Any such attempt must result in failure even supposing all our calculations to be twice too high.

X. Y. Z.

Laying Out Gear Teeth.

MESSRS. EDITORS.—I inclose for publication, a few words of criticism on an article which appeared in your valuable paper, the SCIENTIFIC AMERICAN, for March 13th.

The article signed "J. C." is upon the subject of gear teeth, and I think it will do harm rather than good unless righted. In the first paragraph he says, "Why are the teeth of wheels made on a curve, is a question which, if propounded to a majority of mechanics, who have almost daily experience on the subject, would not elicit a satisfactory explanation." The strength of this remark, it appears to me, is no better exemplified than in some of the statements of the very article in question. For example, it is stated that "the curve forming the point (face) of the tooth of one wheel will be a curve for the root (flank) of the other." Also "the curves *thus* formed are the epicycloidal, the proper mathematical curve for the teeth of gearing." If the writer of the article were familiar with such good authority as "Appleton's Dictionary of

Mechanics," the "Practical Draughtsman," and especially with "Willis' Principles of Mechanism," he would probably have said, that when the generating circles are the pitch circles themselves, the teeth of one wheel only could be formed with the epicycloidal curves, and that the teeth of the other must be mere round points; or, if the points of the one wheel be enlarged to cylindrical pins, parallel to the axes of the gears, the teeth of the other must be formed with curves, which are drawn at a distance from the epicycloidal curves throughout, equal to the radius of the pins, as shown in "Appleton's Dictionary of Mechanics," Vol. I, p. 828, and also "Appleton's Encylopedia of Drawing," p. 169, and that the epicycloidal curves *thus* formed are *not* the proper curves for the teeth of gearing as ordinarily properly constructed. Also, if he had said that the circle rolling upon A, generating the curve for the face of each tooth of A, should have half the diameter of B, and *vice versa* for the opposite wheels, and then instead of using the same curves for the flanks, he had recommended radial flanks, as far as the teeth of the other wheel have bearing upon them, he would have approached more nearly to the modern practice of correct mechanics. The method of thus constructing teeth is also illustrated in "Appleton's Dictionary of Mechanics," Vol. I, p. 830, and in the "Practical Draughtsman," and numerous other works.

He further says that "the epicycloidal curve is not invariably given to the teeth of wheels *because* it is peculiar to the diameter of the wheels for which it is constructed, and admits of a limited range in case the teeth are wanted to be used for other diameters than that for which they were made." But it is shown in "Appleton's Dictionary of Mechanics," Vol. 1, p. 825, in "Willis' Principles of Mechanism," p. 107, and in Rankine's Applied Mechanics," p. 444, how a *single circle of fixed diameter* may be rolled on the outside and inside of a pitch circle of any diameter, to generate the epicycloidal and hypocycloidal curves which shall form the outlines or faces and flanks of the teeth for those pitch circles respectively, giving a great number of wheels of various diameters, any two of which will work truly together. A number of wheels of different diameters thus constructed is called a set, or the wheels are said to belong to the same set. Mr. "J. C." gives favor to an old millwright's rule for shaping teeth and cogs, a rule which has been condemned, for failing in accuracy, for twenty-five years or more. This rule, however, is better than none at all, but why use that where we have a so much better approximate method as that presented in Prof. Willis' "Odontograph?"

To those who desire to become experts in the construction of correct gear teeth, I would recommend a careful perusal of the subject, as given in Prof. Willis' immensely valuable work, already referred to, or as found in Appleton's dictionary, also already cited above, in which the subject of gearing, for the most part, represents a recast from Prof. Willis' work.

S. W. Robinson.

University of Michigan, Ann Arbor, Mich.

Messrs. Editors:—Will "J. C." please explain a few lines of his article on "Gearing," page 165? The sentence commences with the words, "Proceeding to form the tooth," etc; "the curve found." What curve? How found? "Opposite direction from point of bisection." What is meant by this? "With the proper radius." What radius is this? How found?

In his figure what is the meaning of the unlettered lines found touching the curve, E *i* and *d d'*?

In forming the teeth of two wheels of different diameters, is there any definite rule for determining the construction of the curve that forms the outline of the pinion tooth, or is the proper center for this curve determined solely by experience, as this center is sometimes taken at a point not upon the pitch line?

M. N. R.

A Proposition from a Prominent Engine Manufacturer.

Messrs. Editors:—Learning that the American Institute intends to hold a fair during the coming fall, I would make, through your columns, the following proposition, both to the Institute and manufacturers of engines and boilers:

I will contribute $1,000 toward defraying the expenses of a thorough test of steam boilers and engines, to be made under the direction of a committee of experts, to be appointed by the Institute, the test to be made at the next fair. I will send, at my own expense, for competition, one of my trunk engines of 40-horse power, and one of my safety boilers, my competitors also to erect their own engines and boilers of equal capacity.

The test to cover efficiency, economy of fuel, safety, and all other points that make up the practical value of boilers and engines for general use.

John B. Root.

95 and 97 Liberty street, New York.

On Non-Rotary Propulsion.

Messrs. Editors:—On page 165, current volume Scientific American, your correspondent, F. R. P., under heading, "Economy of the Short Stroke of Engines in Non-Rotary Propulsion," takes for granted that, as 75 lbs. pressure (over and above friction) applied at A, could not overcome resistance 10, at the circle B, it would, of necessity, cause resistance 70 at point C, to move to point D. Otherwise it would be obviously impossible, he says, for the engine to make its stroke. (I refer to diagram on page 165, so as to economize space in your valuable paper).

If there was no other alternative but for resistance at B to be overcome and carried to E, or resistance at C to be moved all the way to D, it would follow most assuredly that the power applied at A would be incapable of producing motion. But the power applied at A, instead of moving "all the way" to D may be supposed to move in the direction of D, which is quite another thing. Otherwise (stroke of engine being one foot, power 75 lbs., and resistance at C, being 70 lbs., distance from C to D, 8 feet, as given by your correspondent) we would have, power applied, $1 \times 75 = .75$, and effect produced, $8 \times 70 = 560$, that is, 75 would produce 560, which would be an actual creation of power.

Now, this would be, not only an extraordinary discovery, which would probably soon lead to the further discovery of that great desideratum, perpetual motion, or something akin to it, but it would be a discovery subverting the fundamental laws of mechanics, as well as the late discoveries concerning the correlation and conservation of forces.

Whether there is really any saving of power in the short stroke of engines, I am not prepared to say, but is not certainly *for the reasons* given by your correspondent.

R. Desbonne.

St. Louis, Mo.

Results from Expanding Steam---The Indicator.

Messrs. Editors:—In your isssue of March 17th there is a communication under the title of "Wonderful Results from Expanding Steam," criticising an indicator diagram, published in a certain pamphlet, which is so obviously the one circulated by the Wood & Mann Steam Engine Company, that a few words from us on the subject, perhaps, may not be inappropriate. That the card published in that circular is a literal and reasonable one, no engineer would doubt; that it is a good one—far above the average—no engineer competent to apply the test of the theoretical diagram can deny; but the increasing interest shown by manufacturers in the use of the indicator, and the importance of having its functions rightly understood, induce us to ask the favor of a little space to continue the discussion.

Let us state, in passing, that the card published in the Scientific American, is not exactly a reduced copy of the one in the circular; the characteristics which are enlarged upon in the article seem to be exaggerated in the engraving. Your correspondent is evidently familiar with the law governing the expansion of gases and the "Joule's equivalent;" that his experience is very limited in the practical working of those laws, as shown by the indicator is also evident, or he would not take upon himself to say "that such a card was never fairly taken from any steam engine." They who adopt the slashing style of criticism ought to thoroughly understand their subject.

The high terminal pressure to which he objects is, in ordinary working engines, the rule and not the exception. Only in first-class cut-off engines, and in those not always, does the line traced by the pencil of the indicator show a curve nearly approaching the theoretical. A Corliss engine, driving the Utica Cotton Mill, has been in constant use for seven years, during which time the valves have never been repaired. We have recently taken a card from this engine, which shows the actual expansion curve to be within three per cent of the theoretical.

If your correspondent will be at the pains to apply an indicator to any engine, except a Corliss, running in his immediate neighborhood, and subject the cards to his analysis, he will doubtless be surprised to find their terminal pressures show a still greater disregard of the law governing the "expansion of gases" than the one in the Wood & Mann circular. It will be proper here to state that the card referred to was taken some time ago from an engine, in which certain patent balanced valves were used, but their lack of tightness and excessive steam clearance was found to more than offset the advantage of balance. The one we now use is the slide valve, with the Corliss valve gear.

Your correspondent's method of judging the comparative performance of different engines by bringing them to a common standard is, doubtless, the correct one; but he errs in supposing the amount of steam used is measured by that admitted to the cylinder up to the point of cut-off—it is not the amount admitted, but the amount exhausted; it is the volume of steam in the cylinder at the opening of the exhaust valve which determines the quantity of heat required to do the work of the half-stroke of that engine. The item of "units of heat," lost in developing power may be disregarded, or rather only regarded generally along with other losses of which the indicator takes no note, such as leakage of piston and exhaust valve, condensation, the re-evaporation toward termination of stroke (which latter, especially in a slow-running condensing engine, goes far to produce the result in the expansion line, so startling to your correspondent), goes further than any cause perhaps, except leakage of steam valve, to which the editor alludes. The clearance in this engine, of which you also speak, is large, being four per cent of stroke. This affects the expansion line, but with proper management of exhaust valve and "compression curve," is not a fault. Your correspondent also alludes to the increasing pressure, which begins at one and one-half inches from termination of stroke, and reaches forty pounds at the end; this he evidently believes is due to lead on steam valve. It is, on the contrary, due to early closing of exhaust valve. The card as drawn in the Scientific American, really shows *a negative steam lead*, the steam valve not opening until the piston has moved some little distance on its forward stroke.

That the indicator shows with absolute accuracy the power and working condition of an engine, no intelligent engineer will claim, but in experienced and judicious hands its value is unquestionable, especially in testing the relative performance of various engines. We have found a simple and effective method of bringing engines to a standard, and testing them by their cards, to be the Regnault tables.

Howard Rogers.

Utica, N. Y.

Peat.

Messrs. Editors:—You are probably well advised of the great number of improvements that have, within about four years past, been patented, for treating peat for heating purposes, yet may not be as well informed as to the number of individuals and associations, who during that period have ventured their money and lost in trial to utilize this immeasurably extensive and highly valued product of nature, which is consequently much abused; while the entire fault lies with the too-confiding promoters for trusting to impractical theories, when a little investigation and a few almost inexpensive tests would have proved the fallacy of the system proposed.

As the season is nearly upon us when peat deposits can be worked, and as many parties will doubtless engage in the work, I am confident that you will gratify your army of readers by giving them a few useful hints and practical advice upon this important question for the manufacturing and home interests, as well as to the owners of peat lands, which information will come most legitimately from the Scientific American.

Wherever soil is exposed to constant water saturation, from springs, or by percolation, or intermittent overflow from a stream, pond, or lake, or from any two or more of such causes, the vegetation of such soil will be converted into peat; and all fibrous vegetable matters, whether grasses, mosses, leaves, twigs, plants, shrubs, roots, and even trees, in fact all woody matter which may become enveloped therein, will, in process of time be converted into that dark brown pulpy substance.

Surface depressions, particularly where underlaid by water leaving clays or rocks—even upon the sides and tops of elevated lands—and most meadow lands holding or overflowed by water without intermittent drying, accumulate peat by the annual decomposition of the vegetation growing on the spot, or which may become immersed within it.

Some deposits of grass and moss peat predominate in fiber throughout, and often for a few feet only from the surface. This description is inferior to the pulped or decomposed vegetation. It is manipulated with difficulty and almost impossible to condense from its extreme sponginess and the elasticity of fiber. Except in very rare cases, and then at very considerable depth, all peats are spongy and retain their porosity after being dried, whatever may be the means used therefor, in which condition it has little commercial value as fuel; hence the necessity to condense it, which in fact is imperative, and to do this some mechanical means must be used to knead and break up the cellular structure.

A bed of peat is often more or less impaired by earth washings, particularly around its borders. This is caused by the water shed from adjoining elevated lands, or by freshet overflows from a bordering or bordered stream. Such adulterations may permeate those carboniferous accumulations of ages, from first to last, and consequently impoverish the peat throughout. Such cases, however, are seldom. Sedimentary washings rarely extend beyond a few feet from the escapement of the ground furnishing them.

This earthy matter is the chief cause of difference in the heating values of peat, and it will always be found admixed with the ashes, causing this residue to vary from two to fifty per cent of the original weight, beyond which it is difficult of combustion. Of course the less ash the better peat.

The color of peat when dry is no indication of its quality, whether it be light or dark brown, or even jet black.

Pine, fir, cedar, juniper, and cypress, furnish peat of more combustible nature than less resinous plants. Its commercial or heating value therefore differs considerably according to the nature of the original vegetation.

Peat consequently being the product of vegetable fiber or woody matter, decomposed and concentrated by chemical disintegration without the loss of an atom of the calorific power, it follows that in a condensed state it should have great heating properties.

The first step to be taken is to determine the quality of your peat. To do this, take a few pounds of peat from any convenient depth, and at proper distances from the border to escape the earth washings, if in such a locality, and where the peat is as free as possible from fiber. Dry the peat thoroughly in the air; then pulverize a portion, from which carefully weigh an ounce, say 480 grains, which place on a hot fire—coals are best—in a shallow vessel, covering the vessel loosely to exclude the air. A drip saucer to a common three-inch earthen flower-pot is a good vessel for the purpose.

As most air-dried unmanipulated peat contains about one-fourth its weight in moisture, this will pass off around the edges of the cover as vapor, and be succeeded by gas, which, ignited with a flame, yields a blueish, reddish, or bright flame, according to the character of the peat, the gas being hydrogen and carbon combined in different proportions. When the gas has ceased flowing remove the vessel with the cover still on and allow it to cool, after which weigh the charcoal with care—at the druggist's or doctor's if you have not the means to do so—being careful to note the weight in grains.

Having noted the time that the gas continued to burn, and as near as you can the color, write that down also, and next replace the charcoal on the fire but without the cover. The charcoal spread evenly over the vessel will soon ignite, and by absorbing oxygen from the air decompose and leave the ashes. This process may be slow but it must be thorough, requiring the mass to be occasionally stirred with some non-combustible article until all the sparks of coal have disappeared. Then remove carefully without losing any of the ashes and when cool weigh again. If the ash does not exceed twenty per cent of the weight you can proceed with further investigations, as the heating properties lie first in the gas, and secondly in the charcoal; the combustion of these two mediums determines the measure of calorific power. The weight of peat consumed being known by deducting the ashes and allowing for the moisture, gives directly that destroyed by combustion as the index of value.

For your next number I propose to furnish another paper upon harvesting and manipulating peat for heating use.

J. B. HYDE.

119 Broadway, New York.

Lamp Flames.

MESSRS. EDITORS:—If a lantern with a flat wick—the one noticed had the ordinary kerosene burner without chimney—is suspended by a cord and then rotated, the flame will assume a twisted shape like an auger, but strange to say the twist will go ahead of the wick instead of behind it; that is, if the lantern, as seen from above, rotates to the right, the twist of the flame will be left handed, instead of right as we would naturally suppose it should be considering the resistance of the air. Can your readers explain the cause?

R. F. H.

New York city.

Estimated Horse-power of Engines.

