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Machine for Turning the Ends of Axletrees.

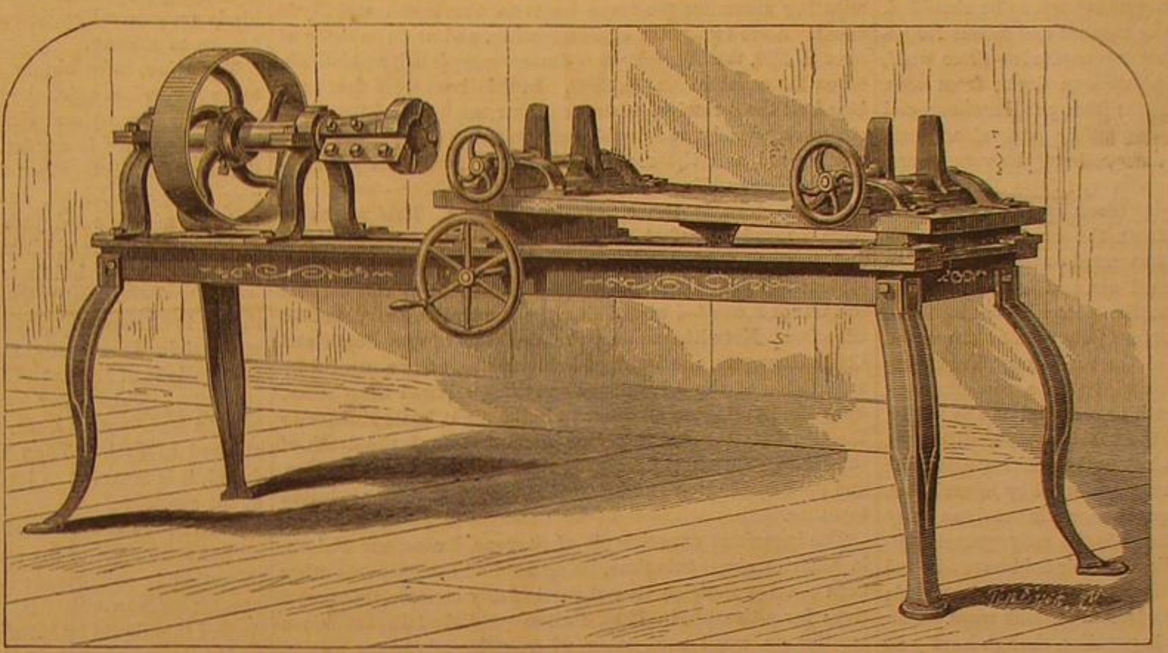
Our engraving gives a very good representation of a machine for turning the ends of axletrees. It is said it will turn the ends to fit thimble skeins in a most accurate manner. The general principle of the machine convinces us that it must work satisfactorily, in which opinion, we doubt not, practical wagon manufacturers will concur.

The bed of the machine rests on suitable legs. On this bed are placed a head stock and spindle, carrying a cutter head and pulley for driving the same. The bed also supports a carriage for the axle, the ends of which are to be turned. The carriage runs on suitable ways, by which it is fed up in line with the cutter head, the feeding being performed by a rack and pinion movement, placed in the central space of the bed piece, and actuated by a short counter-shaft and a hand wheel placed at about the middle of the machine, as shown.

At each end of the carriage are clamping jaws drawn together by hand screws, as shown. The axle being held firmly in these jaws is fed up to the cutter head by turning the side hand wheel, as above described.

The cutter is made on the same principle as the tool ordinarily used by wagon makers for turning spokes.

This tool is said to cut knotty or crossgrained wood smoothly. The method of adjusting the clamping jaws permits adjustment to secure the proper gather and pitch in the wheels, while the axle is cut to the exact length required. Of course the machine, being once set, will cut all the axles alike, so that the same gather and pitch will be obtained on all.



MACHINE FOR TURNING THE ENDS OF AXLETREES.

The machine is stoutly built entirely of iron, and weighs 1,000 pounds. The manufacturers claim that it will turn out 200 axles in 10 hours.

Patented June 8, 1869. Address, for further particulars, A. Booth, Son & Co., manufacturers of carriages, buggies and wagons, Springfield, Ill.

SCHOPP'S PUSH CHAIR OR ICE VELOCIPEDE.

Our engraving shows a push chair, styled by its inventor and patentee, Philip J. Schopp, of Louisville, Ky., an "ice velocipede." It is a cross between a camp chair and an ice boat, and is constructed so that it may be folded into very small space, as shown at the bottom of the engraving.

Fig 1

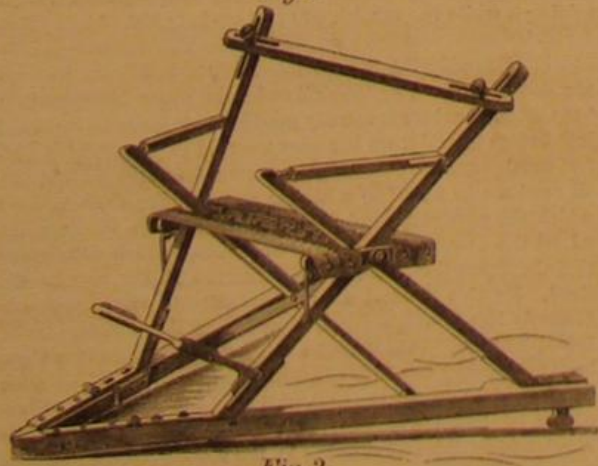


Fig. 2

The seat is flexible, and may be made wide enough to accommodate two or more persons. A convenient support for the feet is also provided, as shown in the principal figure in the engraving, representing the velocipede in readiness for use.

The bottom frame is triangular, like that of the ordinary ice boat, the apex of the triangle resting upon a skate runner, while the rear corners run either on skate runners or rollers (the former being preferred), making it very easy both to propel and guide. Loaded to its full capacity it may be pushed at rapid speed by a single skater, who only employs one hand to push and guide it. A boy ten years old may, it is stated, push it easily when an adult occupies the seat.

The back rail offers a capital support for ladies while learning to skate.

By the use of a double hinge the runners may be made so that they can be set parallel for use on the streets.

On the whole, we judge this invention will be received with favor by all fond of ice sports. The entire apparatus, when folded, strapped together, and placed in a suitable canvas bag, weighs only about five pounds.

It is covered by two patents dated as follows: February 9, 1869, and October 18, 1870.

For further particulars, address Philip Schopp, 445 Jefferson street, Louisville, Ky.

International Exhibition in London.

The exhibition is now in full operation, and attracts much attention; but it is not a mechanical exhibition. Textile and pottery subjects are among the principal industries that are represented. Says *Engineering:*

Conspicuous amongst the machinery in motion connected with the pottery department, is Pinfold's brick, tile, and drain pipe machine. This latter, to which the first prize of its class was awarded at the Oxford meeting of the Royal Agricultural Society, cuts the clay as it is carried forward on an endless band, in a continuous stream from the pug mill, by means of a series of radial wires stretched upon a large wheel, which travels at the velocity required to cut the bricks to size, and which is set at an angle, to counteract the forward motion of the clay, and to insure a square cut. The several potters' wheels exhibited attract great attention, owing, however, to the fact that operators are constantly at work on the wheels, molding rapidly with skilful fingers, and with enviable facility, vessels of all descriptions. The manufacture of tobacco pipes is shown, Mr. W. T. Blake and Messrs. Southern & Co. being the exhibitors, and the operators show as much dexterity in producing these articles of universal use, as do the potters near them.

Thirty gross of short pipes is the average production of each man's work during six working days of ten hours each, being at the rate of seventy-two per hour. Of course this does not include the production of the clay blanks, nor the subsequent trimming of the edges which is required, but it comprises the various operations of piercing the blank stems, covering them with a coating of paraffin, placing them in the mold and lever press by which the bowls are shaped and hollowed out, and cutting out the dead head of clay which is squeezed out by the press.

Minton & Co.'s stamping press for producing mosaic bricks is worth noticing. Slabs from 1½ inches square, used for flooring tiles, down to the minute pieces employed for delicate mosaics, are made here. The machine is a vertical screw press, in which are fitted dies corresponding to the size and shape of the small tiles required; for the smaller sizes four or five dies are grouped together. These dies, when they are depressed, pass through openings in a circular metal table into matrices below. The clay, finely pulverized and colored by different pigments, as desired, is heaped upon the table, and a small portion is swept into the matrices by hand at each downward stroke of the press. With the backward stroke, by a motion of the foot of the operator, the matrices are raised, and the slabs of compressed clay are thrown out and placed on one side to be submitted to the final processes.

A Foreign Tribute to American Mechanics.

A few weeks ago the London *Times*—universally considered the ablest and most influential paper in all Europe—published the following significant comment on the wane of British manufactures:

"At this moment, Birmingham is losing its old market. A few years ago it used to supply the United States largely with edged tools, farm implements, and various smaller wares. It does so no longer, nor is the cause to be sought merely in the American tariff. It is found that the manufacturers of America actually supersede us, not only in their own, but in foreign markets and in our own colonies, and the Birmingham Chamber has the sagacity to discover, and the courage to declare, that this is owing to the superiority of American goods.

"High as are the wages of an English artisan, those of an American artisan are higher still, and yet the manufacturers of the United States can import iron and steel from this country at a heavy duty, work up the metal by highly paid labor, and beat us out of the market after all with the manufactured articles. How is that to be explained?

"The Americans succeed in supplanting us by novelty of construction and excellence of make. They do not attempt to undersell us in the mere matter of price. Our goods may still be the cheapest, but they are no longer the best, and in the country where an ax for instance, is an indispensable implement, the best article is the cheapest, whatever it may cost. Settlers and emigrants soon find this out and they have found it out to the prejudice of Birmingham trade."

YOUNG'S IMPROVED HOT AIR REGISTER.

This invention is an illustration of the fact that a very slight change in form will sometimes add greatly to the utility and convenience of articles in common use.

The engraving shows the nature of the improvement so clearly that no letters of reference will be required.

The first improvement consists in hinging the register to a frame, as shown. This permits the removal of dust, and allows the register to be swung open, so that the feet can be placed in the flue for warming them. Also articles for the nursery and sick room can be set therein and conveniently warmed.

The second improvement consists in attaching the exterior frame molding, by screws, to the retreating part of the frame which is set in the arch; one screw being placed at

each lower corner and one at the middle of the arch at the top, as shown. This allows the front molding and register to be attached after the plastering and painting is done in new buildings, so that its finish is not marred by droppings from the brush or trowel. It also admits of taking off the register and front molding during the process of house cleaning. The application of these improvements does not affect the general ornamental design of such registers. Patented April 25, 1871, by William Young, of Easton, Pa. For further information address either the patentee, as above, or the Tuttle & Bailey Manufacturing Company, 74 Beekman street, New York.

THE APPLICATION OF STEAM TO CANALS.—NO. 2.

BY GEORGE EDWARD HARDING, ESQ., C.E.

In 1472, long before canals, attempts had been made to substitute for the manual labor of oars, the propulsion of boats by wheels moved by oxen; while, on the 17th of June, 1543, with a precision of date which throws much doubt on the probability, the Spaniards claim the construction of a steam-moved vessel. Mention of galleys driven by side wheels are found in the years 1578 and 1587; while, in 1618, David Ramsay obtained a patent from the Crown to apply engines "to make boates for the carriage of burthens and passengers runne upon the water as swift in calms, and more saff in storms, than boats full sayled in great windes;" and again, in 1630, was issued to him a second patent, for a similar purpose.

The many schemes for propelling boats which have been carried to a further or less degree of experiment or practical use since Ramsay's day, are too curious not to be classified, and, at the risk of tediousness, the manner and means for obtaining power of various kinds are enumerated:—From wind, by sails, kites, balloons, and windmills, on deck; from oars, worked by men, animals, and steam; from paddle wheels and screw propellers, placed in every possible part of a vessel, and variously constructed and driven; from the vessel's motion, and from the motion of mercury: from the current-operating machinery on board; from springs and from weights, differently operated; from the explosion of gunpowder, and from gases, either generated or exploded; from the discharge of steam, compressed air, and from falling water. Electricity is to afford the motive power in six instances; while an endless chain, lying upon the bottom of the canal, and passing over various parts of the machinery, has strong advocates. Some haul the craft along by a rope fixed on shore, and some again by a smooth or rack rail on the banks, with which wheels driven from the boats engage. Thirteen sanguine inventors claim that a locomotive moving along the canal, and towing after the manner employed by horse boats, is the only solution of the vexed question, while nearly as many believe that an atmospheric railway is the only system suitable. The larger number of workers in this field have affected the direct discharge of water at the stern as the greatest good; a less number, by the discharge of air in various ways. One by discharging fire under water is peculiar, though hardly so curious as Congreve's device of sponges for propelling a vessel by capillary attraction. Several of the earlier motors were to achieve their end by thrusting poles against the bottom of the canal; two by water in a tube on the shore, suitably connected with the boat. Bourne and others advise either wheels rolling on the bottom, or the adoption of screws so working, which seem to have many disadvantages; but the action of reciprocating rods, armed with fixed floats or valved pistons, shaped as wedges, cones, or as hollow vessels, and worked at the sides, or under the bottom of the boats, either in or out of channels, has always been a favorite plan, opposed again by a numerous class, who allow the reciprocating motion, but insist that movable floats only can succeed. Variations of this last consist in hinged boards and collapsing propellers, operated in divers ways, while some, in their search for novelty, call all the others wrong, and place the floats at once upon an endless chain, by which they hope to use less power and gain more speed. Water or steam, acting in flexible tubes, ends the list. Among all our counsellers, whom shall we select?

Some of these devices are deserving of more than such wholesale notice, and we will particularize a few of the more prominent.

Passing over one hundred and fifty years, during which time we have the invention of the steam engine, and the early labors of such men as Papin, Savory, Jonathan Hulls, James Watt, and Symington, we reach the invention of Patrick Miller, who, in 1787, especially claimed an application of machinery for the purpose of inland navigation. His invention comprised either double or triple vessels, having two or three separate hulls, with one deck over all, with paddle wheels, of any required number, placed in the space between the hulls, so as to be submerged to an advantageous depth. Originally designed to be operated by a capstan, worked by a windmill or manual power, the arguments of Symington, who applied the steam engine, changed the original idea of motive power, and successful experiments were made, in the summer of 1788 and the winter of 1789, upon the Forth and Clyde canal, where a speed of nearly seven miles an hour was obtained. Notwithstanding this success, it seems that Mr. Miller did not consider the invention as practical, since, in 1796, we find Miller again applying for a patent for the construction of vessels propelled by wheels worked by capstans, as in the original scheme.

In 1788, John Fitch, an American, obtained a patent from the States of Pennsylvania, New York, New Jersey, and Delaware, for the application of steam to navigation, and also opposed the application of James Rumsey, for a similar patent, the same year. Fitch succeeded in driving his steamboat eighty miles in one day, by means of six oars, or paddles, working perpendicularly on each side of the boat, similar to the strokes of the paddles of a canoe; but his invention came to no practical use.

Rumsey, who had been refused a patent in his native country, came to England, and, in November, 1788, obtained letters patent of Great Britain, for propelling boats on rivers and canals, by alternately moving a valved box backward and forward under the keel of a vessel, by means of his steam engine. The box opened toward the stern, was provided with a valve at the forward end, which, opening as the box moved forward, allowed the water to pass freely, but, closing with the opposite movement, propelled the boat ahead. A second part of his specification describes an arrangement for drawing water at the bow into a hollow, longitudinal trunk, parallel with the keel, and discharging the same at the stern, by the reciprocating strokes of a large pump. Rumsey also devised two wheels, projecting from the bow of a canal boat, which carried an endless chain with floats. The current was supposed to actuate this mechanism, which, by operating a series of poles for pushing against the bottom of the channel, propelled the boat. The similitude of the plan with that of a man lifting himself over a fence by the straps of his boots, is obvious. The death of Rumsey, in 1792, prevented any practical application of his inventions, though his associates, in the spring of 1793, obtained a speed of four miles per hour on the Thames, from a boat arranged upon his pump system, as described, which boat Rumsey had nearly completed at the time of his death.

Next in order, in the year 1801, Mr. Symington was employed by Lord Dundas to experiment, with the view of substituting steam for the horse boats on the Forth and Clyde canal. After two years experimenting, and at an expense of over £7,000, the *Charlotte Dundas* was completed, and launched on the canal in March, 1803. In this boat were first combined all the principal features of our modern paddle wheel steamers, namely, the double reciprocating engine, with connecting rod, and the crank on the axis of the rotary paddle wheel. The paddle wheel—for there was but one—was placed near the stern, in the center of the boat. This seems to have proved a perfect success in regard to self propulsion and towing of other boats; but, though the efficacy of the system was proved, the opinion of the canal proprietors, that the waves it created would damage the banks, prevented its adoption. Notwithstanding the decision of the Forth and Clyde managers, the Duke of Bridgewater, after a careful investigation of the advantages and the supposed drawbacks, gave Mr. Symington an order to build eight boats similar to the *Charlotte Dundas*, to ply on his canal; but the death of the Duke, soon after, prevented the execution of the scheme, and poor Symington and his canal navigation were neglected together.

The ingenious experiments of Stevens, Evans, and Fulton, in America, about this time, being applied for purposes other than canal propulsion, do not particularly concern this narrative; for although, in 1796, Fulton published in London a treatise on canal navigation, wherein he advocates raising and lowering boats by steam inclined planes, yet he makes no mention of steam boats therein; though in January, 1803, he described some experiments with paddle wheels, as more advantageous than the system of chaplets, or endless bands of floats for propeling a system of boats, which were designed to be formed with bows and sterns convex and concave, so that several would form a line with almost continuous sides. Yet he does not seem, even after his practical success on the North river, in 1807, to have again advocated steam for canal uses. In later years, this arrangement of boats has been revived again and again.

Richard Trevethick and Robert Dickinson took out a patent in 1809 for moving an oar, provided with valves, forward and backward in a channel under a boat; and two years later, one Rose received a patent for constructing a canal boat, with water courses open to the water below and at each end, with two or more paddle wheels and cranks acting on the water. No drawings of these plans are known to be in existence. In the same year were also granted two patents for propeling boats by discharging water at the stern by means of a steam pump, similar to Rumsey's principle, but no experiments are noted.

In 1812, but one patent was issued for improvements in canal navigation, where endless bands traverse over wheels at the end or sides of a vessel, and carrying hinged floats to act on the water when propeling the boat, but caused to lie flat on the reverse stroke, in a manner not plainly described.

In the following year, we find an invention by Thomas Mead, who proposes a double endless chain, moving around two wheels, above and below two parallel tubes; on the chain belt are series of pistons, packed so as to pass steam tight through the tubes. Steam from the boiler forces the pistons continuously along one tube, at the end of which they are successively detained and released by catches, and pushed forward a small distance by eccentrics. The steam escapes by a hole in one of the tubes, which is uncovered at proper times, as the pistons require.

In 1815, Richard Trevethick patented a screw propeller, consisting of a worm or screw, or a number of leaves placed obliquely round an axis, which revolves, preferably within a cylinder, at the head, sides, or stern of a vessel. In some cases the screw is to be made buoyant, and works in a universal joint, the advantage of which construction is hard to perceive.

John Millington, during February of the year 1816, lays claim to a propeller more modern in its features than any preceding. He also claims forcing air into tubes, which operated against the water at the stern to propel the boat. In the same year, we have an arrangement with several cranks on the side of a vessel, connected with each other by horizontal connecting rods, upon which are placed vertical vanes of a curved shape, so as to act upon the water by the revolution of the cranks one way (but carried forward above the surface); and in the next, a method of propulsion by operating oars, held vertically at each side of the boat, in a similar manner to Fitch's earlier experiments, except that, by means of cog wheels, the oar blades were feathered, to pass edgeways through the water during the return stroke.

About the same date, Niece proposes propeling a boat by the pressure, on the water, of the gas and rarefied air produced by the inflammation of the essential oil of resin, injected at intervals into an air reservoir and then ignited. The gases pass through tubes, provided with valves, into a well, from which they expel the water with force along a tube opening below water mark at the stern of the boat. By the use of two receivers, and by spiral blowers, refilling the air reservoirs, the propulsion is effected more evenly.

MANUFACTURE OF VARNISH IN ENGLAND.

[Condensed from the English Mechanic.]

The varnish we shall more particularly describe is that made by intimately mixing gum copal with linseed oil and diluting the mixture with turpentine—the preparation of which requires no small amount of care and attention, and attention, and was formerly attended with no little danger from fire. Copal is a resin found exuding from the *Rhus copallinum*, a tree growing in several parts of America, and from the *Elæocarpus copallifer*, a tree found in the East Indies; it is also imported from the coasts of Guinea. The two latter kinds are generally allowed to be the best, and are commonly known as African.