A correspondent, "Mathematician," of March 27, page 197, deprives the steam engine of its due, by deducting from its usually estimated power, what is required to propel the unprofitable part of its work, viz., the engine and gearing, before arriving at the work desired to be done.

The engine is entitled to credit for all the labor performed, useful or *useless*. "Mathematician" gives, as explaining his views, an engine of 30-horse power, making 75 revolutions when doing the intended work, but, when this work is detached, will make double the number of revolutions, "with the same amount and pressure of steam." Thence coming to the conclusion that twice the power, by the usual estimate, is developed, making the engine a 60-horse power when running empty, and a 30-horse when loaded, "which is absurd."

In the above example, the useful and *useless* work are considered equal, and the engine would, therefore, drive the *useless* alone, through double the space, and, of necessity, for the same amount of steam, under an expanded steam pressure of one-half the pressure on the combined work, which accords with the usual estimate, and *is rational*.

Pittsburg, Pa. T. W. B.

The Kindling-Wood Business---How it is Conducted.

There are at present in this city and Brooklyn about sixty wood-yards, where the business of sawing and splitting wood is carried on, and which furnish the inhabitants of the two cities with their kindling wood.

The largest quantity of the pine wood received here is furnished by the State of Virginia, particularly that portion of the State which is watered by the James and York Rivers. Delaware and Maryland send a large quota, but they are not so prolific in the production of pine as the first-named State.

The State of Georgia grows a great deal of pine wood, but it is not in as great demand, nor does it command the ready sale that the wood does that is raised in the States of Virginia and Maryland, as it contains too much pitch, which, when the wood is used for fuel, causes a very thick black smoke to arise from it, which blackens the housewife's culinary utensils, and clogs up the flues of the stove. Hence, for burning purposes, "Old Virginia" pine has the preference.

In some instances large dealers and speculators buy up large tracts of land covered with pine forests, and, after cutting it down, the wood is placed on board of schooners and brought to this city, where the consignees dispose of it to the smaller dealers. The heaviest shipments are made in the fall of the year, at which time it is no uncommon thing to see a fleet of fifty or sixty schooners laden with pine, anchored off the Jersey Flats, the headquarters for them on their arrival at this port.

A great deal of the wood, on its arrival at the yards, is cut up into kindling size, ranging from two and a half to eight and nine inches in length. The wood which is cut into pieces from two and a half to four inches in length, is tied up into small bundles, which are sold to the retail grocery dealers. The longer pieces are sold by the box, twelve of which boxes, when honestly filled, hold an ordinary load of wood.

There are some dealers who buy the wood already split at the yard, and peddle it about the city in their own wagons. Many of them have become so expert at the packing process that they manage to make half a load of split wood fill up twelve boxes, so as to deceive any one who does not take the trouble to examine the contents and to see how the wood is packed. These unprincipled dealers do not hesitate, when filling their boxes, to so arrange the sticks at the bottom that they form a kind of network, after which they fill up the box; and to those who are not up to the dodge they present the appearance of well-filled boxes, standing any amount of "shaking down." It therefore behooves those who buy their wood by the box from the peddlers, to stand by and see that the packages are honestly made up, otherwise they run the risk of being grossly swindled.

There are three ordinary loads in a cord of wood, and when wood is bought at the yard by the cord, as a great deal of it is, it is cut into as many lengths as desired, at a charge of $1·50 a cord, the number of lengths making no difference, as it is sawed by steam power; whereas the charge when sawed by hand, using a bucksaw, is $1·50 a load.

Boys from ten to fifteen years of age are employed at the yards to tie up the wood into bundles, for which they are paid twenty-five cents per 100 bundles. A smart boy can tie up on an average 600 a day, which enables him to make very fair wages.

A small machine is used which answers the double purpose of gaging the size of, and tightening the bundle. The machine consists of a rod of curved iron about a quarter of an inch in diameter, which extends above the bench, into which the pieces of wood are placed, and when this is filled, the boy places his foot on a lever below the bench, which is attached to the hoops encircling the wood, and by bearing his weight on it, causes the hoop to press the wood closely together.

There are about 800 bundles in a cord, and the present price per bundle, four cents when bought singly, foots up the snug little sum of $32 per cord. When bought at the yard by the cord the price ranges from $14 to $16. Poor people who are forced to buy their wood by the bundle are compelled to pay twice as much for it as the wealthy.

There is very little hard wood used for fuel, lighter wood being preferable, as it burns more readily. The hard wood is used principally for making mallets, wedges, etc.

Spring Diseases.

Reader! have you a mite, one solitary atom, of common sense? If you have, be persuaded to make a healthful use of it and commence on the instant. As soon as spring begins to set in, almost everybody has more or less a feeling of lassitude; there is less buoyancy, less of an appetite, less disposition to exercise; some are so indisposed that they have to keep in the house, and numbers take to their beds. All this is your own fault; it's because you have got no sense, not a particle; or, if you have, you do not make use of it. You can readily understand that now, as the weather is warmer, you do not require as much fire in the house; and may be you are wondering why the servants will persist in making the house hotter now than in the depth of winter; they are only burning as much fuel now as in mid-winter, and they have not the sense to know this, or at least they do not care to think. The human body is a house to be kept warm; and, to be in health, its heat must be maintained at the same temperature the year round—that is, about ninety-six degrees. The stomach is, in a sense, the furnace; the food put into it the fuel; the lungs set it on fire. Why, then, do you eat in warm weather as much as in cold weather? On a spring day, when scarcely any fire is needed in the house, you cram as much fuel into your stomach as in the depth of winter. You see now that you have not as much sense as Biddy; she is only trying to burn up your house, you are trying to burn yourself up with fever. A baby not three months old has too much sense to poke into its little finger into the candle twice, yet you are poking your whole gluttonous hulk, head foremost, every day into the furnace, and yet actually don't know what hurts you. You don't think; or, if you do, they are such diluted, milk-and-water "thinks," that a dime a load would be a bad bargain to the purchaser.

In adult life all the food we eat serves two purposes; it sustains and keeps warm. For the latter object meats, oils, butters, gravies, and sweets are used; hence, in warm weather, a comparatively small amount of these things should be eaten; but in their place take breads, fruits, vegetables, melons, and berries. Nature's instincts call loudly for the acids of berries and fruits, and for the earliest tender vegetables, the "greens" and the salads of our gardeners. It is because they have no heating qualities; they are rather "cooling" in their nature. They who spend much of their time indoors, would enjoy an exemption from a great many bodily discomforts if, upon the first day of spring, they would begin to have meat for only one meal in the day, and in lessening quantities as the summer comes on.

[The above from our excellent cotemporary, *Hall's Journal of Health*, we indorse as, in the main, timely advice. But would it not be better, Doctor, to qualify the advice, and recommend a reduction of animal food in accordance with the consumer's occupation. A man at the "anvil" certainly requires more hearty food than the merchant or professional man. And in recommending fruits and berries, we know many persons on whom the acid of these articles acts injuriously. Admitting this, would it not be well to recommend persons to watch the effect of fruits and berries upon their systems, and if flatulency exists after partaking, had they not better substitute oat meal or other light food which the stomach does not repel?—EDS.

Shiftlessness of an Artist---What Came of it.

An artist in *Harper's Monthly*, says: "In the spring of 1841 I was searching for a studio in which to set up my easel. My 'house-hunting' ended at the New York University, where I found what I wanted in one of the turrets of that stately edifice. When I had fixed my choice the janitor, who accompanied me in my examination of the rooms, threw open a door on the opposite side of the hall and invited me to enter. I found myself in what was evidently an artist's studio, but every object in it bore indubitable signs of unthrift and neglect. The statuettes, busts, and models of various kinds were covered with dust and cobwebs; dusty canvases were faced to the wall, and stumps of brushes and scraps of paper littered the floor. The only signs of industry consisted of a few masterly crayon drawings and little luscious studies of color pinned to the wall.

"'You will have an artist for your neighbor,' said the janitor, 'though he is not here much of late; he seems to be getting rather shiftless, he is wasting his time over some silly invention, a machine by which he expects to send messages from one place to another. He is a very good painter, and might do well if he would only stick to his business; but, Lord!' he added, with a sneer of contempt, 'the idea of telling by a little streak of lightning what a body is saying at the other end of it! His friends think he is crazy on the subject, and are trying to dissuade him from it, but he persists in it until he is almost ruined.'

"Judge of my astonishment when he informed me that the 'shiftless' individual, whose foolish waste of time so excited his commiseration, was none other than the President of the National Academy of Design—the most exalted position, in my youthful artistic fancy, it was possible for mortal to attain—S. F. B. Morse, since much better known as the inventor of the electric telegraph. But a little while after this his fame was flashing through the world, and the unbelievers who voted him insane were forced to confess that there was at least, 'method in his madness.'"

The "Wave" Time of the Electric Telegraph.

We have already published a full account of the interesting experiment of transmitting telegraphic signals to San Francisco and back; but the Boston *Traveler* adds the following official figures from the records at Harvard College: "It was proposed to begin with a comparatively short loop, extending from Cambridge to Buffalo and back, and then to extend the loops successively to Chicago, Omaha, Salt Lake, Virginia City, and finally to San Francisco. The plan was put into execution on the nights of February 28 and March 7, and in both instances the results were extremely successful. It was quite fascinating to stand before two instruments, a few inches apart, and to see and hear a signal made upon one repeated on the other in a fraction of a second, after having traversed a distance of over seven thousand miles.

"Below is given a table which shows the time, to hundredths of seconds, occupied by a signal passing from Cambridge to each of the stations and back. The numbers of repeaters in the circuits are also given:

"TIME OF TRANSMISSION FROM CAMBRIDGE.

	Seconds.	
To Buffalo and return	0·10	1 repeater.
To Chicago and return	0·20	3 "
To Omaha and return	0·33	5 "
To Salt Lake and return	0.54	9 "
To Virginia City and return	0·70	11 "
To San Francisco and return	0·74	13 "

"The actual time of transmission, from Cambridge to San Francisco and back, does not probably exceed three-tenths of a second; the 'armature times' of the thirteen repeaters in all probability amounting to four or five-tenths of a second."

Paint for the Protection of Metals from the Action of Sea Water.

A paint for the protection of iron and other metals from the detrimental influence of sea water, and the prevention of "fouling," has been invented, and is made in England as follows:

30 parts of quicksilver.
7 " thick turpentine.
55 " red lead.

These materials are mixed with as much boiled linseed oil as is necessary to make a paint of the proper consistency. The quicksilver must be thoroughly amalgamated with the thick turpentine by grinding or rubbing, and this mixture must be ground with the red lead and more boiled oil. A little oil as is necessary to make the paint "lay" well must be used. In damp weather, some fine ground manganese may be added. To make this paint adhere more firmly, a previous coat of oxide of iron paint may be applied. The use of the quicksilver, turpentine, and red lead are the special features claimed by the inventors.

AMMONIA AS A REMEDY FOR SNAKE BITES.—In the last volume of *Transactions of the Royal Society of Victoria*, published at Melbourne, there was an account of Dr. Halford's interesting researches into the nature of the change produced in the blood by the poison of snake bites. The doctor worked with the microscope, satisfied himself that there was a change, and described it, and has since had an opportunity of testing his theory and his antidote. A man working on a railway was bitten by a snake: ere long, drowsiness came on; medical assistance was obtained, but by the time it arrived, the man was comatose, and his lower extremities were paralyzed. Dr. Halford was then summoned by telegraph: he made an incision in a vein, inserted the point of a syringe, injected ammonia diluted with water; and the effect produced is described as "marvelous and immediate." The man became conscious, steadily recovered, and became quite well. Henceforth, let all people who live in districts infested by poisonous snakes, remember that ammonia injected into a vein is the remedy for a bite.

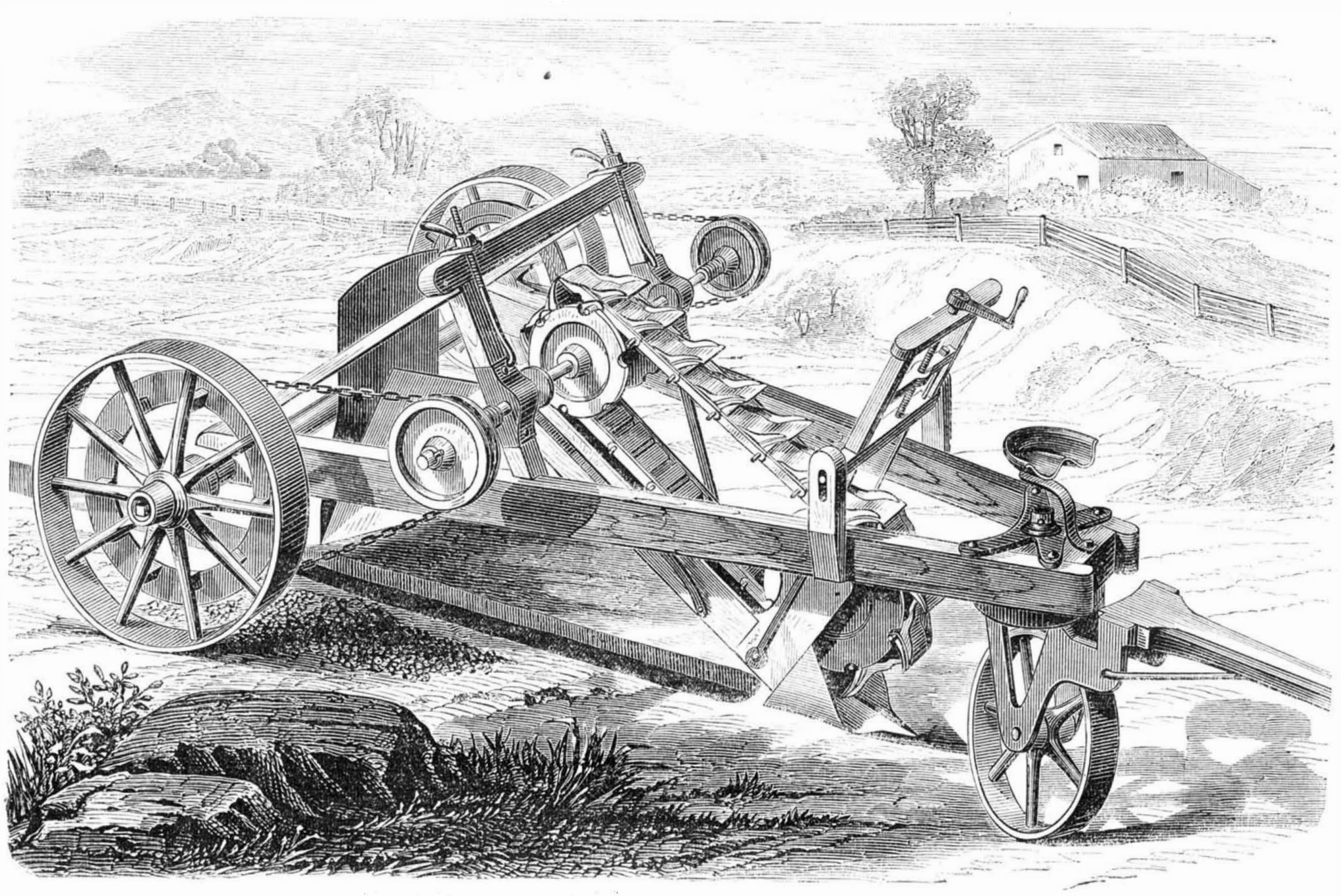
STRAW HOUSES.—An English inventor has built some houses on a novel principle at New Hampton. The houses are of a cheap order designed for laborers. He compresses straw into slabs, soaks them in a solution of flint, to render them fireproof, coats the two sides with a kind of cement or concrete; and of these slabs the cottages are built. By ingenious contrivances, the quantity of joiners' work is much reduced, and the chimney is so constructed as to secure warmth with the smallest consumption of fuel, and at the same time to heat a drying closet. The cost of a single cottage of this description, combining "all the requirements of health, decency, and comfort," is eighty-five pounds. The commissioners on the employment of children, young persons, and women in agriculture, report favorably of these cottages.