The object to be obtained in the preparation of varnish is to impart to it a quick-drying property, retaining at the same time transparency and elasticity. To secure these characteristics great care is necessary, in melting the gum, in boiling that and the oil together for the requisite time and at the proper degree of heat, and in the complete solution of the resinous matter employed. To achieve these results a pure and limpid sample of oil is generally chosen, which is placed in a copper pan holding from 80 to 100 gallons, and heat gradually applied till the scum rises, after removing which the oil is allowed to boil for about two hours, when it is dosed with calcined magnesia in the proportion of an ounce to every four gallons of oil, but added by degrees and with occasional stirrings. This being completed, the oil is again boiled briskly for about an hour, and then, the furnace being drawn, allowed to cool. When the temperature is sufficiently reduced, it is removed to leaden cisterns, where it is stored till fit for use.

Under the old system of making varnish, the gum pot and oil pot were open to the atmosphere of the shop in which the operation is performed; but the vapors arising during the process are now either taken into the furnace shaft, or condensed into liquid by suitable refrigerators. The *modus operandi* is somewhat as follows. The oil being placed in its boiler and approaching the requisite degree of temperature—namely, that at which the gum melts, the copal is placed in its copper, about 10lb. being the usual quantity fused at a time. In a few minutes it begins to melt, and gives off unpleasant vapors. When thoroughly melted and clear, a portion of the oil is added, and the mixture boiled and stirred till of the proper consistency; it is then taken and emptied into the boiling pot, from which the requisite quantity of oil for the following charges of gum has been previously withdrawn. The gum pot being thoroughly cleansed, another portion of the gum is placed in it and melted in a similar manner to the first, and so on, till sufficient gum has been fused for the quantity of oil prepared. The whole is then placed on the furnace and boiled till a scum rises and spreads gradually over the whole surface, which then froths up rapidly in the same way as boiling milk, and must be instantly removed, when the scum being stirred down, the dryers are added, a little at a time, and the boiling continued till the mixture feels stringy to the fingers. The boiling pot is then removed from the fire, and when sufficiently cool, turpentine is added till the desired consistency is attained, when the varnish may be placed in the storing tanks. Formerly a great waste of turpentine took place by evaporation through mixing it while the varnish was still too hot; but of late years a vast improvement has been adopted in this respect, and it has been practically demonstrated that not only is there no necessity for "boiling" the oil and gum after incorporation but that the produce is equally good if the turpentine be added just before the mixture becomes too cold to permit of a perfect amalgamation. In fact, it is now acknowledged that the oil need not be raised to a higher temperature than that at which the gum employed fuses, and that when the two are mixed the lowest possible degree of heat which will insure their incorporation, is sufficient to secure all the results desired. By this method a large quantity of the turpentine formerly lost in evaporation, is saved and there is, moreover, less risk of fire. It is indeed a moot point whether it is absolutely necessary to add turpentine in quantity at all, as even when the loss during the preparation of the varnish is reduced to a minimum, a still further reduction occurs whilst the varnish is ageing and clearing in the storing tanks, and it is sometimes found necessary to thin it before it can be used.

To prevent the workmen being distressed by the pungent odors of the melting gum, in modern varnish factories the boiling and gum pots are placed close together, and by means of caps and heads (provided with openings to facilitate stirring,) the pots are connected with chimneys which carry off all vapors into the smoke shaft, or to the condensing tanks. A close fitting cover is also provided for the boiling pot to extinguish the flames in case the oil should take fire—a great improvement on the old fashioned carpet, which an assistant stood ready to throw over in case of accident; while tramways are laid down so that the boiling mixtures can be rapidly conveyed into the open air in the event of firing, and for the purpose of cooling before the addition of the turpentine.

MECHANICAL TESTS.

[Condensed from the (London) Artizan.]

We certainly possess great facilities for applying various kinds of strains to any samples we may desire to experiment upon; but experience shows that, although a sample of material may withstand a certain test once or twice, yet at some future, and perhaps not very distant, time that same sample will rupture under a strain not equal to that applied at the time of testing, but considerably below it.

Some engineers have a great objection to iron which stretches notably previous to its fracture, but for purposes where the structure, in which the iron is used, is liable to alterations of strains, producing vibration and concussion, this description of metal is decidedly preferable. Good bar iron for girders and bridgework may stretch nearly, but not more, than one inch per foot previous to fracture, and ultimately break at about 23 tuns to 25 tuns per sectional square inch. Iron which will not stretch much is usually hard, and of less ultimate strength than the softer material here alluded to. About three quarters of an inch, as the ultimate oblongation per foot, may be very fairly specified for the class of work to which we are alluding, but there should be no perceptible permanent elongation (or permanent set, as it is more commonly called), until the strain has reached at least 10 tuns per sectional square inch.

In stretching, the bars or pieces of plate necessarily become reduced in sectional area, and it may be worthy of notice that they contract chiefly in width, and scarcely at all in thickness, if they be tolerably thin, which is probably due to the position in which they are rolled in the iron mill; for the thickness of the bar or plate being determined by the distance of the rolls between which it is drawn, and its being squeezed through such rolls, it follows that the various layers or lamina of metal are pressed very close together, so as to strongly resist being brought into nearer proximity, whereas there being little or no pressure laterally upon the bars, the fibers are not in this direction so closely packed; thus the bar becomes narrower, more readily than thinner, than it was previous to being submitted to the process of testing.

In testing structures or machines of any description, especial care should be taken to guard against over testing, and no test should ever be applied much in excess of the greatest strain to which the material will be subjected in ordinary work; for if the iron be once injured, the injury will be continually augmented by even moderate loads, and at last the work will give way under a strain perhaps one half of the test load originally applied. In fact, we have no doubt that in many cases of accidents which have occurred even after years of satisfactory working, the cause of disaster is to be found in original over testing of the metal, inaugurating a slight flaw or lesion of fiber which has gradually, but surely, increased, until at last the sectional area of the metal which remains is insufficient to do even its ordinary duty.

The safe working strain on iron is about one half of that load which produces the first permanent set, and this, as we have stated above, should not occur under less tension than ten tuns per sectional square inch, or say 20,000 lbs., hence the safe working load in tension of plate and bar iron may be taken at 10,000 lbs. per square inch of sectional area. In compression the permanent set should commence at about 16,000 lbs. per inch, therefore the safe working load would be taken at 8,000 lbs. per square inch of sectional area.

Now, let us see what is the proper course to pursue in testing material of which it is proposed to construct bridges or other works in iron. First, as to the terms of the specification, let us assume that the iron is not to stretch more than three quarters of an inch per foot before rupture, and not to break under 44,000 lbs. per sectional square inch. In the first place, portions taken from plates, flat bars, and angle and T irons for the purpose, should be tested, in order to ascertain their qualities; this done, the iron used in the work should be examined carefully to see that there are no visible flaws in it; and if there be large masses of metal, the fire test or the magnetic test may be applied to ascertain if there are within it any imperfect welds, or "cold shuts" as they are technically termed; and when the work is complete, it should be finally tested by loading it with the greatest load that can ever come upon it. This load should be left upon it long enough to allow the rivets, bolts, etc., to take their bearings (say twenty-four hours), after which it should be removed, the permanent set due to imperfect joints noted, and the load applied again, on removing which there should be no further permanent set notable. It may, however, in some cases happen that the joints will not all come down at the first loading; but there is a point in every structure at which it will cease increasing its permanent set with recurring loads, if it should be sufficiently strong to do its ordinary duty satisfactorily.

Thus, to take an example, to show how over testing may lead to subsequent accident, although at the time no injury is visible from the test applied; let it be determined to test some iron to 15,000 lbs. per sectional square inch, and suppose there is a flaw in the metal which loses one fourth of its area, then the actual strain per square inch on the remaining section will be 20,000 lbs.; hence on that part the point of permanent elongation is reached, and in the course of time successive loads continue to stretch the metal until at length it gives way altogether. Now, if that metal had only been tested to a little over 10,000 lbs., the load which it was intended to sustain ordinarily, the metal would not have been injured even at the defective place, but would probably have done its work satisfactorily. On the other hand, it may be said that perhaps the load of 10,000 lbs. might start an injury on some part of the structure—and even that might be the case—but still it is useless to run unnecessary risks of depreciating the strength of the material.

While speaking of the inutility of severe tests, we may refer to an accident which occurred some time since to a large chain, of the description known as short-linked. The chain in question was tested to a load of over sixteen tuns gross weight, and a few weeks after snapped under a load which did not exceed eight tuns. The fractured link exhibited a cold cut, showing that half the area of the metal in the link was lost. A portion of the same chain tested to fracture showed an ultimate strength of over twenty-five tuns gross load.

In our opinion, in respect to the question of chains, a portion of any given chain should be cut off and tested to its breaking strain, and the remainder, or that part which is intended to be practically applied, should be tested to a load but slightly exceeding that to which it will be habitually exposed; and subsequently it should be submitted to the fire test, which is conducted as follows: The chain is gradually passed through a smith's fire, and every link carefully examined when at a clear red heat, water being poured on each link, when any defective shut is sure to show itself, and all defective links must be then cut off and replaced by sound ones. With chains thus examined we have never had an accident in use, but have sometimes found two or three bad links in one length which had passed the ordeal of a licensed testing house, thus showing that the ordinary chain test (unfortunately too much relied upon) is, in a practical sense, no guarantee at all of the safety of the chains tested; which, by the way, might be further instanced had we space to multiply examples.

The remarks made above on the over testing of iron girders will of course equally apply to wrought iron boilers, and, indeed, it seems absurd to test a boiler up to a pressure of eighty or ninety pounds per square inch, which in actual working will never contain more than thirty lbs. per inch, and this is another instance of trying to be too sure.

We will now pass on to the question of testing cast iron girders. Here it may very easily be shown how important it is that the metal should be sufficiently elastic to allow of a notable amount of deflection before fracture, and more especially if the case of a sudden concussion be taken for example. If a body fall a certain distance, it acquires a corresponding amount of accumulated work, supposing there has been no resistance to its motion while falling, and this work is represented by its weight multiplied into the distance through which it has fallen. Let the weight equal 10,000 lbs., and suppose that the hight of its fall is forty inches, then the amount of accumulated work acquired by the mass during its fall will be—

$$10{,}000 \text{ lbs.} \times 40 \text{ in.} = 400{,}000 \text{ inch lbs.},$$

that is to say, work equal to 400,000 lbs. raised one inch high.

Let us now assume that there are two cast iron girders of equal ultimate strength; that is to say, that they will both break with the same weight laid upon them gradually, but that one deflects two inches and the other three inches previous to rupture; that is to say, the latter deflects under a given load fifty per cent more than the former; we shall find the one that deflects most suffers least from the blow of the falling weight. The amount of accumulated work in a body being known, and the distance through which it has to pass in expending such work, the force or pressure is ascertained by dividing the accumulated work by such distance. Now, the distance through which the weight has to pass is represented by the deflection of the girder, consequently in the two cases we have the following means, loads, or pressures on the girders: First girder.—Mean load due to concussion $= \frac{400{,}000}{2} = 200{,}000$ lbs. Second girder.—Mean load due to concussion $= \frac{400{,}000}{3} = 133{,}333$ lbs.

Hence the girder which deflects most suffers least mean load from the fall of a weight upon it, and what is true of a concussion thus produced must be true of all concursions.

TOOLS FOR CUTTING METALS.

[Condensed from the Mechanic's Magazine.]

Tools made of inadequate material, improperly fashioned, and wielded by unskilful hands, will inevitably cut a channel through which an employer will readily glide into the Court of Bankruptcy. It is seldom perhaps that such an unfortunate combination of evils is found to exist in any single manufactory, but one or other of them is generally present. Experience has undoubtedly furnished many valuable lessons as to the best kinds of steel for cutting tools, and the proper way to treat and form them, but the teachings of the monitor are not always understood, and are variously interpreted by different learners. Uniformity of practice is perhaps too much to hope for, but it is strange that what is pronounced to be excellent in some instances is denounced as very bad in others, and that neither masters or workmen are agreed as to a specific method of dealing with the questions involved. Much contrariety of opinion obtains, for example, as to the advantage or otherwise of using tools which have been forged entirely from the solid bar, as compared with those which are retained by, and therefore detachable from, holders. Some assert that small portable cutters of the latter description, and especially if they be made—as they usually are—from round bar steel, are the reverse of being serviceable or economical. They are said to wear very fast on the clearance side, whilst the top edge sustains comparatively little deterioration. If this be so, it is a fatal barrier to any system of machine grinding, and necessitates that this kind of reparation be performed by hand. Here if the statement be true is a manifest disadvantage, involving the expenditure of extra time and money. *Per contra*, it is asserted that separate cutters may be worked with more economy than solid forged tools, since the former can be worked down to a much shorter length than the latter, before being laid aside. This indeed is incontestable, but, say the "solid" men, general and heavy work cannot be effected by such appliances, although light and special tasks may be accomplished by their agency.

In the portable tool, the section need not be so large as in the case of the solid forging, and thus where great quantities are used, the stock of steel held in reserve may be smaller. The economy here of course is obvious, but the "separatists" further advance that, as the solid tool must be cut from a square or rectangular bar, it must also be forged into shape before use, and the operation will have to be repeated again and again ere it is used up. Separate tools do not require forging at all, since whatever section of steel be employed, it is only necessary to select a bar that is uniform, cut it into proper lengths, and then harden and grind the ready made cutters. These and similar practical considerations are, beyond doubt, worthy of attention. Probably it may be discovered eventually that the advocates of solidity and separation are like the travellers with the chameleon, all right and all wrong. Much depends upon the class of work which has to be produced. The happy medium consists in selecting the right tool for the right work, just as we wish to see, in a wider field of action, "the right man in the right place."

There are, however, other phases of diversity in regard to metal cutting tools. Separate cutters made from round bar steel have their advocates, whilst the tools of triangular form are not without supporters. The latter assert that such instruments as the last named, may be made to produce work of a finish superior to that obtained by the use of tools made from round bars. Tools presenting large cutting areas, on the contrary, it is urged, cannot be made to yield the evenness of surface which results from the application of angular and smaller cutting edges. This test of character, however, will greatly depend on the amount of feed or traverse given to the tool, as a coarse or fine pitch with either kind of tool may be made to produce surfaces uneven or smooth; at least one of the largest firms in England manufacturing agricultural engineering work, celebrated for the excellent quality of its machine work, and whose aim has been to minimise the duties of its fitting shop, has adopted the separate cutter plan, the tools being made almost uniformly from round sections.

With regard to the cutting angles of tools, there is less divergence of opinion than exists upon the points above indicated. As a rule, an angle of 50 deg. for wrought iron, and of 60 deg. for cast iron and brass, are the standards adopted, and this arrangement is no doubt the growth of successful and general experiment. Careful grinding is a question perhaps not sufficiently heeded in some establishments, yet it is one of moment to all concerned in the economical performance of the operations of turning, planing, and shaping metal. The cutting edge of a tool is in appearance, as it is in action, the counterpart of a wedge, and when that edge is well and properly maintained, the resulting work will be far better finished than if the reverse be the case. Sir Joseph Whitworth long since introduced a plan of grinding tools by mechanical means, and which has answered well. The stones in this arrangement are fitted on movable seats, whilst the tool is held in the proper diagonal position for giving it its right cutting angle. Some firms have gone so far as to make the grinding of tools a distinct branch of their works, and to appoint a general grinder for the whole of each establishment. This is for several reasons, as it seems to us, a questionable course of action, but its advisability or otherwise must of course be determined by those who are most interested in the results of such experimentation.

In due time the best form of tools, the best material of which to make them, the best way to keep them in repair, and the best way of using them, will possibly determined and adopted by universal consent; meanwhile more light upon all these points is needed.

Circular Saws for Stone Work.

A most important addition to the means for working stone, which art has hitherto advanced very little since the creation, has been proposed by Mr. J. E. Emerson, now residing at Pittsburgh, Pa, the inventor of the movable toothed saw. Mr. Emerson's inventions have been described in our columns, and numerous contributions, of a highly practical and valuable nature, have appeared in this journal, and are familiar to our readers.

With the sagacity of a practical man, Mr. Emerson saw that to avoid the difficulties which have arisen in cutting stone, either by steel or carbon points, the saw teeth should be of the pattern of a mason's chisel, and capable of being varied in position, that new faces of the tool may be applied as the work progresses, and the tooth becomes partially worn. The saw has to be run very slowly, and the teeth must cut away chips of regular size. The effectiveness of the invention is increased by the simplicity with which the teeth can be changed, a new set being inserted in less than three minutes. Mr. Emerson has taken out a patent which covers the use of adjustable, revereible, and interchangeable chisels or cutters, for sawing stone, also the use of adjustable diamond or carbon holders, the use of diamonds or carbons alternated with the chisels, and the manner of fastening them in the saw plate.

THE average length of passage of the steamers in the East India jute trade, plying between Calcutta and Dundee, Scotland, is 56½ days, being several days less than one half that of the sailing vessels.

THE ILLINOIS AND ST. LOUIS BRIDGE.

[Condensed from the Report of the Chief Engineer, Capt. James B. Eads, C. E.]

On the twenty-sixth day of February, 1870, a contract was made with the Keystone Bridge Company of Pittsburgh, for the construction and erection of the superstructure of this bridge, including that of the approaches. By this contract the company agrees, under a severe forfeiture in case of failure, to complete the structure ready for use in all its parts in seventeen months from the time working drawings were furnished to it, provided it is not delayed by masonry work after the first of March 1871. In case of such delay, the time of completion was to be extended no longer than the time the company was so delayed. Completed working drawings were not furnished until the first of July, as the completion of certain parts of them was dependent upon data that were obtained from the testing machine, and which could not be ascertained at an earlier period. This delivery of drawings fixes the time for completion of the bridge on the first of December, 1871. Capt. Eads says in his report that he has no apprehensions that the masonry will not be completed in season to prevent any claim for an extension of time on the part of the Keystone Bridge Company.

The Wm. Butcher Steel Works Company, of Philadelphia, have contracted to furnish the cast steel that will be required in the work. Steel made by this company has shown limits of elastic reaction ranging from seventy thousand to ninety-three thousand pounds per square inch.

Capt. Eads has made several modifications in the general arrangement of the arches and in the details of their construction, since his original design, which will considerably improve the architectural appearance of the bridge and simplify its fabrication.

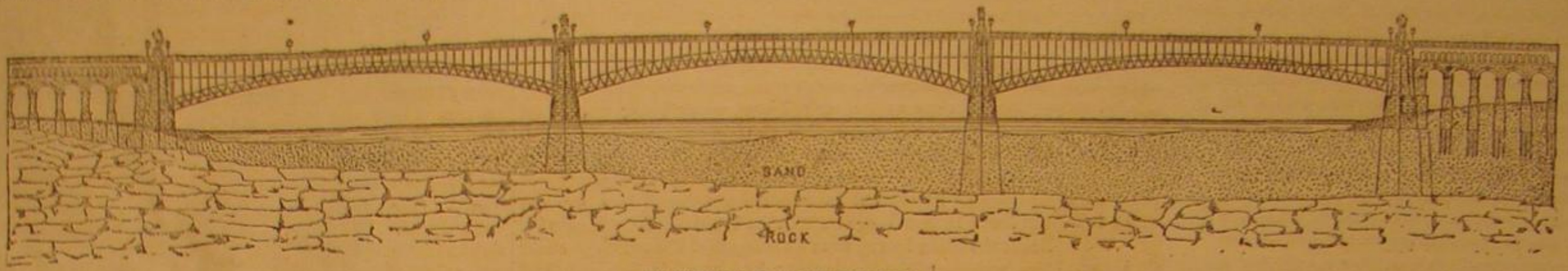
These changes consist mainly in using but one cast steel tube of eighteen inches diameter, instead of two of nine inches, in forming the upper and lower members of each one of the four ribbed arches composing each span; and in increasing the depth of each one of the arches from eight feet to twelve feet from center to center of these tubes.

The railways (which are below the roadway) are raised four feet, so that in no place will they appear below the arches, as they did in the original design. In that design the railways were eight feet lower than the center of the middle span. By deepening the arch four feet and raising the tracks four feet, they are brought level with the center of this span, or above the soffit of the arch. The lower ribs or tubes of the arches spring from the piers at their original level, consequently the arch has four feet less versed sine or rise than before. To lessen the grade of the railways it was necessary that the tracks should descend each way from the center of the middle span. This would cause them to fall below the centers of the side spans, to avoid which the level of the springing of these two spans has been lowered eighteen inches at each abutment. That is, the ends of the arches of the side spans resting against the abutment piers, will be eighteen inches lower than the other ends which rest against the channel piers. These arches, like the central ones, have four feet less rise than as originally designed, and by lowering their shore ends, as stated, an additional gain of nine inches depression is obtained at their centers, by which the gradients of the tracks are proportionally lessened towards the ends of the bridge.