THE directors of the New York and New Haven Railroad have decided, as an experiment, to use wooden wheels on some of the cars upon their road. Quite a number of these wheels have been purchased, and will be substituted for the present iron ones on some of the new cars. They are understood to cost nearly treble the price of iron wheels, but are considered quite as cheap in the end. They are made of elm or teak wood, and bound with steel tires. Besides being less liable to break by the action of frost, they make less noise.

Improved Machinery for Excavating Ditches.

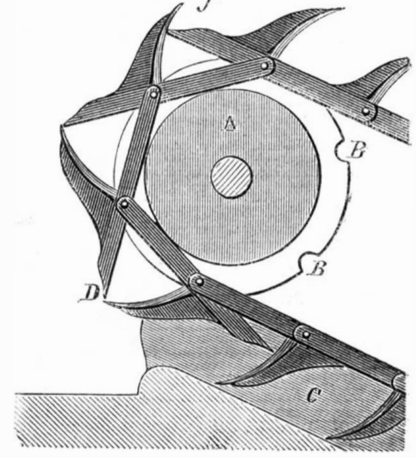
Draining the soil is an important process in agricultural operations and one demanding a large degree of hard labor, labor of the most arduous character; consequently the adaptation of machinery to ditching is very desirable; but most machines heretofore produced have been too costly and too cumbersome to come into general use. The machine shown in the accompanying engravings is intended to supply a want generally felt by farmers. It is comparatively light, easily worked, simple in its parts, and efficient.

It consists, first, of a horizontal triangular frame, the wide or rear end of which supports the main axle, carrying two



CONARROE'S BUCKEYE DITCHING MACHINE.

Fig. 2



broad faced driving wheels. The apex or front end of the frame has a guiding wheel, swiveled by a king bolt to turn in any direction. The main axle has secured on it, just inside the driving wheels, two chain wheels of somewhat smaller diameter, which, by means of chains, give motion to a cross shaft hung on a transverse frame rising from the frame near the rear. This shaft, by means of a suitable wheel at its center, impels an endless apron composed of a series of scrapers which, at the front end, pass over a similar wheel near the ground. Under this endless apron is an inclined trough, adapted in depth and width to the scrapers, and armed at the lower end with a pointed plow. The depth to which this plow is adjusted is governed by a screw seen directly back of the driver's seat. When not working, the plow may be raised entirely above the surface by this means. An examination of the large engraving will explain these parts without the necessity of letters of reference.

Fig. 2 gives the details of the scrapers. A is a section of the upper wheel over which the scrapers pass. These are pivoted together about midway of their length; the pivots projecting to engage with the semi-circular recesses, B, on the flanges of the wheels. These pivots operate, also, as fulcra on which the scrapers turn. As the scrapers travel up the inclined trough, C, bringing the earth with them, they successively turn on the wheel, as seen, their projecting back ends sweeping the face of the scraper next in the rear until they assume the position represented at D, when the earth is thrown out and falls on a V-shaped incline that deposits it on either side of the excavation. This incline and guard are represented in the large figure.

Patented, Nov. 19, 1867, by Robert Conarroe. A patent for recent improvements is now pending. For machines or other information, address Conarroe, Young, and Smyers, Hamilton, Ohio.

WRITE LEGIBLY AND INTELLIGENTLY.

The grand object of putting language on paper—of writing that others may read—is to give to the reader the ideas in the mind of the writer. This cannot be done if the writing is illegible. A large part of the annoyance of editors—those who attempt to give to the public the ideas of their correspondents through the organs (papers) they conduct—is occasioned by the neglect of their correspondents to write legibly. Not infrequently we receive articles containing *facts* that *should* see the light, and theories which should be brought to the notice of our thinkers; but they are frequently presented in such a garb that it is more than they are worth to pick out the grains of wheat from the ocean of chaff. Many of these communications have been laid quietly aside in our oblivion box, which if presented in any reasonable shape would have appeared in our columns. We do not allude only to valuable communications from those who have never had the advantage of a grammar school and do not understand the rules of orthography, but to those who have an idea on mechanical or scientific subjects but are themselves befogged and do not know how to present it, simply because they do not understand it.

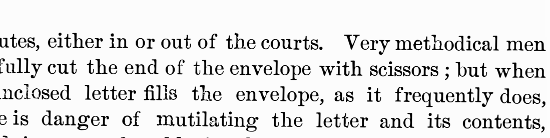
If one has an idea, he should thoroughly understand it himself before he attempts to impart it to others. If he cannot put it into grammatical or journalistic form, that is his misfortune, and on this paper, as least, will not prevent him from a hearing from the great public reached by the Scientific American; but if he does not, himself, understand what he attempts to write about, it is too much to require that the editors of the the paper should do the work which his incompetency prevents him from accomplishing. If correspondents of newspapers and magazines would consider, never so slightly, the labor they impose upon editors in sending illegible and incongruous articles intended for publication they would take some pains to prepare their articles for their insertion.

GROSS' PATENT COMBINED LETTER OPENER.

The ordinary methods of opening letter envelopes by means of an ivory paper cutter, a knife, or the handle of an eraser, is slouchy and in many cases destructive to the envelope, the preservation of which is sometimes very important in settling

Fig. 1

Fig. 2



disputes, either in or out of the courts. Very methodical men carefully cut the end of the envelope with scissors; but when the inclosed letter fills the envelope, as it frequently does, there is danger of mutilating the letter and its contents, which is not comfortable in the case of a dunning letter or one containing greenbacks. The engraving, however, shows two adaptations of a simple device intended for opening letter envelopes, and useful, also, for ripping seams in garments and similar purposes.

Fig. 1 is the device in the form of a watch key, and Fig. 2 the same, forming the head of an ordinary lead pencil. The device is very simple: it is merely a blade, like a diminutive pen-knife blade, held in a sheath or handle of metal, and so formed and pivoted that a light spiral spring, inside the sheath, keeps the blade inclosed until pressure is applied by the finger to the projecting head of the blade. This construction is plainly seen in Fig. 2. In Fig. 1 the manner of using it is exhibited. It forms an ornament to the watch guard or a neat head to the pencil, to which it is attached by a screw thread in the socket.

Patented by Henry Gross, Sept. 8, 1868. All orders should be addressed to Gross, Lysle, & Co., Tiffin, Ohio.

Two large steamers, each 246 feet long, have just been despatched from New York to China. They are to sail on the Yangtse river.

SMALL-POX AND VACCINATION.

The scourge of small-pox has, it is well known, visited the city of San Francisco during the past season with frightful severity. Fears have been expressed that it would, in spite of the precautions taken to prevent its spread, visit the large towns in the Atlantic States. In view of these facts we copy from the *Pacific Medical and Surgical Journal*, facts upon which the public should be posted at all times, and which are of special value upon a threatened invasion of this horible disease.

"Small-pox does not tend to spread extensively in a city or district, unless quickened by an epidemic influence. It may exist in a city constantly, from year to year, a few cases at a time, without displaying an active contagion.

"During an epidemic aggravation *recent vaccination is the only safeguard*. Persons who have had small-pox, or who have been exposed to it in former years with impunity, as nurses and the like, are not secure from attack.

"The duration of an epidemic is from six months to a year. The disease seldom progresses steadily, but fluctuates without relation to the sensible changes of climate. Winter is the season most favorable to its prevalence.

"During an epidemic of small-pox, other diseases are more frequent and more fatal.

"Foul emanations from sewers and so forth have little to do with it. They affect the general health, but do not promote in a marked degree the spread or duration of the epidemic.

"When the disease is not epidemic, the morbific germs emanating from a patient soon lose their vitality. But when an epidemic influence prevails, these germs resist decay and infect the entire atmosphere. They do not cause sickness unless the condition of the individual be favorable to their development. In an infected city, many persons—perhaps most of the inhabitants—receive them in the blood without injury.

"Disinfectants, such as chlorine, carbolic acid, the fumes of sulphur, etc., will not destroy the germs of small-pox, unless they are strong enough to destroy human life. Sunlight, air, and heat are the best disinfectants. Clothing is perfectly disinfected by baking in an oven, or exposure for a short time to a heat at or above that of boiling water.

"The period of most active contagion is after the appearance of the eruption and during the process of scabbing. It is questioned by some good authorities whether the disease is contagious at all prior to the formation of pustules.

"Vaccination will not take perfectly a second time in more than one or two out of every one hundred persons.

"It will take partially, with some resemblance to the genuine cow-pox, in twenty-five per cent of the cases. Here the presumption is that re-vaccination was useful.

"A large scar is no evidence of genuine vaccination, nor is a large and painful sore. A spurious pustule is apt to be worse than the genuine vaccina.

"When re-vaccination is not followed by itching, or any other effect, it should be repeated. The virus may not have been active.

"No other matter should be employed than the lymph or crust from the first vaccination of a healthy child; or that taken from the cow. There is less uncertainty in the former than the latter.

"The crust should never be kept long after mixing it with water. It develops a virulent poison.

"Evacuation of the pustules is advised not only to prevent pitting, but as possibly serviceable in lessening danger from secondary fever, and as a case in point it is stated thus: An entirely unexpected recovery of a very bad case, was effected by the patient opening of the pustules and wiping away of the matter by the wife of the patient, rapid improvement taking place at the time when the dreaded secondary fever should have set in."

India Rubber Liquid Blacking.—Take of ivory black, sixty pounds; molasses, forty-five pounds; gum-arabic dissolved in a sufficient quantity of hot water, one pound; vinegar, twenty gallons; sulphuric acid, twenty-four pounds; India rubber, dissolved by the aid of heat in nine pounds of rape seed oil, eighteen ounces; mix them well together. This blacking may be applied by means of a small sponge, attached to a piece of twisted wire, like the well-known Japan blacking.

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Contents:

(Illustrated articles are marked with an asterisk.)

*mproved Adjustable Jaw-Vise....225
On the Theory of the Luminosity of Flames....225
Explosive Compounds for Engineering Purposes....226
Utilization of High Falls of Water....226
Dr. Mallet's Opinion of the Heaton Process....226
The Electrical Machine at Trinity College....227
Solar Heat as a Motive Power....227
Tea Culture in this Country....227
Galvanizing Iron—Drawing off the Offensive Vapors....227
Casting Steel under Pressure by use of Gunpowder....227
Louisiana Sugar and Sirup....227
*Improvement in Thimbles and Ventilators for Funnel Flues....228
Velocipede Summary....228
Remarkable Millstone Explosion....228
Obituary—Luther Atwood....228
*Intermittent Springs—Silliman all Right....229
The Crank and its Powers....229
Cheap Gas....229
Laying out Gear Teeth....229
A Proposition from a Prominent Engine Manufacturer....230
On Non-Rotary Propulsion....230
Results from Expanding Steam—The Indicator....230
Peat....230
Lamp Flames....231
Estimated Horse-power of Engines....231
The Kindling-Wood Business—How it is Conducted....231
Spring Diseases....231
Shiftliness of an Artist—What came of it....231
The "Wave" Time of the Electric Telegraph....231
Paint for the Protection of Metals from the Action of Sea Water....231
*Improved Machinery for Excavating Ditches....232
Write Legibly and Intelligently....232
*Gross' Patent Combined Letter Opener....232
Small-Pox and Vaccination....232
The Natural Highways of Travel....233
The Scientist, Inventor, and Mechanic....233
The Preservation of Timber....233
Ventilation in Buildings....233
Taste and Smell—A New Theory....234
Beet Root Sugar....234
Editorial Summary....235
Manufacturing, Mining, and Railroad Items....235
Answers to Correspondents....235
Applications for the Extension of Patents....235
Recent American and Foreign Patents....236
New Publications....236
List of Patents....236
Inventions Patented in England by Americans....237

THE NATURAL HIGHWAYS OF TRAVEL.

While in other countries the artificial means of intercommunication are works undertaken, completed, owned, and managed by the government, our policy has been to leave these matters to private enterprise, or to the management of corporations chartered for the purpose; although where the work was a matter of national necessity, or advantage, appropriations in aid have been made from the public treasury, and privileges have been granted to the stockholders who raised the principal means and carried forward the work. In many cases this assistance is judicious, and whatever may be the opinion as to the extent to which corporations may be thus aided, it is certain that such work as is necessary to keep open and in order our natural highways, as navigable rivers, belongs properly to the national government.

The rivers and lakes that form our splendid system of natural intercommunication are, and should be, free to all, and no company or corporation, should be allowed to obstruct them for their own benefit. The right of locomotion, even if not laid down in any bill of rights, declarations of independence, or constitutions, is one as inalienable and unquestionable as that of breathing. Especially is this right necessary in a country like ours, of such vast territorial extent, of such diversified topography, varied climate, and difference of products. By cheap and unobstructed communications the sectional interests become national and the parts become a whole, exemplifying our national motto, *E Pluribus Unum.*

We, therefore, regard the obstruction of a navigable stream as a national rather than a sectional calamity, but a calamity nevertheless, whether viewed in a general or local sense. If the resources of engineering talent were exhausted, in carrying railways or common roads across navigable estuaries and rivers, only by means of short span bridges supported by frequent piers, or bridges of too low an elevation to admit the passage of vessels without raising or swinging a draw, there might be reason in thus obstructing natural highways for the benefit of artificial ways deemed to be more valuable. But where a single span of trestle work or arch is not feasible, the suspension system is practicable, in most cases; or if neither of these is advisable, or possible, a tunnel may be substituted. There are few localities where the tunnel may not be used. It may be built on shore, in sections, if required, and sunk to the bed of the river, or on piers laid for its support, of sufficient hight to level the inequalities of the river bottom.

The superior cheapness of water carriage, especially for heavy and bulky freight, should be sufficient inducement to preserve intact our navigable rivers, and to improve them by the removal of obstructions that accumulate by natural agencies, rather than to add to these obstructions by building piers in the water way to act as *nuclei* for the accumulation of silt and the formation of sand bars. That this is the effect of such structures no observing person can doubt. Above the pier the current deposits its load of sand, gravel, etc., making an elongated Λ-shaped shoal; and below, the cross currents, by their eddies, do the same thing, so that on either side, in time, there is deposited an island of an elongated lozenge form, its longer diameter extending many yards both up and down stream, the pier itself being the center. Such obstructions, if formed by nature, either in the channel or on its borders, would be deemed, as they are, obstructions, and demand removal. That they are the result of artifical erections does not remove the objection to their formation. It is certain that, from what cause soever these obstructions occur, they are inimical to navigation, and to means of intercommunication, and, therefore, unworthy of toleration. Our rivers should be free, as free from artificial obstacles as from legal exactions.

THE SCIENTIST, INVENTOR, AND MECHANIC.