Raising the tracks to the hight of the centers of the arches will unquestionably improve the appearance of the structure, and it is generally conceded that the alteration in the level of the springing of the shore ends of the side spans is likewise an architectural improvement. The effect upon the eye caused by it, will be somewhat similar to that produced by the camber of the bridge.

Of course these changes involved the necessity of revising the former investigations and results, so as to ascertain the difference in the strains, and to determine the alterations required in the sectional areas of the various members of the structure, when thus modified. An entirely new set of detail and general drawings was likewise required in consequence of these changes.

The view of the bridge in our engraving is a very correct representation of the structure, as it has been definitely determined upon, and as now being constructed. This view also shows the depth of the bed rock at the site of the different piers, and the depth of sand overlying it during ordinary stages of water.



ILLINOIS & ST. LOUIS BRIDGE

The True Philosopher.

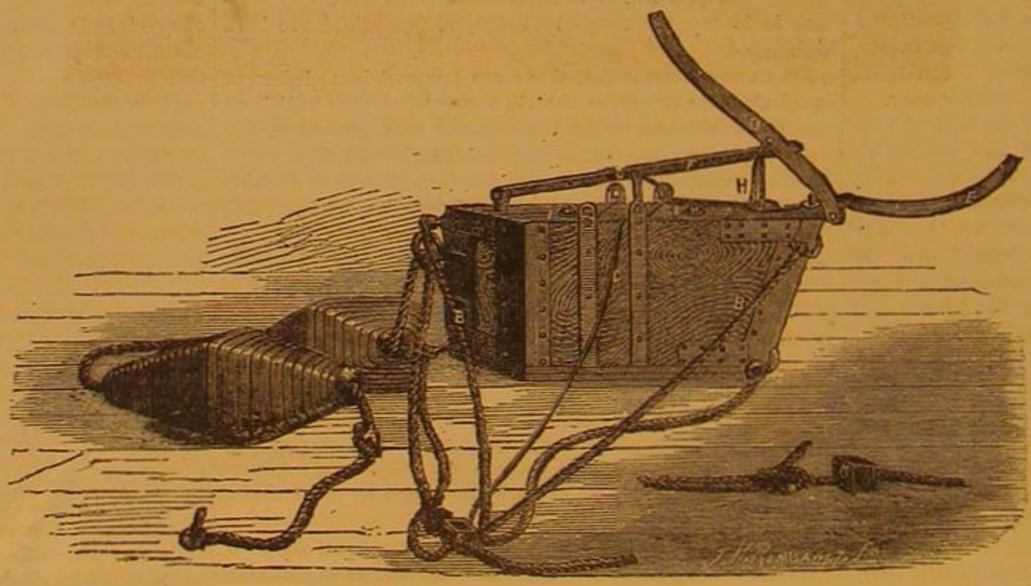
The character of the true philosopher is to hope all things not impossible, and to believe all things not unreasonable. He who has seen obscurities which appeared impenetrable in physical and mathematical science suddenly dispelled, and the most barren and unpromising fields of inquiry converted, as if by inspiration, into rich and inexhaustible springs of knowledge and power, on a simple change of our point of view, or by merely bringing to bear on them some principle which it never occurred before to try, will surely be the very last to acquiesce in any dispiriting prospects of either the present or future destinies of mankind; while, on the other hand, the boundless views of intellectual and moral, as well as material, relations which open on him on all hands in the course of these pursuits, the knowledge of the trivial place he occupies in the scale of creation, and the sense continually pressed upon him of his own weakness and incapacity to suspend or modify the slightest movement of the vast machinery he sees in action around him, must effectually convince him that humility of pretension, no less than confidence of hope, is what best becomes his character.—*Sir John Herschel.*

The Harvey Torpedo.

Our engraving shows a perspective view of the Harvey torpedo. It is shown in the position in which it is towed against an enemy's vessel, the torpedo ship, from which its movements are controlled, being a small, quick speed craft, so designed that the action of the enemy's shot will be of but little consequence to her when bow on. The casing of the torpedo is made of stout timber strengthened with iron straps at the ends and sides. The torpedoes are of various sizes, according to requirements; the one we have illustrated measures four feet six inches in length by two feet in depth and six inches in width. The torpedo, when being towed, has a divergence of 45° from the line of progression of the vessel towing it, which is due to the vertical plane of the torpedo being thrown at that angle by the manner in which it is slung. The tow line is seen at A in the engraving, B B being the slings which enable the operator to diverge the torpedo alongside the enemy's ship in meeting, parting, or crossing, whichever method of attack is adopted. C is the line by which the operator withdraws the safety key after the torpedo is well afloat. D is the top firing lever, and E, the side lever, either of which, when pressed, acts upon the after top lever, F, which, pressing down the exploding bolt, G, fires the charge. The top lever, D, acts directly upon the after top lever, the side lever being connected to it by means of the lanyard, H. This lanyard is reeved through the after top lever, and on to studs on the top lever, as a precaution against a back hit, which might part the levers, although such a hit could hardly happen. The eyes, D L, are for the purpose of attaching ropes for lifting the torpedo about.

The exploding apparatus, the firing bolt of which is seen at G, consists of a tube containing one chemical agent and a bulb holding another. The nature of these chemicals is such that when they combine violent combustion ensues, which explodes the charge. Its action is as follows: The after top lever forces down the exploding bolt, the bottom of which presses upon a pin in the bottom of a brass tube. At the bottom of the exploding bolt is a specially prepared composition, and a bulb containing an acid; the puncturing of this bulb frees the acid, and the combination of the chemicals effects the explosion. The composition embodies certainty of action when combined with the acid, and great explosive power. The charge in the torpedo under notice consists of either seventy-six pounds of gunpowder or 100 pounds of dynamite, which is inserted through the two loading holes, I I. These holes are first closed with corks, and afterwards with screwed plugs, as shown in the engraving. Although a somewhat small charge, it is nevertheless amply sufficient, as its full force is exerted upon the object of attack, the explosion only taking place by absolute contact. It may be as well to observe that there is hardly a limit to the size of these torpedoes. As the surfaces increase as the squares, and the contents as the cubes, a very slight increase in the dimensions would give a great increase of charge. The present charge, however, is considered ample with reference to the conditions under which it is employed, and the torpedo as at present made is of a very manageable size. The highly dangerous character of this torpedo demands that every precaution should be adopted to insure the safety of the operators. With this view Captain Harvey has devised a safety key, which is inserted through the stem of the firing bolt, G, and to which is attached the line, C. This line is attached by a split yarn to an eye of one of the iron straps on the side of the torpedo. When the weapon is clear of the operating vessel, the key is withdrawn by slacking the tow rope and holding fast the safety key line, which breaks the yarn and withdraws the key, which is then hauled on board.

It will be observed that two buoys are attached to the torpedo, and these are sufficient to insure its flotation at any given depth. They are attached to the tow rope, A, on the further side of the thimble, K, to which the slings are made fast. The tow rope passes through the thimble, and the buoy rope through a large eye fixed to the upper part of the torpedo. The object of this arrangement is to enable the torpedo to be cut adrift, should the necessity arise. The tow line being severed on board the torpedo vessel, the torpedo would at once sink, the line passing through the thimble and the eye, and, being attached to the buoys, could be afterwards recovered. Such an emergency might arise from a missfire in the torpedo, which would be dangerous to haul on board, but which would thus be easily cut adrift. The torpedo can be used either by day or night, the latter time being preferred.



THE HARVEY TORPEDO

In operating with the Harvey torpedo, a small vessel of great speed is used, from which the weapon is launched. The tow line is paid out from a drum fitted with a strap brake, the safety key line being run out from a similar, although smaller, apparatus. The torpedo on being set afloat at once diverges at an angle of 45° from the ship, and is thus readily towed against an enemy's vessel. It offers but little resistance in towing, and the experiments at Portsmouth, England, against the *Royal Sovereign*, and further experiments with the *Pigeon* at Plymouth, with blind torpedoes, showed that contact was invariably made low down, in some instances near the keel. The exploding apparatus never failed when proper contact was secured by a reasonable amount of speed in the torpedo vessel. We may here mention that this torpedo can be so arranged as to be fired by electricity if desired, a special circuit-closing apparatus having been designed for that purpose by Captain Harvey. In changing a mechanical to an electrical torpedo, the exploding bolt and its casing are taken out, and a tube is inserted containing the means of effecting electrical communication with the charge. This arrangement of the torpedo, however, is not so perfect as the mechanical, inasmuch as the firing wires are liable to be broken, should too great a strain be accidentally brought upon the tow rope containing the insulated wire. This torpedo is considered to be one of the most effective now in use.

We are pleased to learn, through our consul at Aspinwall, Chas. Erasmus Perry, Esq., that Mr. Charles E. Stewart has been appointed Master Mechanic of the Panama Railroad Company. Mr. Stewart has been connected with the mechanical department at Aspinwall for a number of years, and the appointment is his reward for abilities which the company rightly appreciate.

[For the Scientific American.]

WOOD-BORING BEETLES.

BY PROFESSOR E. C. H. DAY.

Nature has, at all times, to preserve carefully the balance of power among her subjects, so that she may everywhere maintain the largest possible amount of life. She is full of contrivances tending to this end, and has co-ordained the varied conditions of existence so beautifully, that her system is self-regulating. She wastes neither her material nor her time. We have already seen that it is a rule in her economy that decaying substances should not only be speedily made away with, but that they should, even in the process, afford sustenance to many forms of life.