Not seldom the functions of these three great departments of human knowledge and progress are merged into one, so far as general opinion may reach, while the fact is they may be as distinct as any separate departments in any one art. The scientist deals with the qualities of matter and the laws which govern them separately or in combination. He is, or should be, in close communion with Nature, a student in her school, and a progressionist into her mysteries. He grasps the bare crags of knowledge, climbs to their summits, or explores their caverns. He notes the substances with which Nature works and the methods and agents of her working. Sometimes from the knowledge thus gained he becomes, himself, an inventor, but usually his investigations are too absorbing for him to relax his efforts in this direction, and he is satisfied with the almost endless vistas that open to him as he clears away the rubbish left by previous explorers and surmounts the obstacles placed by Nature herself. It is a noble department of human endeavor, as its demands are large, its obstacles formidable, and its rewards glorious. Moreover its field, although patiently worked by his predecessors, is ample enough for the exercise of all the energy and determination of the scientific explorer. However many may have scoured the ground before him, there are points of interest they have never seen, and mines of wealth they have never discovered—only dreamed of. But even if the scientific explorer is content to traverse paths already worn bare by the feet of his predecessors, he will not infrequently find unnoticed flowers by the roadside and rejected gems in the dust of the way. He prepares the way, by his accumulations of facts and his series of theoretical suggestions, for the inventor, who asks only the opportunity and means to give a living form to the scientist's discoveries.

The inventor must have a practical mind, whether he has a practical knowledge of mechanics or not. The constructive faculty is absolutely necessary to the inventor. He takes the facts discovered by the scientist and gives them form, which the mere student never could have done. In his hands the crude or bare facts of scientific investigation, in connection with the experiments necessary to their development, assume form and may be brought forth into useful shapes to bless and assist toiling millions, instead of merely astonishing and entertaining gaping audiences. The curious experiment becomes under him the useful possibility; the discovery of the student becomes to him a suggestion of practical use; facts, or even possibilities, are to him living realities.

But it is the mechanic who elaborates the idea of the inventor. He it is who clothes it with a practical form, furnishes it with nerves of steel and muscles of iron, and endows it with life and motion. Without his skill the result of the scientist's search and of the inventor's thought would be comparatively valueless. Indeed, his skill is frequently the only means of making the inventor's idea useful. In short, the mechanic, who as the model maker elaborates the inventor's idea, is often the real inventor. The crude, unworkmanlike contrivance of the inventor, that in his unskillful hands is merely a travesty on a machine, is made to assume form, proportions, elegance, and efficiency. So valuable is mechanical skill to the perfection of an invention that it is not surprising that practical mechanics constitute the large proportion of inventors. But if valuable inventions are often made by unskilled persons, it is seldom they are successful until after they have passed through the hands of the mechanic; and sometimes the addition or alteration, made by the mechanic and modestly termed an improvement, is the element of the inventor's success.

THE PRESERVATION OF TIMBER.

Perhaps the solution of no modern engineering problem has been more earnestly sought than a cheap, reliable, and universally applicable method of preserving timber. Although methods have been devised which approximately fulfill these conditions, there has yet been nothing attained that is suitable for universal adoption in architecture and in other branches of the arts.

It would appear at first sight an easy matter to preserve wood from decay, when it is remembered that the chief causes of decomposition, at least the chief immediate causes, are changes in its hygrometric condition. Rapid successions of dampness and dryness will speedily destroy most species of timber. There are a few species which are naturally protected by essential oils contained in their texture, but such woods are too rare and valuable for general use.

The physical characters of different kinds of timber afford the clue to the difficulties in solving this problem. Wood is a porous material of great absorbent power upon nearly all kinds of liquids. Many kinds will absorb their own weight of water under favorable circumstances, and part with a large portion of it again when exposed to warm currents of air. To preserve such woods from decay implies the stoppage of the pores, by filling them with some impervious substance or the saturation of the timber with some antiseptic material.

No process based upon either of these principles has as yet been discovered not attended with some drawbacks. Either the process is expensive, or the texture and grain of the wood suffer change, or its natural beauty is marred so as to render it unfit for ornamental work. The latter consideration may be left out of the account, when wood is to be applied to the coarser purposes of engineering, as piles, railroad-ties, pavements, etc., but the item of expense tells more heavily in these cases than in ornamental work, where the cost of the material is a small item in the cost of the structure.

But natural decay is not the only destructive agent against which it is desirable to provide. One of the greatest objections against wood for building purposes is its liability to destruction by fire. Many processes have been devised to remedy this evil, and although a recent Italian process has been favorably spoken of as being free from the objections pertaining to processes of earlier date, it is quite probable that further news respecting it may not be so favorable.

So far as we are aware, no process has ever been discovered that could be very cheaply applied to both the preservation of wood from decay, and also from fire, and which at the same time could be relied upon as certain. The most simple and the cheapest method adopted, has been that of the application of fireproof paints; but paints are liable to crack upon exposure, and from the natural shrinking and springing of timber, and thus give access to moisture. This method has been only partially successful.

It is impossible to give here anything like a detailed notice of the various wood-preserving processes. A whole class of them is included in the impregnation method, in which different chemicals possessing antiseptic properties have been forced by pressure or absorption into the pores of the timber. Sulphate of zinc, sulphate of copper, corrosive sublimate, creosote, carbolic acid, coal tar, etc., have been employed, the three last with the best results yet attained, so far as preservation from natural decay is concerned. None of these processes have been without failures in some instances. So far as these failures relate to the creosoting of wood, they are doubtless due to the imperfections in the method of performing the work. Sulphate of copper has also been used quite successfully but is expensive. The use of coal tar products is the cheapest method yet devised, but it is obviously unadapted to use where a finish is to be given to wood. The smell of timber thus preserved is also an objection to the process. We see then that anything like a perfect process for preserving timber under exposure to high temperatures and variations in hygrometric condition is yet to be devised. It may be that it is impossible to invent any method that shall cover all the conditions of the problem. The rich reward, however, which most certainly awaits the fortunate discoverer of such a method, ought to stimulate experiments in this field and give the world something far ahead of anything yet proposed.

VENTILATION IN BUILDINGS.

The topic of ventilation has been discussed and re-discussed, and a library might be collected of books and lectures and reports of learned societies upon the subject; yet churches, theaters, school houses, and private houses, judging from universal complaints, still remain unventilated. We hear, indeed, from time to time, of success in the use of apparatus for ventilating capital buildings, or parliament houses, but when circumstances compel us (as they do occasionally) to visit some such place, we find but little to praise in this respect. We however moderate our disappointment when we reflect how very difficult it must be to keep a pure atmosphere in these places. For the most part buildings in which people congregate are ventilated about as well as a certain horse car, the unwonted brilliancy of whose lamps elicited some inquiry on the part of a curious passenger. The phenomenon was explained by the scientific conductor's pointing out some flues admitting fresh air from the outside to the small cells inclosing the lamps, in order, as he learnedly stated, that the foul air from the lungs of the passengers might not totally extinguish them.

The amount of learning displayed in discourses on ventilation would make even our scientific conductor open his eyes. Few indeed who have not given a lifetime to the study of this important subject, can be aware of the intimate relations existing between the geological periods and the scientific mode of getting bad air out of a room and replacing it with pure air. It would be still more preposterous to suppose that ordinary practical minds could be able to grasp this subject without being first well grounded in the cosmical theories of La Place, and the "Principia" of Newton. In short the subject embraces, if the harangues and discourses of Professor this or Doctor that are any index to its magnitude—all the knowledge as yet attained by mankind, with a very large proportion of what is yet unattained.

An English journal states that Dr. Edward Smith, F. R. S., read a paper on ventilation before the Society of Arts, on the evening of the 24th of February, in which he treated the subject *comprehensively without recommending any particular plan.* Treating the subject comprehensively is the mode. Of what use is it to descend to particulars when so much science can be displayed in generalities? Of what use is it to teach others if we fail to show that we ourselves are learned?

The fact is that the science of ventilation is small, the art is easy, and the learned discourses which have lately dragged their tedious lengths along in the *Journal of the Franklin Institute,* and have burdened the pages of many other scientific journals, as well as the patience of their readers, are called for no more than learned discussions upon the problem how to avoid cutting two holes in a back door to let out two cats, one being a large one and the other a small one.

We have many times urged the supreme folly of treating the subject in the ridiculous manner described, and have given rules, the simple observance of which will insure well ventilated apartments. To apply these rules requires common sense, mechanical skill in construction, and arithmetic; "only these and nothing more." It seems, however, that upon this as upon many other subjects upon which we write frequently, we must repeat our lessons often. There is no subject upon which we receive so many inquiries.

First, then, the fundamental law upon which ventilation is based is, that hot air rises and cold air descends. It follows if the pure air admitted to a room be heated by a furnace, the impure air which is cooler will settle to the bottom of the apartment, at which the registers for its escape ought to be placed. If the room be heated by radiation, as with steam apparatus, stoves, etc., and the pure air be admitted cold, the registers should be at the top of the room.

Second, good ventilation can not be secured by using long flues, unless mechanical appliances, as fans, etc., or apparatus for heating them are employed. The air gets cold before it passes through them, and consequently ceases to rise, or rises but slowly. The best thing for this purpose is an open grate at the bottom of the room having for its chimney the flue through which the foul air is desired to pass.

Third, strong winds over the unprotected external mouths of flues, are apt to reverse or obstruct currents. The mouth of every flue should be covered with a hood so adjusted that it can rotate with the wind. The winds blowing from any quarter will thus aid rather than impede the egress of air from them.

Fourth, they, as well well as the flues for the admission of pure air, should be made of a size proportionate to the requirements of each particular case. Here the arithmetic comes in, and the data are as follows:

The number of respirations in a healthy adult per minute, is from 14 to 18. The average amount of air taken into the lungs at each respiration is about twenty inches. From this air the oxygen is removed, and its place supplied with carbonic acid at the mean rate of ·0435. From these figures it is easy to calculate the rate at which fresh air must be admitted to supply the demand or (as admission of fresh air implies in any proper system of ventilation the removal of foul air) the rate at which the foul air ought to be removed. The size of the escape flues ought to be proportioned to the size of the room, and the number of people it is intended to contain, which can be easily done by any competent architect. To those who are not competent we say, err if you must on the safe side, make the hole large enough for the adult cat and the kitten will also be accommodated. Of course if a building is not constructed so as to admit of proper ventilation, it will be impossible to ventilate it properly, a statement so logical that even Dr. Edward Smith, F. R. S., will not dispute it.

Fifth, the admission of pure air should be so adjusted when the air is not previously heated that all sharp drafts shall be avoided. This can easily be done by causing it to enter through wire gauze, breaking the currents by screens, etc., in the application of which means, common sense is of much more value than large scholastic acquirements. Thus ends our discourse upon ventilation, which if not so learned, will, we are confident, do more good than that of Dr. Edward Smith, F. R. S., before the Society of Arts, above mentioned.

TASTE AND SMELL--A NEW THEORY.

A scientific gentleman, in a recent conversation, broached to us a theory of taste and smell, which, so far as taste is concerned, is, we think, new. A similar theory in regard to smell has been propounded by Piesse, and is, we think, the true one.

The theory of odors hitherto accepted, has been, that invisible particles, emanating from bodies, and coming in contact with the olfactory nerves, produce the sensation of smell. Substances to be odoriferous, need, therefore, to be volatile to a certain extent.

Taste, says one author, "is merely a more delicate kind of touch." The nerves of the whole interior of the mouth are the ones supposed by some to be endowed with this "delicate touch," while others limit the nerves of taste to certain parts of the mouth, of which the tongue is chief. In general, substances insoluble in the fluids of the mouth, are regarded as being destitute of taste.

The nerves of special sensation have been a subject of most profound study on the part of physiologists, who have never yet been able to find in their anatomy or composition anything to account for their peculiar functions. Knowledge bearing upon the subject, therefore, relates principally to the external phenomena of special sensation, and it is to these that the theory of which we write entirely pertains.

The phenomena of sound have all been referred to vibrations of sonorous bodies, transmitted to the complex mechanism of the ear, by solid, liquid, or gaseous media, or a combination of such media. The phenomena of sight are also referred to vibrations of luminous bodies, transmitted to the eye by a medium called ether. In these sensations actual contact of the body, which is the primary cause of them, is known to be unessential. The new theory of taste and smell brings these sensations also into the category of impressions produced by vibration. In other words, these sensations are attributed to vibratory motions in external bodies, a knowledge of which is communicated to the mind through the nerves of taste and smell, in a manner analogous to that in which impressions caused by light and sound, are transmitted to the mind. In the case of taste, it is possible that no medium exists that can convey its impressions; the communication of such impressions must, if this be the case, be immediate, that is, the tongue must touch, in the popular sense, the thing tasted. There are, however, difficulties connected with this hypothesis, viz.: How are we to account for the absence of taste when insoluble substances are placed on the tongue? How, if fine division and intimate contact with the nerves of taste is essential to this sense, are we to account for the absence of taste when certain gases are taken into the mouth? Certainly, in the latter case, we have the minutest subdivision and as perfect contact, as is physically possible to obtain. It becomes evident, then, that there are bodies incapable of affecting this sense, as there are bodies which are non-luminous to the eye, and others which, to the ear, are deficient in sonorousness.

But, supposing no known medium to be able to convey impressions of taste to the nerves of that sense, the theory of vibrations does not, on that account, become untenable. We are far from believing, however, that the subject has been studied sufficiently to pronounce with certainty upon this point.

The corpuscular theory of light has been discarded as failing wholly to account for optical phenomena. In like manner have the theories of phlogiston and caloric successively given way to more enlightened views. Both light and heat are now considered as modes of motion.

If now we retain the corpuscular hypothesis for the sense of smell, we suppose that to be the most delicate of all the senses, for by it we may, without artificial help, detect quantities of matter so small that they can be detected by no other sense, even though aided by the most powerful instruments science has been able to devise or art to construct. If we consider the act of smelling as only a more delicate kind of touch, as it has hitherto been thought, we suppose the power of sensation in the olfactory nerves infinitely superior to any others. Some illustrations will make this appear in a stronger light. A grain of musk exposed for six months in a large room, communicates its odor to all the bodies in the room, *without any sensible loss of weight*. If a handkerchief thus perfumed with musk, be exposed to the most critical examination by the microscope, no musk can be detected deposited in its fibers. But, it may be said, the odoriferous principle exists in a gaseous state. If this were so, it might be reasonably supposed that delicate chemical tests would afford a trace of its presence, but they do not. Does not, then, the vibratory theory conflict less with the facts in this case than the theory of emanations? The only grounds we have upon which to base the hypothesis of emanations is a sensation produced, and we have the same ground for believing that light and heat are emanations.

But, it may be asked, how can the smell in the handkerchief be accounted for if the musk be not present? To this it is answered, in the same way that sensible heat in a body is accounted for, after it is removed from a contact with another heated body, or fluorescence in bodies after exposure to sunlight. These phenomena are referred to the continuance of vibrations in bodies after the exciting cause is removed. It does no violence to analogy to suppose the same cause as continuing the effect of an odor, after the primary cause is removed.

A bar of block tin, when rubbed, emits a peculiar smell. No test, however delicate, can demonstrate the presence of metallic particles in the air or of the oxide or salts of tin, in this experiment. Applying the same reasoning adopted in relation to sound, heat, and light, it is extremely difficult to believe that smell, in this case, in produced by actual contact.

It is well known that perfumes blend harmoniously when combined according to a scale, which may be represented by a gamut, in which different odors correspond to different musical sounds; and the other analogies between smell and sound are indeed very striking, as is shown by Piesse, in his work on "The Art of Perfumery," second section.

A wide field of study and experiment is here opened, and, we have no doubt, that in future works on physics, the subjects of odor and taste are destined to find a place by the side of heat, light, sound, and electricity.

BEET ROOT SUGAR.