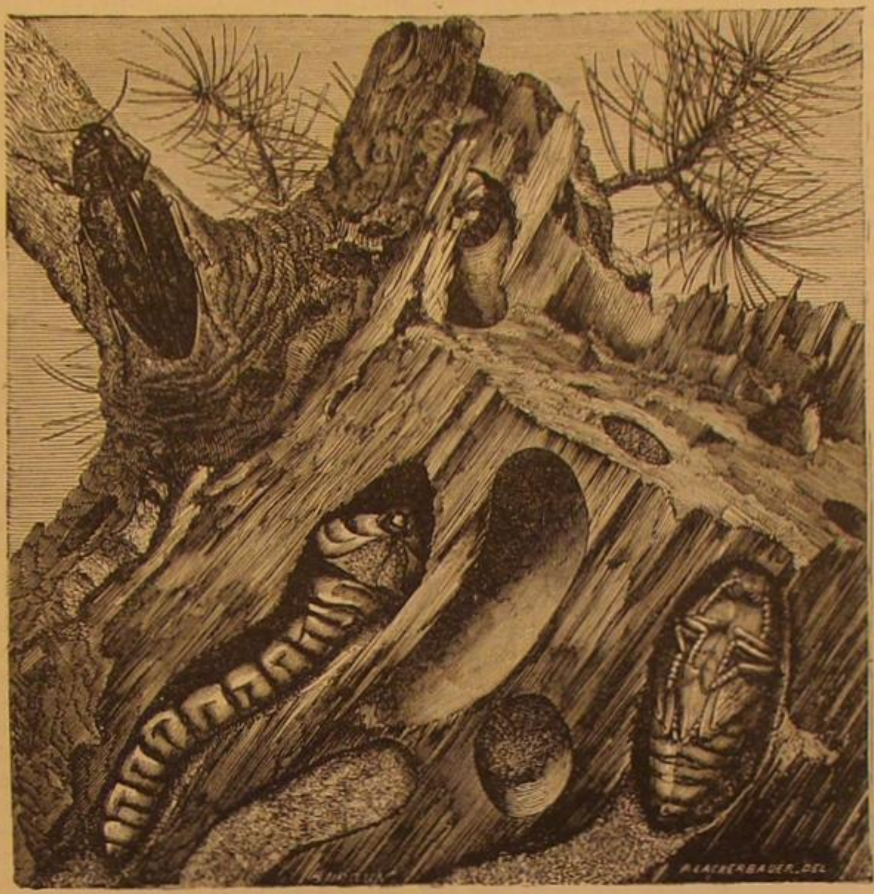
It is also a matter of fact, that every plant and every animal is perfect according to its kind, that is, not in itself, but in its relation to the rest of the design of which it forms an item. Every organism, therefore, directly or indirectly, living or dead, sooner or later, has to contribute to the existence of many others. It may appear at times that some species, endowed with an excess of vitality, contravene this law; they obtain a seemingly undue predominance over surrounding races; without supporting their share of attendant life, they trample out, as it were, that of others. But this special exuberance is only temporary; it obtains for such forms a firm establishment, insuring them a prolonged existence among the host of foes that ultimately will prey upon them, so that this over-running and killing off of weaker species, by one of greater vitality, results eventually in the appearance of new forms, better suited to the latest of the ever-changing and progressive conditions of this continuous creation. Such species are not merely heralds of the new introductions, but they are an absolutely essential commissariat department sent on ahead of them. We find all these points illustrated in the history of forest life. Trees past their prime must be rapidly disposed of to make way for more vigorous growths; incoming forms must be of the strongest to insure their foothold, all weakness must therefore be killed off. On the other hand it is equally desirable that those species which have played their part should be finally extirpated. All these needs are made the means of support to a vast variety of organisms, vegetable and animal. The fungi and the higher plant-parasites, as the mistletoe, the orobanches, and the orchids, sap the strength of the vigorous tree, or derive their growth from its decay, and their work is shared and expedited by a vast host of insect laborers. In their turn, the wood-inhabiting population feeds a great variety of birds; the woodpeckers and the tree-creepers, the tomtits and the wrens obtain a large part of their subsistence from the insects that live under the bark or whose grubs bore deeper into the wood. The insects which, in their larval and even in their perfect state, bore into wood, belong to several orders, and every man has a more or less direct interest in a knowledge of them and their habits. But it is among the coleoptera, or beetles, that we find the most abundant authors of internal injuries to both our forests and our orchards. Nor do their ravages cease with the living state of the wood, for, as all of us know to our cost, our furniture, the timbers of our houses, and the lumber in our yards, are subject to the attacks of a variety of foes. Nature, while she is fully capable of withstanding the attacks of man, pays no heed in return to his especial interests; her servants have been instructed to destroy the sapless wood, and they do so regardless of the uses to which human beings may wish to put it.

The practical use of entomology has been over and over again illustrated, by the history of Linnæus and the ship timber in the Swedish dockyards; but the story is significant rather by reason of the unwonted recognition of the value of natural science wrung from "practical" and "great" men by the Upsala professor, than from being by any means an exceptional case of damage by insects, or of a remedy suggested by the intelligent study of their habits. Among the beetles which pre-eminently rank as timber borers, while in the grub state, are the buprestidans. This family belongs to the group of serricorns (saw-horned), so named because the tips of the joints of the antennæ usually project more or less on the inside, somewhat like the teeth of a saw. Harris adds: "The buprestis of the ancients, as its name signifies in Greek, was a poisonous insect, which, being swallowed with grass by grazing cattle, produced a violent inflammation and such a degree of swelling as to cause the cattle to burst. Linnæus, however, unfortunately applied this name to the insects of the above mentioned family, none of which are poisonous to animals, and are rarely, if ever, found upon the grass."

It has been suggested that the Greek name referred to the blistering beetles (cantharides), and this seems plausible, although it is just possible that the evil quality of the beetle, whatever it may have been, so designated, may have been a fallacy of the vulgar, and the name as absurdly libelous as those of the goat-sucker and of the sap-sucker among birds. However this may be, the name is now attached to the kind of insect so well represented in the accompanying engraving. "The elliptical or oblong oval form, obtuse before, tapering behind, and broader than thick:" the head very much shortened by being "sunk to the eyes in the thorax;" the short antennæ and small legs; these characters combined with their peculiarly metallic hues, will enable even the unscientific eye to recognize the perfect insect at sight; while the disproportionally enlarged segment in the forepart of the body of the white limbless grub equally distinguishes this from the larva of other beetles. Every one who has ever had the curiosity to examine the contents of the perforations in firewood, must often have noticed these odd-looking grubs; for, as Harris says, of our native species, "pines and firs seem particularly subject to their attacks, but other forest trees do not escape, and even fruit trees are frequently injured by these borers." Nor can the extent of the mischief that these creatures do be appreciated without recognizing the fact that they live for several years in the grub state, incessantly devouring the wood, hollowing in all directions the soundest parts, and undermining the vitality of the portions that they do not chance to penetrate. Say quotes an instance of the emergence of the perfect insect from wood in which the grub must have existed for at least twenty-two years.

As the distribution of the buprestidans is world-wide, the total amount of destruction they accomplish in the economy of Nature must be enormous; and as far as man's property is concerned, we only know of one kind of allies over which he has any control against this insidious enemy; these are the insect-eating birds, and more especially the woodpeckers. Unfortunately many of the woodpeckers are possessed of a handsome plumage, and every boy, attracted by their scarlet crests, makes the poor bird his aim. Older persons, too, think the sap-sucker, that girdles their apple trees, deserving of death for the deed; ignorant that if insects had not taken up their abode in the wood, the woodpecker would not waste his time in girdling in search of them; and utterly unconscious that it has probably been their own neglect of their valuable trees that has allowed them to fall into such a weak state as to encourage the attacks of the insects. For although it is a fact, that insects attack some sound trees, yet it is equally certain that any even unnoticeable feebleness will at once produce a condition peculiarly favorable to the development of insect life. Orchards, therefore, unpruned and unmanured, are first-rate nurseries for "bugs."

It is but a small compensation to us for all the mischief they do, that these insects afford ornaments to gratify the human love of finery, not only among semicivilized races, but even among the ladies of our northern world. Wallace first detected the existence of an entomological prize, "a grand new beetle" of this family, by seeing "one of its wing cases ornamenting the outside of a native's tobacco pouch;" thus reminding us that clues to new discoveries are to be found in the most unlikely places.



METAMORPHOSES OF THE BUPRESTIS.

Earn what you Spend.

Three fourths of the difficulties and miseries of men come from the fact that most want wealth without earning it, fame without deserving it, popularity without temperance, respect without virtue, and happiness without holiness. The man who wants the best things, and is willing to pay just what they are worth, by honest effort and hard self denial, will have no difficulty in getting what he wants at last. It is the men who want goods on credit that are snubbed and disappointed and overwhelmed in the end. Happiness cannot be bought by the bottle, nor caught up by the excursion train, nor put on with any robe or jewels, nor eaten at any feast. It does not exist in any exhilaration, excitement, or ownership, but comes from the use of the faculties of body and mind.

The Wire Railway.

The practical application of the wire railway, or tramway, which consists in suspending a strong wire cable on posts and rollers, giving motion to the cable by a steam engine, and attaching the burdens to be carried to the cable, is rapidly extending. According to the *Mechanics' Magazine*, the plan is now in operation at Nevada:

We have watched with much interest the development of the wire tramway system of transport, and have from time to time noticed its progress. Its spread over several foreign countries, and some of our colonies, has been most remarkable, no less than forty-five lines having already been undertaken, most of which are constructed and in successful operation. One of the most remarkable instances of its success is that of the line constructed for the Ebertrard and Aurora Company, in Nevada, U.S. The materials for this line were forwarded from England late in the autumn of last year, and reached Nevada while the whole of the mountain district, in which they were to be placed, was enveloped in snow. Nevertheless, during the spring, the line (of nearly three miles in length) was constructed, and has recently been put into most successful operation, a telegram having been received by the directors of the Ebertrardt Company, in London, to the effect that the line was working splendidly. On it there are grades of 1 in 3, and spans from post to post of some hundreds of feet. The quantity of material carried is about 200 tuns a day, and it may safely be asserted that the difficulties of this mountain country could not have been overcome, for the purposes of so considerable a transport, by the employment of any other means.

Lines have been forwarded to Peru and Brazil, for sugar cane transport. One has been opened in Peru, but too late for the season, and another at St. Kitt's, from which most favorable results have been obtained. In Austria, the system has been employed to the carriage of turf, and in Bohemia to the carriage of fire clay from pits, requiring an ascent of an angle of thirty degrees from the horizontal.

The Indian Government are now adapting the system to the development of the Salt Mines in the Punjaub; and the Spanish Government have applied it to a fifteen mile length in the mountains of Asturias, of which about nine miles are already in operation. The War Office have taken a line for transporting powder casks from the store at Purfleet to the examining shed and back again, the inducement being that the transport could by this means be effected without bringing either animal or steam power within the precincts of the establishment. The power is to be supplied from a boiler situated at a distance of several hundred yards from the powder store. Stimulated by the rapidly increasing demands, not only of our countries, but the development of mineral and agricultural productions, means of transport are now in great demand, and rapidly on the increase.