No. III.

CULTURE OF THE BEET.

CLIMATE.—Few of our cultivated plants thrive under more varied conditions of climate than does the beet. It is grown in Europe, from the shores of the Mediterranean to very near the Arctic circle, and from the Atlantic to the Caspian Sea, so that in few portions of the United States would meteorological conditions offer any obstacle to its successful cultivation. The relative season for sowing, so that it can be harvested in the right time, can be so regulated by the intelligent cultivator, according to the degree of latitude, so as to suit the exigences of the manufacturer.

Heat and moisture being needed in considerable quantities for its perfect development, very cold or very dry localities will alone prove antagonistic to its profitable production as a sugar plant.

The seed germinates at a temperature of 44° Fah.; the root rots on thawing if exposed to a cold much below the freezing point.

SOIL.—The beet vegetates in all soils, but a sandy loam or an argillaceous soil is the best suited to its nature. In chalky soils or very sandy ones, its development is stunted. It prospers in light, silicious ground if this be rich in humus or in manure. A medium consistence between stiff and light is the best for it, but too stiff soils are preferable to too light ones.

The soil for beets must be loose, fresh, and free from stones. If water is contained in the subsoil, it must be artificially drained.

A certain amount of lime in the soil is advantageous, but it must contain no *excess* of potash or soda, as these salts have a deleterious influence on the ulterior production of sugar during the process of manufacture.

It is best, for many reasons, not to grow beet as a first crop on newly-cleared lands. This plant having a long, taper root, the radicles of which penetrate far down into the ground, the necessity of a deep and well-pulverized soil is apparent.

PREPARATION OF THE GROUND.—The instructions for this purpose may be summed up as follows: Plow deep in the autumn or early winter; better twice than once. This may best be done by means of two successive plowings with an ordinary plow or by the use of a subsoil plow. The following spring pass a heavy iron-toothed harrow over the land, and follow this soon after by a scarifier. After this, spread your manure equally over the land and plow it in to a depth of four or five inches.

Harrow and roll with an iron roller so as to equalize the surface and break up clods, and the field is ready to receive the seed. These last operations must, if possible, be performed before the month of April.

SOWING.—Our instructions in this case are: In the first place, purchase your seed, fresh imported, from a reliable dealer, or import it yourself until you can make your own (which will require two years). The amount needed per acre will be from ten to twelve pounds, which can be purchased in New York, at present prices, at 50 cents per pound, for small quantities of from ten to fifty pounds, with a very liberal discount for larger amounts.

The seed, before sowing, is soaked in water for 24 hours, and piled up into small heaps until signs of approaching germination are manifested. It is then rolled in fine dust-bone black, which forms a dry adherent coating.

The land by this time must have been very carefully "marked," or laid out in regular superficial lines or grooves running at right angles to each other. This is done by means of a special implement drawn by a horse. These lines are so distanced that those in one parallel series are placed at one foot six inches, and those in the other at one foot ten inches from one another. One beet root is destined to be grown at the angle of each quadrangle formed by these intersections, so that one acre of land produces between 21,000 and 22,000 beets. The marking has to be done with great accuracy, as the subsequent horse hoeings would be impossible if the regularity of the rows was imperfect.

The seed is sown by manual labor or by horse power. In the first case this is done by special hand machines, which rapidly deposit the seed along with a minute quantity of some dry, pulverulent fertilizer at the angle of the square "marked," as above described. It is then covered by passing a roller over the ground.

More generally, however, the seed is drilled into the land by a sowing machine, drawn by one or two horses, that sows several rows at a time. These machines, of which many various kinds are at present in use in Europe, generally open a groove in the ground, drop the seed in a continuous stream into this groove, deposit along with it a small amount of superphosphate or other finely-comminuted fertilizer, and finally cover the seed, all in one operation. The seed ought to be buried at a depth of from 1½ to 2 inches.

If the season is propitious, the young plants will show themselves above the surface in from eight to twelve days.

The time of year for sowing the seed must, in the United States, vary according to localities, from the 1st of March in the Southern States to the first week in May in the Northern. The average for our Middle States, East and West, would correspond to about the 15th of April, or as near to this date as circumstances will allow.

CARE OF THE GROWING CROP.—Very soon after the young beets have fairly shown themselves, or even before this, if weeds are thick, and the original drill lines or marks are still visible, a horse hoe is lightly run across the field between the 18-inch rows.

This implement is made to take from three to five rows at one time, in which cases it is, respectively, drawn by one or by two horses. As soon as this operation has been performed, the small beet plants are "thinned" in the rows by means of a broad-bladed hand hoe, which is by two successive strokes of the laborer made to clear a little less than one foot ten inches of the space to be left between two plants in the same row. With skillful drivers this operation may also be performed by the horse hoe; the implement in this case being so constructed as to allow of varying at will the distance between the hoes.

A workman, or woman, with a small, short-handled grubber now follows, and stirs the earth carefully around each plant, so as to loosen the soil, and to leave only one beet at the end of each determined interval.

A few rows of young beets must be left in each field untouched, or only "thinned," in order to allow by transplantation the filling up at some future period (generally after the second hoeing, or when the root has attained about half an inch in diameter) of any vacant spaces in the line produced by the non-germination of seed, late severe frosts, or other accidental causes. The transplanting is done by hand, and the replanting with a blunt-pointed, hard, wooden borer, great care being taken not to injure the young roots when taking them up or during their transportation. These last operations are often satisfactorily performed by means of a "*deplantoir*," or "transplanter," a special instrument constructed for the purpose.

After this period, two successive horse hoeings will, in most cases, generally suffice to keep the ground clear of weeds until the foliage of the beet itself will become a self-protector by smothering all spontaneous vegetation between the rows. In some instances, however, when the soil is particularly foul, or when it has become caked by the combined influence of excess of rain and heat, it may become necessary to repeat the hoeings once or twice more, and it may prove beneficial to "earth up" the beets, either by means of special contrivances adapted to the horse hoe itself or by using a very light mold-board plow.

As the plant is a biennial, harvested during the first year of its growth, it cannot be called ripe or mature at any time before maturation of seed, but the proper season for its extraction is indicated when the thermometer in the autumn months has, during several successive days, fallen as low as 45 or 50 degrees of Fahrenheit's thermometer, and when consequently the first frosts may be anticipated.

HARVESTING.—This is done with hand graips, or much better with a mold-board or gridiron plow, the coulter of which has been removed.

The plants are taken up, well shaken, and laid in rows, with the roots pointed all one way. The tops, or collars, are then cut off by means of a strong, heavy, sharp knife, which does the work by one stroke.

Care must be taken to "decapitate" the beet root fully, so as to prevent vegetation or sprouting of new leaf buds during the winter months, which would develop themselves at the expense of the sugar. The roots must be cleaned, but without excess, as a little dirt left on them will hurt them much less than rough handling and bruising.

The season for harvesting will vary from the beginning of September to the end of October, according to localities, seasons, and periods of sowing the seed. The later the harvest is gathered the more advantageous will it prove to be in the end to the manufacturer.

PRESERVATION.—The beginning of the beet root harvest and of sugar making for the campaign are simultaneous. The beets needed for immediate consumption, or for use within a few days after the gathering, are laid in the open air in layers, which must not exceed three feet in thickness, and must be frequently stirred if their sojourn is accidentally prolonged beyond this length of time.

The roots destined to be worked during the winter months must be preserved from frost, and are placed in long trenches dug in the ground near the factory buildings. These trenches are generally made about ten feet wide and seven and a half feet deep. Their bottoms have a gentle slope from each side toward the center, where longitudinal drains are dug out for the purpose of collecting any water which might percolate through the pile of beets. This water is carried off by a long, narrow ditch, dug at a lower level than the trench, and put into connection with it by means of drainage pipes.

The bottom of the trench is next covered with small poles or faggots, laid across so as to bridge the central drain, and the beet roots are carefully filled in, care being taken to leave air holes or chimneys (made by converging poles or boards) at distances of every twelve or fifteen feet. The beets are piled somewhat higher than the upper level of the trench.

As long as the weather remains fine, and no frost is apprehended, all that has to be done is to cover the upper surface of the beets with a few inches of straw, or dried leaves, in order to protect them from the action of the sun, which is apt to induce heating and consequent fermentation and putrefaction.

As soon as the cold weather sets in, a portion of the earth dug up in making the trenches is placed in a layer of from 1 to 2½ feet in thickness on the top of the covering of straw or dried leaves. This protection is only removed as the beets are needed for the supply of the works. One single thing has to be attended to during the winter, namely, to close the air holes or chimneys whenever the weather is frosty, and to open them on mild or rainy days.

PLACE IN ROTATION OF CROPS.—It is improvident, and bad farming to cultivate the beet root twice or more years in succession on the same piece of land.

In Europe it is brought once only in a triennial or quadrennial system, this last being preferable as requiring the labor of only one manuring during a period of four years.

Here are examples of rotations such as we can conscientiously recommend:

I.

1st year	Beets, manured.
2d "	Barley or oats.
3d "	Clover or sainfoin.
4th "	Wheat.
5th "	Beets, manured.

II.

1st year	Beets, manured.
2d "	Wheat.
3d "	Clover.
4th "	Rye or oats.
5th "	Beets, manured.

III.

1st year	Potatoes, well manured.
2d "	Beets, not manured.
3d "	Wheat. [age crop.
4th "	Clover, hay, or some for-
5th "	Potatoes, manured.

MANURE AND FERTILIZERS.—In order to obtain a twenty-tun crop of beet root without impoverishing the soil on which it has been grown, we have to return to it the whole of the leaves which were cut off at the period of harvesting, and further, to add by means of farm-yard manure, and by other fertilizers, either natural or artificial, the following substances per acre in the quantities here given:

Nitrogen	747	pounds.
Sulphuric acid	45	"
Phosphoric acid	166·5	"
Lime	189	"
Potash	1,125	"

These figures, with a large allowance for waste and losses, will allow intelligent agriculturists to make their own calculations as regards the needed quantities of the manure they may choose to employ. Let us remark, in conclusion, that during the processes of making beet root sugar many very valuable refuse, or so-called waste substances are produced, all of which are of the highest value as fertilizers, and are carefully collected as such. These are: The waste dust or refuse bone-black left after washing; the exhausted lime of defecation; the pressed scums; the worn-out woolen sacks from the pulp presses; the ashes from under the boilers; the small roots and rootlets from the root washer; and, finally, the dung of the animals fed upon the beet root pulp after the sugar has been manufactured therefrom.

Editorial Summary.

WE learn that a bill for the inspection of steam boilers has been introduced into the Pennsylvania Legislature. It provides that within thirty days the Governor shall appoint one suitable person, to serve for three years, in each Congressional district, as inspectors. They shall examine all except locomotive and low-pressure boilers, and shall keep a "lock-up" safety valve on each boiler. The owners shall have their boilers ready for inspection when notified, and shall pay four dollars for inspection, and shall attach a low-water indicator, connected with the steam whistle.

WORKMEN AND THEIR TOOLS.—A good test of a good workman—one of the best apart from his workmanship—is his care of tools. If he leaves a worn out or dilapidated tool in its imperfect state until he gets time to put it into shape, he he lacks in the organ of order, which should be the shop's, as Pope says it is Heaven's first law. But if he repairs the tool soon as it is injured, whether wanted for use at the time or not, he can be depended upon. A carpenter may be known by his chips; but a workman at any business may be known by the state of his tools.

EFFECT OF TREES ON CLIMATE.—The dryness of the Egyptian climate is such that rain is unknown in Upper Egypt, and in olden time it never rained oftener than five or six days in a year on the Nile delta. The viceroy, Mehemed Ali, caused twenty millions of trees to be planted on this delta; these have now attained their full size, and the number of rainy days has increased to forty annually. Such is the power which man can exert over nature in the matter of varying meteorological conditions.

A "NEW England Mechanics' and Art Association" has been organized at Boston, of which ex-Governor Bullock, of Worcester, Mass., is President. The circular before us, which we are requested to notice, does not give any information respecting the purposes of the association, but we should judge, from the number and character of the gentlemen who are its sponsors, that a good deal may be expected from it.

MONUMENT TO HUMBOLDT.—It is proposed by a number of our citizens to commemorate the centennial birthday of Humboldt by the erection of a monument to his memory, in the Central Park, at a cost of $2,500. Subscriptions are solicited in behalf of this commendable undertaking by a committee of well-known gentlemen, of which Christian E. Detmold, of this city, is the treasurer.

IMPROVED PRINTING MECHANISM.—One of Bullock's patent presses, at the Government printing office, Washington, attended by two persons, does the entire work which recently required for its execution no less than eighteen of the Adams presses, coupled with the labor of twenty persons. The steam power used to drive the Bullock press is not much greater than that needed for one of the old presses.

INK FROM ELDER.—In a receipt for making ink from elder, on page 180, an incongruity has crept in. The sentence reading "add to 12½ *parts* of the filtered juice one ounce of sulphate of iron," etc., should read, add to 12½ ounces of the filtered juice one ounce of sulphate of iron, etc.

A NEW chemical laboratory, just completed at the University of Leipsic, is the largest and most perfect, in regard to its internal arrangements, of any in Germany. The corner stone was laid in August, 1867, and the building was opened to students in last November.

THERE are only seventy-five miles of rail remaining to be laid on the Pacific Railroad, and it is expected that a locomotive will run through to San Francisco early in the summer. The highest point on the road is 7,500 feet above the sea.

WE are out of some of the back numbers of this volume. Subscribers who write for missing numbers will always be supplied when it is possible for us to do so. We make this statement to answer several applications.

WE are indebted to General H. A. Barnum, of Syracuse, N. Y., for a copy of Report of the Inspectors of State Prisons, for 1869, for which he will please accept our acknowledgments.

MANUFACTURING, MINING, AND RAILROAD ITEMS.

The new American Print Works, at Fall River, Mass., are nearly finished, and are filling with machinery. The Mechanics' Mills, in the same town, are receiving machinery, and will commence running in about three months. They will run 50,000 spindles, 1,200 looms, and will weave 13,000,000 yards of print cloths per annum.

A powerful steam saw mill on wheels is building at Worcester, Mass., It is to be moved about the country and used wherever wanted. The machine weighs twelve tuns.

Almost one thousand passengers were delayed along the line of the Union Pacific Railroad by the recent snow blockade.

It has been estimated that at present rates of cutting, the pine timber of Michigan will be exhausted in 17 years.

The Georgia White Oak Lumber Company have now in operation a floating steam factory turning out 1,500 finished staves per day.

Part of a brewery at Morrisiana, N. Y., was crushed on Saturday by several thousand tuns of rock and earth falling upon it from a hill in the rear.

The Turner's Falls (Mass.) Water Power Company have leased 200-horse power, with privilege of 400 more, to a gentleman of New York, who will employ it in making paper pulp from poplar wood.

Two millions of cattle are, upon the authority of Letheby, killed annually in South America for the fat skins and bones solely.

A green corn company is erecting at Farmington, Me., a factory 100 feet by 60 feet and three stories in hight.

There are 107 cabinet manufacturing establishments in New York city, employing in the aggregate 3,000 men.

The Philadelphia Water Works supply water to 959 manufacturing establishments.

Kansas has already 600 miles of railroad in active operation.

Answers to Correspondents.

CORRESPONDENTS who expect to receive answers to their letters must, in all cases, sign their names. We have a right to know those who seek information from us; beside, as sometimes happens, we may prefer to address correspondents by mail.