The traction engine has received some remarkable improvements of late, and promises to aid, if not to frequently supersede, horses on common roads; but the wire tramway system has the advantage of not requiring a ready made road for its employment, and is undoubtedly the pioneer of all existing means of transport.

Freak of Nitro-glycerin.

Nitro-glycerin does not seem to become any more civilized as it mixes in scientific society. We read, in a German publication, an extraordinary account of the explosion of only ten drops of this substance, which a pupil in a laboratory had put into a small cast iron saucepan, and heated with a Bunsen gas flame. The effect of the explosion was that the forty-six panes of glass of the windows of the laboratory were smashed to atoms, the saucepan was hurled through a brick wall, the stout iron stand on which the vessel had been placed was partly split, partly spirally twisted, and the tube of the Bunsen burner was split and flattened outwards Fortunately, none of the three persons present in the laboratory at the time were hurt. When nitro-glycerin is caused to fall drop by drop on a thoroughly red hot iron plate, it burns off as gunpowder would do under the same conditions; but if the iron be not red hot, but yet hot enough to cause the nitro-glycerin to boil suddenly, an explosion takes place.

The Vendome Column.

The Vendôme Column, lately destroyed at Paris by the crazy Commune, was one of the noblest monuments in the world. It was erected by the first Napoleon, its exterior being covered with magnificent historical bas reliefs, commemorative of French military achievements. It was made from the bronze of 1,200 cannon, captured from the Russians, Prussians, and Austrians. It was begun on the 25th of August, 1806, and entirely finished in 1810. Total weight of the bronze, 600,000 pounds. The expenses for the construction were as follows:—Melting the bronze, 154,837 fr.; weighing same, 450 fr.; chiseling, 267,219 fr.; the statue, by Chaudet, 13,000 fr.; 33 sculptors for the bas reliefs, 199,000 fr.; sculptured cornices, 39,115 fr.; general designs, 11,400 fr.; masons, locksmiths, carpenters, and plumbers, 601,979 fr.; architects, 50,000 fr.; 251,367 kilog. of bronze, at 4 fr., 1,005,468 fr.; total, 2,352,468 fr., or about $170,500.

Correspondence.

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

Steam on Canals.

Messrs. Editors:—I would like to suggest a few plans which are applicable to this purpose:

1. A long screw fixed to the bottom of the boat and run by steam or other power.

2. A common paddle wheel placed at or near the center, and run by steam or other power, as above mentioned.

3. A screw fixed and run as the wheel last mentioned.

4. Glenn's patent device, mentioned in Vol. XIX. No. 6, new series of the Scientific American. G. Manuel.

Napa City, Cal.

Messrs. Editors:—As the subject of steam canal propulsion is now attracting considerable attention, induced, no doubt, by the large reward offered to him who succeeds in devising a practical machine for that purpose, it may be well to give a brief outline of several experiments which we tried on the Harlem river in 1857. The apparatus consisted at first of a single lever pushing from the stern of the boat, which was worked by a hand lever. This plan was afterwards altered to four pushing rods, a pair working alternately on each side. This device propelled our boat at the rate of six miles an hour, making scarcely a ripple on the surface of the water. The boat was twenty feet long and five feet wide; the engine was of two horse power. The results were very satisfactory, and would have been continued to ultimate success, had there been inducements such as are now offered for solving the problem of steam canal navigation. The similarity of our contrivance to that of the traction engine, which Mr. McKenzie says in a recent issue could be made available for canal propulsion, has prompted us to briefly make known our experience in that direction, as the description of the mode of working the traction engine seems identical with ours. William Guilfoyle.

New York city. B. P. Finnell.

Messrs. Editors:—One hundred thousand dollars for a new propeller for use on the canals seem quite a liberal offer. But it is hedged about with restrictions that are likely to defeat the object. As I understand it, the conditions are that the inventor must test his invention at his own expense. Now, as most all new inventions require considerable experiment, the inventor must needs have about ten thousand dollars ready to invest, a sum seldom found together with brains to originate such an invention. At any rate, it does not give the poor mechanic the same chance as his wealthy neighbor. Now, to give all an equal chance, could not the State afford to spend ten thousand dollars in experiments, rather than any individual? Of course this should not be done until the committee appointed should select the best plan submitted to them for inspection. Then if the invention proved successful, they might retain the amount, used for experimenting, from the prize offered.

If the Legislature shall so amend this act, I have no doubt that the invention desired will be forthcoming. Should no invention which would commend itself as practicable to the committee be submitted, then the State would be at no expense, and a number of individuals would be saved the expense of experimenting. John Bamber.

Rochester, N. Y.

[We see no objection to the law being amended as our correspondent proposes. As it now stands, however, there will not be much difficulty, we think, in enlisting capital to practically test such plans as promise well.—Eds.

The Erie Canal and its Improvements.

Messrs. Editors:—Your remarks about the practicability of steam towage on the canal, recall the speculations of men who are interested in our canal commerce, and for nearly half a century have been engaged in it.

As you truly say, it is needless to think of any other motive power than steam; other powers may, in the process of time, be discovered, and found to answer a better purpose than steam; but it is steam only with which it is best to experiment. To speculative mechanical philosophers we may leave the subject of applying other as yet untried and undiscovered powers. To steam, and steam applied to the screw, it is best to limit our experiments, and it would seem that no better agent, or application of that agent, is at present worthy of consideration, or, for that matter, to be desired.

With canal boats of the size now in use (220 tun boats), with their absurd models, steam power is not desirable. The machinery takes from the boat too large a proportion of its carrying capacity, and, owing to the box-like model, close fit in the locks, and excessive draft (leaving but six inches of water under its bottom in the canal), a speed of more than two miles per hour is not practicable, so that, on the whole, animal towage, with such boats, is likely to hold its place.

What has got to be done, if any improvement is effected in canal carrying, is this: The locks on the canals have to be reduced in number, by increasing their lifts, and making a double set of them, say, 220 feet long, and 27 feet wide, with 8 feet draft of water. With locks of this size, the boats should not exceed in length 200 feet, and in width 25 feet, with a draft of 6 feet. Such boats will carry 600 tuns, besides their engines, etc., and can readily be passed through the locks. Their models should be prescribed by law, so that they would run easily through the water.

Well modeled boats, with abundance of power, might be relied upon for five miles per hour in the canal, and eight or nine miles in the Hudson river, making the passage from Buffalo to New York in about four days, ordinarily, giving time for lockages.

Instead of lining the banks of the canal with hydraulic cement, stone walls of rubble, perhaps laid in cement to high water mark, would be cheaper and better; and, considering that a large part of the canal is now walled up with stone, would not entail much additional expense.

It might, perhaps, be thought best to add a foot to the present depth of the canal, after the locks should be enlarged—not a very expensive work—and, here and there, an addition to the width of the prism, in its most thronged parts.

The question of supply of water would next arise. Of its sufficiency, there is no doubt, for at all times there is a large amount of water passing from one level to another; but, if thought best, the number of reservoirs could be increased, at an inconsiderable expense.

With the improvements suggested, the Erie canal would literally become a river, and with its steam vessels of 600 tuns, would secure our State and New York city forever against any rival route, or mode of transportation. If some such improvement be not adopted, the canal might as well be filled up at once, for it is fast losing its commerce.

Buffalo, N. Y. Forwarder.

Steam Towage.

Messrs. Editors:—An experiment in navigation was tried on the lakes last year, and continued this season, which may yet become of great importance.

From time to time, for six or seven years, as one after another of the great passenger steamers on these upper lakes became unprofitable, in consequence of railroad competition, the valuable engines were taken out of them, and sent to the East and sold, and their hulls converted into barges for carrying lumber, being towed through the lakes by powerful tugs. These vessels were profitable, carrying very great loads and as many, sometimes, as two or three of them were taken by one tug and towed, in all states of the weather, for distances of six or eight hundred miles.

The success of those vessels was such, that others engaged in the transport business, have, of late years, had built large barges, new and strong, for carrying of iron ores, etc.

Last year, as is stated above, a gentleman here had built a great tug of 1,200 tuns, with corresponding power, two low pressure engines, with 42 in. cylinders, 100 lbs. pressure of steam, and two barges of 1,500 tuns each, for the grain trade; and all three, tug and barges, carry successfully from Chicago to Buffalo 140,000 bushels of wheat—4,200 tuns, dead weight.

This tow, as it is termed, makes, on an average, ten miles an hour, in all weathers. Now and then time is lost in very bad weather, but they do as well as other vessels, without tows.

The barges carry about eight men and boys, all told; they have each three short spars, with fore and aft sails, of very heavy canvas, as easily handled as a pilot boat, though they carry their 1,500 tuns; their tow line is a steel wire rope, which cannot (practically) be broken.

Is not this fact one which is worth commenting on in your journal? and why cannot this system of towage be introduced on the Atlantic, first for coasting, and eventually for transatlantic voyages?

The cost of transportation or freighting by tows is said to be about half what it is by sails or steam vessels, so that freighting by towing, at the nett cost of what it costs sailing or steam vessels, pays a large profit. So says rumor.

Buffalo, N. Y. Forwarder.

Invention versus Discovery.

Messrs. Editors:—On page 324, current volume of the Scientific American, I find an interesting article entitled "Some Useful Suggestions," in which, after giving some valuable hints, the writer concludes as follows: "I have no opportunities to experiment in any device, but if my suggestions should prove new and valuable, I hereby give notice to the patent examiners that I claim them as mine: and if you print this, they will have been published in a public journal, and no one can claim them."

I hold, Messrs. Editors, that the end and aim of all good men is to benefit their race; and the writer of the above, with many thousands of other good men, believes that a valuable idea should be used by mankind free from all claims of royalties to the discoverer. In this I am perfectly willing to concur. But the question arises, can the world be benefited by simply advancing crude ideas?

Supposing that the writer's object be fully secured, and the patent law excluded all persons from using the ideas and reducing them to successful application, would not the result be rather a loss than a gain? Who would spend time, labor, of money, in making the experiments which your correspondent has no opportunity of making, if no reward could be gained? Suppose that a law existed by which all precious metals (when suggested to exist in a certain locality by the learning of some geologist, and the suggestion were "published in a public journal"), all gold or silver mined should be public property? Would men mine? Would they expend time, labor or money? Would they risk their lives to bring the precious metals to light, smelt and coin them so that they might easily be divided among their fellow men? I, for one, doubt if such generous men could be found.