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 should be by volume and page.*

C. L. H., of Ohio.—An aqueous solution of gum-arabic is the best varnish for leaves and flowers.

W. S. S., of N. Y.—Your communication upon rat-proof buildings fails to explain how they should be constructed. In its present shape we cannot regard it in any other light than as an advertisement of a pat ent.

E. J. F. of Me.—An application of glycerin to the tubs will not injure the taste of butter, and the article is harmless. You can get it at the druggists.

L. O. B., of Ind., wishes to know a practical method of scouring wool oil containing petroleum, out of cloth or yarn. He says the yarn when this oil has been used, turns yellow after standing awhile, and never comes out as white as when pure lard oil has been used, and when he attempted to scour with lye or country soap, he could not get good results. Can any of our correspondents give the desired information.

Wm. S. C., of——The usual estimate of a horse power, 33,000 lbs. raised one foot in one minute, is the work that average horses will perform steadily with suitable machinery. The best method of applying the power of a horse to propulsion of machinery is in our opinion, the endless chain horse power in common use if properly made and set with reference to the machinery to be driven.

J. Van O., of Pa.—We have practiced the following method for drying chlorine gas, with excellent results. Take of pumice stone a quantity of small fragments the size of a pea, soak them in strong sulphuric acid, then calcine them until acid fumes cease to be disengaged. These fragments are then re-saturated with sulphuric acid and inclosed in a tube through which the gas is passed in the ordinary manner of drying other gases. The sulphuric acid will seize the water contained in the gas the latter passing over in a dry state.

J. E. C., of Iowa.—When the same length of belt is to be used to give different speeds, the centers of the pulleys remaining equi-distant, the diameter of the driver must be increased as that of the driven is diminished, or *vice versa* and the speed of the circumference of both the driver and driven pulley will increase exactly as the diameter of the driver is increased. The number of revolutions made by the driven pulley will be to the number of revolutions made by the driver, as the diameter of the driven pulley is to that of the driver. Thus if the diameter of the driver be 4 and that of the driven 2, and the number of revolutions of the driver be 60, the proportion will be, 2 : 4 : : 60 : 120 the number of revolutions made by the driven pulley.

F. P. H., of Mass.—We know of no "water-proof glue" for uniting wood. Many recipes are published which assume to be waterproof, but we do not believe in any of them, as glues are dissolved in water, and of course water will re-dissolve them. India rubber (virgin) dissolved. 4 parts in 30 parts naphtha, or benzine, and 65 parts ground or powdered shellac melted in it make as near an approach to water-proof glue as anything we know. It will also unite metal and wood if the surfaces are clean. Molesworth, in his "Engineer's Pocket Book" gives the following: "For a glue to resist moisture, melt 1 lb. of glue in two quarts of skimmed milk. A strong glue, add powdered chalk to common glue. His marine glue is similar to that, the formula of which is given above. We cannot tell you where "machines for plaiting silk fishing lines" are to be obtained.

J. S. C., of Pa.—We do not consider the question of the precise instant when the gun receives the recoil of the explosion—whether at the time of ignition of the powder, or when the bullet leaves the barrel, thus creating a vacuum—of sufficient value to occupy a space in our columns.

H. A. S., of Me., says he saw in the SCIENTIFIC AMERICAN about two years ago a statement of the erection of a flour mill in New York, to hull the wheat before grinding. He asks "What became of it and why don't the owners advertise?"

S. W. H., and Bro., of Mo., say that they use an exhaust pipe of tin, four inches diameter, for leading their exhaust to a heater. It drops two feet from the engine cylinder, traverses ten feet horizontally, and then rises four feet to the heater. In starting the engine March 5th, the horizontal portion collapsed. "What" they ask "is the reason?" The only cause is the pressure of the atmosphere without, and a vacuum within the pipe. Probably an examination would show that the communication with the atmosphere was closed either by the action of the back pressure valve opening outward or by the water. Sheet tin is *in any case* a poor material for conducting steam.

W. S. T., of N. H.—Number of feet traversed by minute of your little engine is 562; pressure, about 4 lbs. on piston, result less than one-sixteenth of one horse power.

T. F. H., of Conn.—A good dark bronze dip is made by dissolving iron scales (scales from the forge) 1 lb., arsenic 1 oz., zinc 1 oz. in 1 lb., muriatic acid; the zinc to be added to the solution just before using. The metal to receive it should be cleaned by diluted acid.

L. V. G., of Ohio.—For an ordinary foot lathe for wood or light metal work, a wheel of iron from 30 to 36 inches diameter is sufficient for a driver, weighing 150 to 175 lbs. The live spindle should run in brass composition or Babbitt metal.

APPLICATIONS FOR THE EXTENSION OF PATENTS.

BUOY FOR RAISING SUNKEN VESSELS.—Joseph C. Fuller, executor of the estate of Elisha Fitzgerald, deceased, has petitioned for the extension of the above patent. Day of hearing, May 31, 1869.

MACHINE FOR PEGGING BOOTS AND SHOES.—Alpheus C. Gallahue, of New York city, has petitioned for the extension of the above patent. Day of hearing, May 31, 1869.

MACHINE FOR MITERING PRINTERS' RULE.—William McDonald, of Morrisania, N. Y., has applied for an extension of the above patent. Day of hearing, June 14, 1869.

CARD EXHIBITOR.—Wright Duryea, of New York city, has applied for an extension of the above patent. Day of hearing May 31, 1869.

METHOD OF SECURING CUTTERS TO ROTARY DISKS.—Jonah Newton, of New York city, has applied for an extension of the above patent. Day of hearing May 31, 1869.

WATER METER.—Henry R. Worthington, of Greensburg, N. Y., has petitioned for an extension of the above patent. Day of hearing, June 28, 1869.

MACHINE FOR PUNCHING METAL.—George Fowler, of Seymour, Conn., has petitioned for the extension of the above patent. Day of hearing, June 7, 1869.

Recent American and Foreign Patents.

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

STOVE.—John H. Roelker, Evansville, Ind.—The object of this invention is to improve the construction of cooking stoves in such a manner that when the "fire bottom" burns out and has to be thrown away, the whole of it need not be thus rendered useless, but the burnt portion can be removed and another piece, of similar construction, substituted in its place, while the hearth and other portions, not destroyed, remain undisturbed.

GIG SAW.—Isaiah B. Arthur, Sidonsburgh, Pa.—This invention has for its object a new and improved arrangement of the parts by which a gig saw is put in motion, whereby the machine is rendered easier of operation than heretofore.

DEVICE FOR CONVERTING ROTARY INTO RECIPROCATING RECTILINEAR MOTION.—Chas. F. Hadley, Chicopee, Mass.—The nature of this invention consists in the arrangement of means whereby a rotary may be converted into an even and continual reciprocating rectilinear motion, forming a substitute for the crank.

MOP HEAD.—John Fahrney, Boonsboro, Md.—The object of this invention is to provide for public use a neat, simple, and durable mop head, to which the mop can be instantaneously attached without the necessity of stooping or touching it with the hands, even though the mop, at the time, be lying on the floor or in the wash tub.

COMBINED WHIP SOCKET AND LINE HOLDER.—Joseph R. Finney, Youngstown, Ohio.—The object of this invention is to provide a neat, cheap, and and convenient device which shall serve both as a whip holder and rein holder, being attached, for that purpose, to any convenient part of the carriage.

FLEXIBLE HARROW.—Charles Lane and Jesse M. Healy, Jamestown, N. Y.—This invention relates to a new harrow, which is composed of parallel bars, connected by means of jointed bolts so as to produce a flexible harrow which will adapt itself to uneven ground much better than a solid or stiff harrow, and which will be easier handled, and occupy less room, when packed away, than the ordinary harrows now in use.

TOILET MIRROR.—L. H. Rogers, Boston, Mass.—This invention relates to a new toilet mirror of that class, in which a portion can be swung out to reflect into the main mirror the reverse of the figure placed between the two, and the invention consists in a novel manner of connecting the main with the reflecting mirror, whereby the latter can be swung any desired distance from the main mirror, and turned in any desired direction, or placed above the main mirror, as may be required.

DOUBLE COOLER.—Judson Van Duzer, Otisville, N. Y.—This invention relates to a new cooler which can be used for two kinds of liquids at once, so that, for example, beer and water, or any other two kinds of liquor can, at the same time, be cooled therein. The invention consists in arranging around the main cylindrical ice and water receptacle, and within the outer shell, an annuler vessel, which is to contain the second kind of liquid, so as to keep it cool and fresh.

POTATO MASHER.—William Zeiger, Elmore, Ohio.—This invention relates to a new device for mashing boiled potatoes, so that the same will be thoroughly and properly transformed into a pasty substance without any difficulty or inconvenience. The apparatus is a cylindrical shell, with a hopper-shaped upper end; a grinder is arranged within the cylinder, carrying cutters in the hopper, stationary cutters being arranged in the latter. As the cylinder is turned, the potatoes will be cut into small pieces in the upper, and ground or mashed in the lower part of the vessel, so as to be discharged through a proper spout in the desired state. The stationary cutters are made removable, so that the whole apparatus can be taken apart for cleaning purposes.

TEA-POT.—C. H. Reynolds and George Z. Clark, Croton Falls, N. Y.—The object of this invention is to provide means for removing the leaves of tea from the entrance to the spout of the teapot, and it consists in arranging a spring scraper in the inside of the pot.

LIFTING JACK.—James Dampman, Lebanon, Pa.—This invention has for its object to furnish a simple, convenient, and effective lifting jack, by means of which weights may be quickly and readily raised, and held till secured or made ready to be again lowered to their places.

TRACE CARRIER.—James H. Harris, Vermont, Ill.—This invention relates to an attachment to harnesses for holding and carrying the traces or tugs when the team is detached from the wagon or carriage, and consists in a ring, which, in connection with a plate and hooks, forms a portion of the harness fastening.

CHURN.—William M. Rumrill, Roanoke, Ind.—This invention has for its object to furnish an improved churn dasher, which shall be so constructed and arranged as to bring the butter quicker and in greater quantities than in ordinary churns, and at the same time gathering it as it is developed from the cream.

THILL SHIFTER.—S. Jennings, Patterson, N. Y.—This invention has for its object to furnish an improved means of connecting the thills to the sleigh, which shall be strong, durable, and simple in construction, and at the same time so constructed that the thills may be shifted from a side to a central draft, or the contrary, with one hand, while the horse is attached or even while he is in motion.

COTTON PRESS.—C. W. Millerd, Monticello, Ark.—The object of this invention is to provide a simple, effective, and easily operated press for baling cotton and other analogous matter for which it may be found applicable.

FORMER FOR MAKING UPHOLSTERING CONE SPRINGS.—William A. Goodale, Colton, N. Y.—This invention has for its object to furnish an improved machine for forming or turning upholstering cone springs, which shall be simple in construction and effective in operation, forming the springs quickly and accurately.

BUNG CUTTER.—Benjamin and Frederick Geyler, Cincinnati, Ohio.—This invention relates to improvements in cutter heads, whereby they may be readily adjusted to cut them of any desired size, and the cutting tools may be fed up to the work with facility.

WELT KNIFE.—M. J. Ferren, Stoneham, Mass.—This invention relates to improvements in welt knives designed to provide an adjustable cutter which may be changed in its position, as may be required, and also be readily removed for sharpening or other purposes.

KNITTING MACHINE.—Wm. Franz and Wm. Pope, Christline, Ohio.—This invention relates to improvements in knitting machines, by which it is designed to provide a convenient and simple arrangement whereby a part of the needles of a rotary knitting machine may be thrown out of action to admit of narrowing and widening for forming the heels and toes of stockings, or for knitting other flat fabrics or fabrics in strips, also an improved method of forming the heels and toes of stockings.

FASTENING FOR OPEN HORSE COLLARS.—Mr. John A. Meyer, Dutch Creek, Washington Co., Iowa, has invented a simple device for strengthing, keeping in form and place, and fastening horse collars. It is a tempered steel spring encircling the collar, to be placed either inside the collar rim, or on the outside in the hames. The upper ends of the spring are formed into hooks for the reception of a strap or link when the collar is in use. The collar can thus be fastened or unfastened instantly, without the use of strap and buckle, and when the collar is removed the spring keeps it in shape, preventing the liability to break. It may be applied to collars now in use and can be made by any ordinary blacksmith. Its cost is slight, but its advantages great. Those interested may address the patentee as above.

EXTENSION TABLE.—Lambert Freeman, New York city.—This invention has for its object to furnish a simple and convenient extension table which shall be so constructed that it may be extended much or little, as may be desired, and which will be firmly supported however much it may be extended, and whether extended at one or both ends.

GATE.—E. J. Wolfgang and J. W. Kenreigh, Salem, Ohio.—This invention has for its object to furnish a simple and convenient gate, which shall be so constructed and arranged that it may be easily and readily opened and closed by those passing through, without being necessary for them to get out of the carriage.

REELS FOR HARVESTERS.—J. R. Jones, Clarksville, Iowa.—This invention relates to improvements in reels for harvesters, and consists in an arrangement whereby the beaters may be readily changed from one position to another for acting on the grain to straighten it or incline it to the right direction, when it leans in any direction tending to make it cut disadvantageously.

FLOUR SIFTER.—James Coyle, Boston, Mass.—This invention relates to improvements in flour sifting apparatus, such as are used for sifting and pulverizing the flour previous to cooking.

PRINTERS' GALLEY.—Edwin Hutchins, Hartford, Conn.—This invention relates to improvements in printers' galleys, and consists in providing a rest for the same, whereby the bottom thereof will be presented to, and maintained in the same plane with the top of the table to receive the type.

GRAIN BINDING MACHINE.—G. B. Shafer, Delta, Ohio.—This invention relates to improvements in grain-binding attachments for reaping machines, whereby it is designed to provide an attachment, the moving parts of which may be operated from the driving gear of the reaper, to bind up the bundles of grain as they are delivered to it, and discharge them when so bound.

CORN PLANTER.—Daniel P. Leach, Franklin, Ind.—This invention has for its object to furnish a simple, cheap, effective, and accurate corn planter, which shall be so constructed and arranged that it may be easily adjusted to do its work, as the circumstances of the case may require.

NEW PUBLICATIONS.

PLANCHETTE; OR THE DESPAIR OF SCIENCE. Being a full Account of Modern Spiritualism, its Phenomena, and the various Theories regarding it. With a Survey of French Spiritualism. Boston: Roberts Brothers.

This, as its title tells, is a book devoted to the peculiar manifestations of present and past times, which have been called witchcraft, second sight, inspiration, possession, spirit manifestations, etc., etc. It contains an array of facts, the most inexplicable of any that have ever presented themselves to scientific investigation, with the opinions of various writers and thinkers upon the subject.

HOW TO READ CHARACTER. A new Illustrated Hand-Book of Phrenology and Physiognomy, for Students and Examiners, with a Descriptive Chart. New York: S. R. Wells, publisher, 389 Broadway.

TREATISE ON THE POWER OF WATER AS APPLIED TO DRIVE FLOUR MILLS, AND TO GIVE MOTION TO TURBINES AND OTHER HYDROSTALIC ENGINES. By Joseph Glynn, F.R.S., Member of the Institute of Civil Engineers of London. Third edition. Revised and Enlarged with numerous Illustrations. New York: D. Van Nostrand.

This is an eminently practical and useful little book to every one that needs any information upon the subject of which it treats.

HANS BREITMANN'S PARTY. With other Ballads. By Chas. G. Leland.

A volume of these droll and sprightly laughter-provoking poems has been issued on heavy tinted paper, by T. B. Peterson & Brothers, Philadelphia. Price, seventy-five cents.

Official List of Patents.

Issued by the United States Patent Office.

FOR THE WEEK ENDING MARCH 23, 1869.

Reported Officially for the Scientific American.

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88,002.—MANUFACTURE OF SHEET IRON.—George Atkins (assignor to George W. Westerman, Robert Fox, and Robert May), Sharon, Pa.

88,003.—MANUFACTURE OF BREECH-PLATES FOR GUNS.—Walter Baker, Ilion, N. Y.

88,004.—BREWING.—Edward Beanes, Cordwalles (near Maidenhead), Great Britain.

88,005.—AUTOMATIC BOILER FEEDER.—Julius Boden, Columbia, Pa.

88,006.—ELECTRO-HEATING APPARATUS.—W. Leigh Burton, Richmond, Va. Antedated March 12, 1869.

88,007.—FIFTH-WHEEL FOR VEHICLES.—E. G. Cameron, Tiffin, Ohio.

88,008.—VALVE FOR BOTTOMS OF VESSELS.—Luther S. Chase and Zebina H. Chase, New Bedford, Mass.; said L. S. Chase assigns his right to Z. H. Chase.

88,009.—HAY RAKER AND LOADER.—Robert Chestnut (assignor to himself and George Kelley), Richmond, Ind.

88,010.—TRIPPING MECHANICAL DETENTS.—Stephen Chester, New York city, and Charles T. Chester, Englewood, N. J. Antedated March 4, 1869.

88,011.—COOKING STOVE.—Orson E. Clark, Waterford, Mich.

88,012.—PROJECTILE.—Wm. A. Cobb, Orange, Mass.

88,013.—OAR.—Henry W. Connor, Troy, N. Y.

88,014.—FLOUR SIFTER.—James Coyle, Boston, Mass.

88,015.—LIFTING JACK.—James Dampman, Lebanon, Pa.

88,016.—APPARATUS FOR BUTTER MAKING.—Frederick P. Deuel, Tecumseh, Mich.

88,017.—WRENCH.—L. R. Dexter, Whitefield, N. H.

88,018.—ROAD SCRAPER.—E. L. Dorsey, Winslow, Ind.

88,019.—ROLLER FOR EXTRACTING COCKLE FROM WHEAT.—Wm. G. Douglas, Warrenton, Va.

88,020.—MOLD FOR CASTING PIPE.—Jacob Edson, Boston, Mass.

88,021.—BRIDLE BIT.—Alfred B. Ely, Newton, Mass.

88,022.—BOOK HOLDER.—Freeman Emmons, Danvers, Mass.

88,023.—STRAW CUTTER.—Samuel F. Estell, Richmond, Ind.

88,024.—WELT KNIFE.—Myron J. Ferren, Stoneham, Mass.

88,025.—CULTIVATOR PLOW.—Simeon B. Forbes, Steubenville, Ohio.

88,026.—MACKEREL LATCH.—Charles S. H. Foster, Deer Isle, Me.

88,027.—KNITTING MACHINE.—William Franz and William Pope, Crestline, Ohio.

88,028.—EXTENSION TABLE.—Lambert Freeman, New York city.

88,029.—LAST MACHINE.—Roscoe R. Frohock, Boston, Mass.

88,030.—BUNG CUTTER.—Benjamin Geyler and Frederick Geyler, Cincinnati, Ohio.

88,031.—MAKING CONE SPRINGS.—William H. Goodale, Colton, N. Y.

88,032.—FAUCET.—Daniel W. Green (assignor to William Brundage), Port Chester, N. Y.

88,033.—CIGAR AND CIGARETTE.—Thomas Griffin, Roxbury, Mass

88,034.—CULTIVATOR.—Anthony Grohmann, South Saginaw, Mich.

88,035.—MACHINE FOR CONSTRUCTING VEGETABLE MEMBRANE.—Stuart Gwynn, New York city.

88,036.—VEGETABLE MEMBRANE, OR PARCHMENT.—Stuart Gwynn, New York city.
88,037.—SLATE-PUNCHING AND CUTTING MACHINE.—L. M. Ham, Boston, Mass.
88,038.—TRACE CARRIER.—J. H. Harris, Vermont, Ill.
88,039.—SEWING MACHINE.—M. C. Hawkins (assignor to himself and A. Z. Waters), Edinborough, Pa.
88,040.—MECHANICAL MOVEMENT.—Henry R. Huling (assignor to himself and John M. Marston), Boston, Mass. Antedated March 10, 1869.
88,041.—PRINTERS' GALLEY.—Edwin Hutchings, Hartford, Conn.
88,042.—THILL SHIFTER.—S. Jennings, Patterson, N. Y.
88,043.—HARVESTER REEL.—J. R. Jones, Clarksville, Iowa.
88,044.—FLY TRAP.—John H. Kiplinger and Joseph Kiplinger, North Manchester, Ind.
88,045.—CULTIVATOR.—Henry Landes, Bath, Pa.
88,046.—HARROW.—Charles Lane and Jesse M. Healy, Jamestown, N. Y.
88,047.—HYGIEOMETER. — Benjamin M. Lawrence, Galesburg, Ill.
88,048.—CORN PLANTER.—Daniel P. Leach, Franklin, Ind.
88,049.—SASH-FASTENING AND HOISTING DEVICE.—A. W. Livingstone, Bluffton, Ind.
88,050.—BOOT.—John H. Livingston, Providence, R. I.
88,051.—HOE.—James F. Lowe, Louisville, Ky.
88,052.—PADDLE WHEEL.—William R. Manley (assignor to himself and Wm. H. Webb), New York city.
88,053.—CHAMFERING MACHINE.—Benj. F. Mattox and Sidney Corson, West Ridge, Ill.
88,054.—PORTABLE BATH TUB.—Robert McCully, Philadelphia, Pa.
88,055.—RAILROAD CAR HEATER.—F. McManus, Ellenburg Center, N. Y.
88,056.—CHURN.—Charles Messenger, Cleveland, Ohio. Antedated March, 9, 1869.
88,057.—COMBINED COAT HOOK AND LINE HOLDER.—Wm. A. Middleton, Harrisburg, Pa. Antedated March 12, 1869.
88,058.—BEE FEEDER.—Peter Miller, Jr., Fredonia, N. Y.
88,059.—COTTON PRESS.—C. W. Millerd, Monticello, Ark.
88,060.—PENCIL HOLDER.—J. L. Moore, Bridgeport, Conn.
88,061.—APPARATUS FOR TRANSMITTING ROTARY MOTION.—Samuel Rodman Morgan, Philadelphia, Pa. Antedated March 18, 1869.
88,062.—AUTOMATIC FAN.—John Naugle, Mooresville, Ind.
88,063.—DEVICE FOR TURNING LOGS IN MILLS.—Isaac H. Newton, Grand Rapids, Mich. Antedated March 10, 1869.
88,064.—PROCESS OF PREPARING FISH FOR FOOD.—Joseph Nickerson, Boothbay, Me.
88,065.—HAND-SPINNING MACHINE.—Francis M. Nixon (assignor to himself, William Leet, William Dixon, and Jacob S. Best), Lena, Ill.
88,066.—GLASS FURNACE.—Samuel Oakman, Boston, Mass.
88,067.—HORSE HAY FORK.—Oscar Paddock, Watertown, N.Y.
88,068.—MONEY DRAWER.—Carlos L. Page, Cambridge, Mass.
88,069 —WATER ELEVATOR.—C. D. Palmiter (assignor to himself and Lavinia P. Webb), Oswego, N. Y.
88,070.—SPRING BED-BOTTOM.—Byron Partello, Detroit, Mich.
88,071.—FRUIT GATHERER.—Hiram Perry, Manlius, N. Y.
88,072.—CRUCIBLE FOR MELTING METALS.—Edw'd R. Playle, Great Bend, Pa.
88,073.—CASE FOR MELODEONS, ETC.—Geo. Sanford Randall, Providence, R. I. Antedated Sept. 23, 1868.
88,074.—GRAPE TRELLIS.—Alvin Rathbun, Smith's Mills, N.Y.
88,075.— COMPOSITION FOR KINDLING FIRES. — Abraham Reed, Louisville, Ky.
88,076.—TEAPOT.—C. H. Reynolds and Geo. Z. Clark, Croton Falls, N. Y.
88,077.—TOILET MIRROR.—L. H. Rogers (assignor to himself, and George A. Rogers), Boston, Mass.
88,078.—CHURN.—William M. Rumrill, Roanoke, Ind.
88,079.—APPARATUS FOR GENERATING GAS, AND HEATING DWELLINGS AND OTHER BUILDINGS.—S. C. Salisbury, New York city.
88,080.—FURNACE FOR UPRIGHT STEAM-GENERATORS.—Silas C. Salisbury, New York city.
88,081.—FURNACE FOR HORIZONTAL STEAM GENERATORS.—S. C. Salisbury, New York city.
88,082.—REVERBERATORY FURNACE.—S. C. Salisbury, New York city.
88,083.—BLAST, SMELTING, AND CUPOLA-FURNACES.—Silas C. Salisbury, New York city.
88,084.—FURNACE FOR HEATING AND ANNEALING STEEL INGOTS, ETC.—S. C. Salisbury, New York city.
88,085.—TELEGRAPH APPARATUS.—John. E. Selden, Albany, N. Y.
88,086.—MODE OF POLISHING HARD RUBBER AND OTHER ARTICLES.—W. F. Semple, and R. W. Stephens, Mount Vernon, Ohio.
88,087.—GRAIN BINDER.—G. B. Shafer, Delta, Ohio.
88,088.—POTATO DIGGER.—Isaiah Shaw, Four Corners, Md.
88,089.—WASHING MACHINE.—John P. Simmons, Schoolcraft, Mich. Antedated March 18, 1869.
88,090.—SUSPENDED PORTABLE FENCE.—Alonzo Skinner, Warren, assignor to L. A. Skinner, West Novi, Mich.
88,091.—KNIFE HEAD FOR HARVESTERS.—H. A. Soliday, Doylestown, Ohio.
88,092.—MACHINE FOR HACKLING CORN HUSKS.—George B. Stacy, Richmond, Va.
88,093.—APPARATUS FOR TURNING LOGS.—L. J. Stannard and M. L. Perry, Newark, N. Y.
88,094.—RULE CLAMP.—D. H. Stephens, Riverton, Conn.
88,095.—CHURN.—J. H. Stephens, Orange Court House, Va.
88,096.—MILK COOLER.—J. C. Thayer, Dunton, Ill.
88,097.—CLOTHES PIN.—Chas. N. Tyler, New York city.
88,098.—DOUBLE COOLER.—Judson Van Duzer, Otisville, N.Y.
88,099 —BUTTON.—W. W. Wade, Medford, Mass. Antedated March 5, 1869.
88,100.—MANUFACTURE OF CHAINS.—Wm. B. Wadsworth, Cleveland, Ohio. Antedated March 8, 1869.
88,101.—Cancelled.
88,102.—MANUFACTURE OF PAPER.—Z. C. Warren (assignor to H. C. Hulbert), Brooklyn, N. Y.
88,103.—STEAM TRAP.—Jos. E. Watts, Lawrence, Mass.
88,104.—CONDUIT FOR INVALID CHAIRS.—Geo. Wells, Bethel, Conn. Antedated March 11, 1869.
88,105.—SHOW BOTTLE.—Henry Whitney, East Cambridge, Mass.
88,106.—ALARM BELL.—Chas. Wiley, Hannibal Center, N. Y.
88,107.—HAT.—David Wilcox (assignor to himself, W. H. Slocum, and W. A. Brown), Boston, Mass.
88,108.—GATE.—E. J. Wolfgang and J. M. Kenreigh, Salem, Ohio.
88,109.—PLANE GUIDE.—John Woodville, Cincinnati, Ohio.
88,110.—CLOTHES WRINGER.—John Young, Amsterdam, N.Y.
88,111.—POTATO MASHER.—Wm. Zeiger, Elmore, Ohio.
88,112.—COOKING STOVE.—J. J. Anderson, Rochester Pa.
88,113.—DOOR KEY.—Wm. H. Andrews (assignor to Burton Mallory), New Haven, Conn.
88,114.—GIG SAW.—Isaiah B. Arthur, Sidonsburg, Pa.
88,115.—MILKING STOOL.—Ira Barrows, Hermon, N. Y.
88,116.—HAT.—J. P. Beatty, Norwalk, Conn. Antedated Feb. 2, 1869.
88,117.—SPRING.—E. U. Benedict, Chicago, Ill.
88,118.—COOP FOR POULTRY.—S. S. Bent, Port Chester, N. Y. Antedated March 22, 1869.
88,119.—MACHINE FOR CLEANING STABLES.—D. S. Bigler, and Wm. N. McCracken, Monaghan township, Pa.
88,120.—VELOCIPEDE.—John B. Blair, Philadelphia, Pa.
88,121.—AUXILIARY TABLE.—Jas. Blake (assignor to Blake and Company), Scranton, Pa.
88,122.—BUT HINGE.—Etienne Boileau and Chas. Mesnier, St. Louis, Mo.
88,123.—CLOTHES DRYER.—R. H. Boughner, East Germantown, Ind.
88,124.—ELEVATING AND WEIGHING APPARATUS.—James H. Brookmire, St. Louis, Mo.
88,125.—BLACKSMITHS' SWAGE.—G. W. Brown (assignor to himself and A. T. Gifford), Providence, R. I.
88,126.—MEAT CHOPPER.—C. N. Brumm, Minersville, Pa.
88,127.—HAY RAKE.—R. I. Burbank, Boston, Mass.
88,128.—BLACKING BOX.—Richard Cadle, Shawneetown, Ill.
88,129.—SASH LOCK AND BOLT.—L. O. Cameron, Allegheny City, Pa.
88,130.—CAR COUPLING.—Richard Campion and J. W. Thomson, Jr., Camden, N. J.
88,131.—BOOT.—M. F. Chandler, Boston, Mass.
88,132.—EXTENSION TABLE.—Giacomo Chelini, Washington, D. C.
88,133.—KNOB LATCH.—A. B. Clemons, Ansonia, Conn.
88,134.—MEDICINE FOR CURE OF RING BONE, SPAVIN, ETC.—W. A. Cleveland, Waterville, N. Y.
88,135.—PLASTERING MACHINE.—J. L. Coburn, Mineral Point, Wis.
88,136.—CULTIVATOR.—Alex. Connolley, Milan, Ind.
88,137.—BOLT FEEDER.—Jacob Cornwell (assignor to himself, D. B. Merrill, and W. H. McCourtie), Kalamazoo, Mich.
88,138.—SCOOP.—Wm. Craine, South Brookfield, N. Y.
88,139.—COMPOSITION PAVEMENT.—J. P. Cranford, Brooklyn, N. Y.
88,140.—LAMP FOR DESTOYING INSECTS.—Geo. C. Cranston, South Bend, Ind.
88,141.—PILES.—S. B. Cushing, Providence, R. I.
88,142.—TEMPERING STEEL SPRINGS.—Joseph H. Deniger, Bridgeport, Conn
88,143.—CUTTER FOR TONGUING AND GROOVING.—D. C. Devall, New York city, assignor to J. B. Schenck, Matteawan, N. Y.
88,144.—CLOVER HARVESTER.—Paul Dismukes, Gallatin, Tenn.
88,145.—BLIND WIRING MACHINE.—W. F. Dodge, Newark, N. J.
88,146.—SOFA BEDSTEAD.—Jacob Dourson, Columbus, Ohio.
88,147.—FLOOD FENCE.—Zachariah Dowden and C. T. Anderson, Clarksburg, Md.
88,148.—CHURN.—S. D. Edgar, Dayton, Ohio.
88,149.—ADJUSTABLE POLE ATTACHMENT FOR CARRIAGES.—H. F. Edwards (assignor to himself and B. I. Peabody) Worcester, Mass.
88,150.—MOP HEAD.—John Fahrney, Boonsborough, Md.
88,151.—VELOCIPEDE.—H. J. Ferguson, Whiting, N. J.
88,152.—SHUTTER FASTENING.—W. C. Fisher, Charlestown, Mass.
88,153.—SPRING BED BOTTOM.—Mark Flanigan, Detroit, Mich.
88,154.—RAILWAY CAR WHEEL.—A. C. Fletcher, New York city.
88,155.—CAR SPRING.—A. C. Fletcher, New York city.
88,156.—HARVESTER RAKE.—J. S. Fowler, Davenport, Iowa.
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88,174.—TOY HOOP.—C. C. Johnson, Springfield, Vt.
88,175.—CLOTHES-LINE FASTENER.—Job Johnson, S. J. Smith, and Simon Ingersoll, Brooklyn, N. Y., assignors to Job Johnson and S.J. Smith.
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88,177.—SAW SWAGE.—Nelson Johnson, Jasper, N. Y.
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88,191.—METALLIC CARTRIDGE.—Edwin Martin, Springfield, Mass., assignor to himself, S. W. Porter, and J. F. Cranston.
88,192.—BREAST STRAP SLIDE.—John H. Martin, Columbus, Ohio.
88,193.—WASH BOILER.—A. McDaniel, Dubuque, Iowa.
88,194.—STREET SWEEPER.—J. W. McDonald, Chicago, Ill.
88,195.—HARROW.—Samuel Mendenhall, Muncy Station, Pa.
88,196.—FIFTH WHEEL.—Wm. Munson, Abington, Pa.
88,197.—WALKING DOLL.—A. W. Nicholson, Brooklyn, N. Y.
88,198.—VELOCIPEDE.—W. L. Paine, Boston, Mass.
88,199.—POTATO DIGGER.— Chester Palmer, Willoughby, Ohio.
88,200.—ROLLER STOP FOR WINDOW SHADES.—I. E. Palmer, Hackensack, N. J.
88,201.—WASHING MACHINE.—F. D. Paradis, Chicago, Ill.
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88,203.—SELF-REGISTERING LUMBER MEASURE.—D. E. Pease and George Richards, Richland Center, Wis.
88,204.—OPERATING VALVES OF STEAM ENGINES.—Hart F. Pease, Brooklyn, N. Y. Antedated March 15, 1869.
88,205.—VELOCIPEDE.—R. H. Plass, New York city.
88,206.—LAMP-SHADE HOLDER.—J. T. Pope, New York city.
88,207.—CONSTRUCTION OF RAILWAY WHEELS.—James Rae, London, England, and George Miller, Glasgow, Scotland.
88,208.—MANUFACTURE OF IRON AND STEEL.—John Ralston, A. L. Thomas, and Wm. Parkinson, Tamaqua, Pa.
88,209.—HARVESTER.—Amos Rank, Salem, Ohio.
88,210.—NERVING BRIDLE.—J. V. Reardon, Elkton, Md. Antedated March 11, 1869.
88,211.—SHEEP RACK.—Shelby Reed, Scottsville, N. Y.
88,212.—CHALK LINE SPOOL.—J. E. Richardson, Lowell, Mich. Antedated March 18, 1869.
88,213.—GRATE FOR COOKING STOVE.—J. H. Roelker, Evansville, Ind.
88,214.—BOLT-HEADING MACHINE.—John Root (assignor to himself and McLagon and Stevens), New Haven, Conn.
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88,234.—CORN MARKER.—G. W. Tucker, Eugene, Ill.
88,235.—BEEHIVE.—G. W. Umbaugh, Lima, Ohio.
88,236.—MITER BOX.—C. H. Underwood, Dorchester, assignor to J. A. Dupee, Boston, Mass. Antedated March 18, 1869.
88,237.—CIGAR DRYER.—Oliver Vallandigham, St. Louis, Mo.
88,238.—VELOCIPEDE.—William Van Anden, Poughkeepsie, N. Y.
88,239.—NECK-TIE RETAINER.—Jas. Varley, Hudson City, N.J. Antedated March 15, 1869.
88,240.—CARRIAGE AXLE.—Frederick Volkmann and Augustus Miller, Philadelphia, Pa.
88,241.—FANNING MILL.—W. W. Wait, Richmond, Ind.
88,242.—AXLE BOX.—Lewis Wakefield, Minneapolis. Minn.
88,243.—WASH BOILER.—Samuel J. Wallace, Keokuk, Iowa.
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88,245.—EXPANDING CHUCK.—Wm. Webb, Waterbury, Conn.
88,246.—AUTOMATIC BOILER FEEDER.—T. B. Webster, Sekaukus, N. J.
88,247.—ROLLER CLEANER IN SPINNING MACHINES.—Horace Wells, Hopkinton. R. I.
88,248.—AUTOMATIC TRANSMITTING TELEGRAPH APPARATUS.—C. Westbrook, Harrisburg, Pa.
88,249.—GATE.—S. P. Williams, Sheridan, N. Y.
88,250.—MACHINE FOR SPLITTING WOOD.—Wm. L. Williams, New York city. Antedated March 18, 1869.
88,251.—DISH AND CLOTHES WASHER.—G. W. Williamson, Gouldsborough, Pa.
88,252.—FENCE.—J. Q. A. Yonkey and F. M. Rawson, Frankfort, Ind.
88,253.—COMBINED SOWER AND CULTIVATOR.—Martin Woodard, Des Moines, Iowa.
88,254.—HARVESTER.—Geo. W. N. Yost, Corry, Pa.
88,255.—TABLE ATTACHMENT FOR CHAIRS.—Wm. Zimmerman, Bloomington, Ill.
88,256.—ARTISTS' EASEL.—F. W. Bacon, New York city.
88,257.—MACHINE FOR WINDING CLOTH.—G. F. Hargis, Decatur, Ill.
88,258.—PROCESS OF DERIVING USEFUL PRODUCTS FROM GARBAGE, etc.—W. E. Johnson, Chicago, Ill.
88,259.—LIQUID METER.—J. H. Shedd, Waltham, Mass.
88,260.—COMPOSITION FOR DENTAL PLATES.—L. R. Streeter, Chelsea, Mass., assignor to himself and A. B. Ely, trustees.

REISSUES.

23,826.—Dated May 3, 1859; reissue 3,333.—SKATE FASTENING.—E. H. Barney and John Berry, Springfield, Mass., assignees, by mesne assignments, of John Coe, administrator of the estate of John H. Coe, deceased, and W. B. Sniffin.
78,699.—Dated June 9, 1868; reissue 3,334.—NAIL EXTRACTOR.—J. V. Bogert, New York city, and J. F. Lowell, Boston, Mass., assignees, by mesne assignments, of James Tyzick.
42,842.—Dated May 24, 1864; reissue 3,335.—ELECTRO-MAGNETIC TELEGRAPH.—S. F. Day, Ballston Spa, N. Y.
81,799.—Dated Sept. 1, 1868; reissue 3,336.—SULKY PLOW.—J. B. Lewis and J. E. Udall, Concord, Ill.
75,319.—Dated March 10, 1868; reissue 3,337.—COTTON-BALE TIE.—D. C. Lowber, New York city, and G. L. Laughland, New Orleans, La., assignees, by mesne assignments, of Wm. Trowbridge.
87,123.—Dated Feb. 23, 1869; reissue 3,338.—MANUFACTURE OF ILLUMINATING GAS.—Levi Stevens, Washington, D. C.
35,960.—Dated July 22, 1862; reissue 3,339.—SEEDING MACHINE.—G. W. Van Brunt, D. C. Van Brunt, and Hiram Barber, Horicon, Wis., assignees of G. W. Van Brunt.
55,564.—Dated June 12, 1866; reissue 3,340.—HOT-AIR FURNACE.—Allen & Willard, Hartford, Conn., assignees of Edward Webster.
23,721.—Dated April 19, 1859; reissue 868, dated Dec. 20, 1859; reissue 3,341.—STOP COCK.—Erastus Stebbins, Chicopee, Mass.

DESIGNS.

3,404 to 3,407.—STOCKING FABRIC.—Conyers Button, Philadelphia, Pa. Four Patents.
3,408.—STOVE.—J. V. B. Carter, Albany, N. Y.
3,409.—STOVE.—Calvin Fulton, Rochester, N. Y.
3,410.—LABEL.—G. F. Gantz, New York city, assignor to G. F. Gantz & Co.
3,411.—LOCKET.—George Hartje and Lucien S. Jacquin, New York city.
3,412.—BARN-DOOR HANGER.—J. L. Haven, Cincinnati, Ohio.
3,413.—CHAMBER PAIL.—J. S. Jennings, Brooklyn, E. D., N.Y.
3,414.—FLOOR OILCLOTH PATTERN.—C. T. Myer, Bergen, N.J. assignor to E. C. Sampson, New York city.
3,415.—FLOOR OILCLOTH.—C. T. Meyer, Bergen, N. J., assignor to E. C. Sampson, New York city.
3,416.—CARPET PATTERN.—V. E. Meyer, Harrison, N. J., assignor to A. Folsom & Sons, Boston, Mass.
3,417 to 3,420.—CARPET PATTERN.—E. J. Ney (assignor to Lowell Manufacturing Co.), Lowell, Mass. Four Patents.
3,421 and 3,422.—BOTTLE STAND OR CASTER.—Wm. Parkin (assignor to Reed & Barton), Taunton, Mass. Two Patents.
3,423.—OTTOMAN.—W. H. Reed, New York city.
3,424.—TRADE MARK.—R. H. Rice, Newport, R. I.
3,425.—SPOON OR FORK HANDLE. — Geo. Sharp, Philadelphia, Pa.
3,426.—PLATES OF A COOK'S STOVE.—Garrettson Smith and Henry Brown (assignors to W. L. McDowell), Philadelphia, Pa.
3,427.—STOVE.—Isaac Snider, Jas. Woodruff, and J. M. Woodruff, Salem, Ohio.
3,428.—BODY OF A PICKLE JAR.—S. A. Whitney, Glasborough, N. J.
3,429.—FORK OR SPOON HANDLE.—H. C. Wilcox (assignor to Meriden Britannia Co.), Meriden, Conn.
3,430.—TRADE Mark.—Edward Wilhelm (assignor to A. W Fox & Co.), Buffalo, N. Y.

Inventions Patented in England by Americans.

[Compiled from the "Journal of the Commissioners of Patents."]

PROVISIONAL PROTECTION FOR SIX MONTHS.

504.—MACHINE FOR MAKING SEWING NEEDLES.—Francis W. Mallett, New Haven, Conn. Feb. 18, 1869.

534.—BUT HINGE.—James Bidwell, San Francisco, Cal. Feb. 20, 1869.

538.—FLOATING VELOCIPEDE.—J. G. Holbrooke, New York city. Feb 20, 1869.

546.—MANUFACTURE OF IRON AND STEEL.—T. S. Blair, Pittsburgh, Pa Feb. 22, 1869.

548.—ARTIFICIAL STONE.—Wm. Munroe, Boston, Mass. Feb. 22, 1869.

550.—VELOCIPEDE.—L. B. Flanders, Philadelphia, Pa. Feb. 22, 1869.

551.—SCREW WRENCH.—C. L. Perkins, New York city. Feb. 22, 1869.

564.— FIRE BOXES AND ASH PANS OF LOCOMOTIVE ENGINES.—H. L. Lansin and G. H. Chase, Buffalo, N. Y. Feb. 23, 1869.

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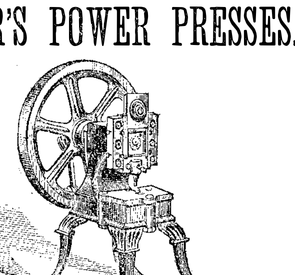

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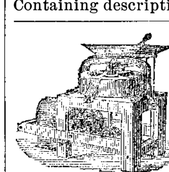

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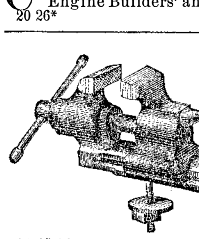

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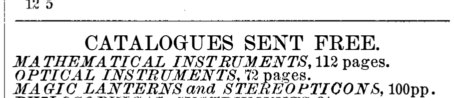

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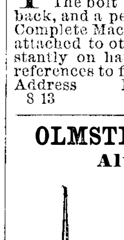

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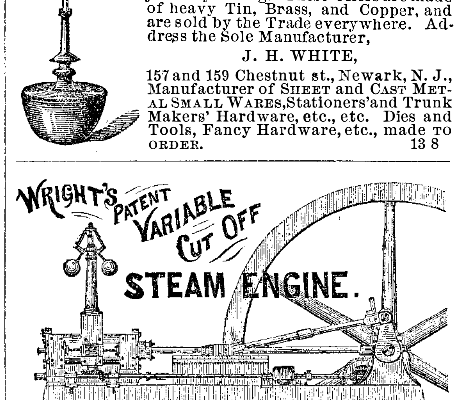

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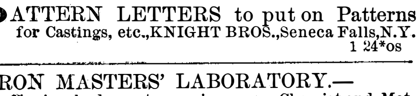

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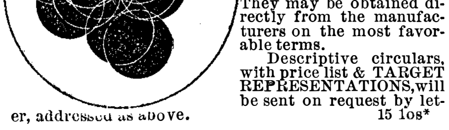

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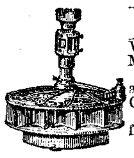

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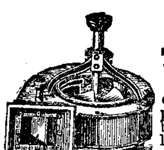

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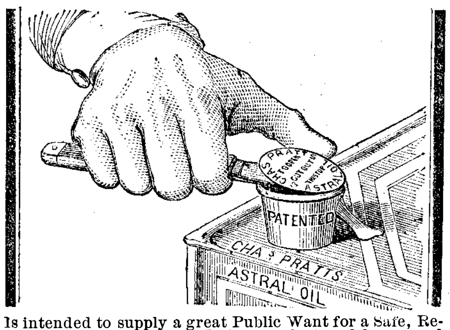

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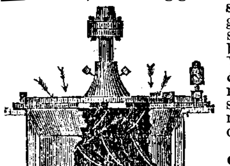

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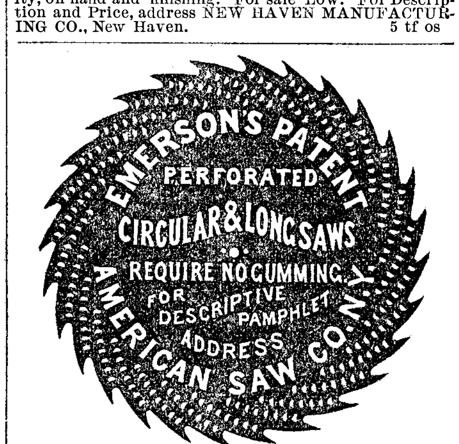

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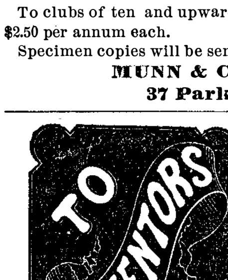

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