Much stress is laid upon the fact that scientific men freely, without charge, give up their discoveries to the world. Yet I find that when Liebig, after giving us the discovery of his *Extractum Carnis*, experiments on its production on a large scale, he secures to himself a portion of the benefits to reimburse him for his outlay. And yet Baron von Liebig has experimented on giving some of his valuable discoveries free to the public, but soon found that the people were not benefited as he wished. For instance, his malt sirup, for which he published the receipt, was made by druggists in such a manner that it failed to have the properties which its discoverer claimed for it; and Liebig was compelled to publish the names of two or three chemists who made it under his special supervision. Professor Horsford has given to science many valuable discoveries, but when he invented his self-raising bread preparation, nothing but the security of a patent could have brought its benefits into every household.

When a scientific traveler in South America finds a plant resembling our domestic potato, I can understand how he would examine the same, test its quality, and publish the discovery to the world free of charge. But when a farmer has plowed his field in early spring, bought the seed, hoed, tended, and watched the plant, would you ask him to cart his potatoes to the nearest city and divide them among its inhabitants? It is the same with inventions. The true inventor does not carry an idea to market, but furnishes the world with the practical and useful application of concentrated thought, observation, and experiment. Believing in the security of the patent issued to him, he spends his time, labor, and money for the benefit of mankind, hoping to receive a small share of the general benefit, to reward him for labor and anxious care, which none can appreciate who have not, as your humble servant has, spent the best part of an active life in the cause. Joseph A. Miller.

Boston.

How to Further the Cause of Temperance.

Messrs. Editors:—On page 308, current volume of the Scientific American, is a communication on temperance, from "Humanity." You are in favor of improvements, and I am glad you do not exclude this kind, for it is much needed. "Humanity" is right as far as he goes, but it is no more than half way.

Why not educate the boys in the same way? I don't believe it is harder to keep boys from drinking than girls, if the right course be taken. Let them be taught the fact that all alcoholic liquors are poison, that drinking is degrading and unbecoming to any one; that getting drunk is an attempt to commit suicide (which is true)—let these things, I say, be taught to the boys as well as to the girls, and then there will be something accomplished. Without this, but little can be done.

If every one would take my pledge they would be better off. It is that I will neither make, buy, sell, use, nor give away, nor cause to be used or given away, either as a beverage or a medicine, any spirituous, malt, or fermented liquors, or any other liquors that will intoxicate (that is, that contain alcohol). This is strong, I know, too strong for some; but whoever keeps it need never fear filling a drunkard's grave (except it may be with a shovel), or being troubled with ophidians in his pedal coverings, or even getting any building material in his *chapeau*.

As for alcoholic liquors being used as medicine, I think they are not necessary. Dr. Parson, of Pa., says: "Neither wine, malt liquors, nor alcohol, are necessary for medicinal purposes; there are more harmless agents in the laboratory which have all the virtues attributed to alcohol." Dr. Trall says: "The use of alcoholic drinks always did and always will follow in the wake of alcoholic medication. All the data of science, of experience, and of argument, which can be alleged in favor of alcohol as a medicine, can be, with equal cogency and propriety, adduced in favor of alcohol as a beverage." Dr. Emlin says: "All use of ardent spirits is an abuse; they are mischievous under all circumstances."

Very many of our M. Ds., some of them self-styled, will, either wilfully or ignorantly, persist in using liquors in their practice, and their teachings cause parents to be very slow to disallow their use. But this is no excuse for them. They should have no scruples about banishing all liquors from their homes, and forbidding their use under all circumstances; but remember that 3 scruples make a dram, 2 drams make one tight, 4 tights make one like to get drunk, and 2 drunks make one—well, a mere animal.

This matter is of interest to mechanics, as well as to the rest of mankind; hence, my writing this to you. That it may do some good is the wish of

Wauseon, Ohio. Lew Q. Bracian.

An Ingenious Contrivance.

Messrs. Editors:—Being at Annapolis, Md., a few days ago, I visited the Naval Academy, and saw there a most ingenious and economical expedient applied to make an air pump of an oscillating engine, to drive a working model beam engine, to show and compare the actions of radial and feathering paddle wheels. I learned that this novelty was contrived by First Assistant Engineer, Geo. W. Roche, one of "the highly scientific corps" on duty there under the popular Chief Engineer, Henry Lee Snyder, who is at the head of the Department of Steam Engineering at the United States Naval Academy.

The oscillating engine is run by a belt from the line shafting of the machine shop, backwards, while the valve had the ahead motion, taking the air through the exhaust pipe, and forcing it out, by the action of the piston of the engine, through what had formerly been the steam pipe. The operation is analogous to that of a locomotive engine, which is forced ahead by the momentum of a train, while the valve is operated by the backing eccentric. A locomotive when forced ahead by a train, with the backing eccentric operating the valve, compels the engine to force air into the boiler, instead of taking steam from it, as will be shown any time by the gage under the circumstances. The whole concern is worked by compressed air forced into an iron tank.

Philadelphia, Pa. J. A. Carter.

How Matches are Made.

A correspondent of the *Mechanic's Magazine* who has been visiting an extensive London manufactory, thus describes it: The factories are situated in the Fairfield road, Bow, and cover five acres of land. There are four distinct branches of manufacture carried on here, namely, that of patent safety matches, which ignite only on the box; that of ordinary matches, of vesuvians, and of wax vestas. Following the order of manufacture, we will first take our readers into the yard where is a series of stacks of spruce timber, selected for its superior quality and fineness of grain. This timber is used for making the match boxes, which, however, are not made on the premises, but afford work to a great number of women and children, principally in the east end of London. Passing by an extensive suite of offices on the right, we enter a large building, which is used for a store for empty match boxes. At right angles to this is another building of similar size, appropriated to a similar purpose; in this and the adjoining store were immense piles of match and vesuvian boxes, besides hundreds of reams of packing paper, and thousands of packets of labels of every kind and pattern. The subjects of these labels are extremely well engraved, and some of them were very tastefully designed.

Quitting the stores, we proceed to the department where the manufacture of the patent safety matches is carried on, which is a very large building. The splints, which are supplied to the works in bundles of 1,900 each, are first prepared by dipping the ends in melted wax. The splints are 5 in. long, double the length of the made matches; the bundles are placed on end upon a hot plate, by which they are slightly charred. They are then dipped endwise in a pan of melted wax, the pan being heated by a steam jacket, and returned by the dipper to the hot plate; a boy reverses them, and the opposite end is then dipped in the wax, which is absorbed by the wood to the depth of about $\frac{1}{2}$ in. and causes the match to burn freely. One man will dip as many as 1,000 bundles per hour. The prepared splints are then conveyed to machines to be filled into frames for dipping in the igniting composition. These machines have hoppers into which the bundles of splints are fed, the binding string having been cut. The splints are placed in horizontally, and at the bottom of the hopper is a brass plate having a number of grooves, into which the splints are brought from a frame under the hopper, to which a reciprocating motion is given. As the splints fill the plate, they are pushed to the front by a series of needles set in a bar behind the machine, and are received by the attendant on the first bar of a wooden frame, another bar being immediately placed on the splints to hold them in position. This process is continued until the frame is filled, when it contains about 2,000 splints.

From the filling machines the frames are conveyed to the dipping department. The patent composition consists of chlorate of potash and other ingredients for working it into a paste. This paste is spread upon a slab to an even thickness of about $\frac{1}{8}$in., and the ends of the splints, which project from one side of the frame, are dipped in it. As the frames are dipped, they are removed to the drying houses. The time occupied in drying the matches varies according to the state of the atmosphere; if the air be damp, the matches may require a day, whilst if it be dry, a few hours will suffice. When one side is dry, the frames are taken back to the dipper and the opposite ends of the splints are dipped, and the frames returned to the drying rooms. When the second side is dry, the frames are taken to the boxing benches, and the double ended matches are dexterously removed from the frames and placed in a pile by the side of the box hands. The operator takes in her hand what she judges will be enough when cut to fill two boxes, and her judgment rarely fails her. The matches are placed in a grooved rest, the center of the handful being placed exactly under the knife, which is brought sharply down, cutting the matches through, the end of the blade being fixed by a pin as a center on which it turns. The operator first seizes one and then the other half of the bundle of severed matches, and places each in a box, a pile of boxes being ready to hand beside her. From the filler the boxes are carried away to another department, where the patent composition is laid on their outsides.

And here it may be as well to explain what to many is a great mystery, namely, how the safety matches are made to ignite only on the box. The secret of this real safety depends simply upon the circumstance that, instead of ignition being produced by simple friction as in the ordinary matches, it is the result of chemical combination, one material being placed on the box and the matches being tipped with another. After the composition has dried on the boxes they are carried to the wrapping room, where a number of girls are engaged in wrapping the boxes in paper and forcing them into parcels. From this room, they are passed on to the packing room, where they are packed in cases for the market or for exportation. In another part of the safety factory are three vertical boilers, which supply steam to the engines which drive the various machinery. They also supply steam to heat the wax for the first, and the composition for the last process of dipping.

There are two buildings in which the ordinary matches are made. The processes carried on in them are much the same as in the patent safety match factory. The ends of the splints are dipped in wax, they are then taken to the frame filling machines, and from thence in the frames to the dippers, and on to the drying room, after which they are cut, boxed, and packed in the same way as the others are. The composition with which the ordinary matches are tipped is of course different from that used for the safety matches, and is prepared in a separate building, their manufacture being much the same as that of matches, with modifications in the dipping process.

The last process we have to describe is that of making wax vestas, which is carried on in another and separate building having three stories. The basement is the manufacturing department, the ground and upper floors being used respectively for boxing and packing the vestas, and for stores. Proceeding to the basement we find the following process being carried out: The balls of cotton forming the wicks of the vestas are placed to the number of twelve in a box with divisions, one in each division. The ends are then attached to a winding drum, about 3ft. in diameter, on which the twelve lengths of cotton are wound. The ends are then passed through a frame having twelve holes and so through a silver trough of melted stearin and paraffin, and fastened to another revolving drum at the opposite end of the building. This latter drum being set in motion unwinds the wick from off the first drum and winds it on to itself, the wick having passed through the trough and taken its first coat of wax. This process is repeated until the surface of the taper is smooth and clear. The winding drum No. 2 is then removed to a cutting machine, where, by an ingenious automatic arrangement the lengths of taper are drawn off the drums, cut into any required length accordingly as the machine is set, and passed into frames ready for dipping. As the frames are filled they are taken to the dipping department and thence to the drying rooms from which they are removed, when the vestas are dry, to the box filling and packing departments on the ground floor. The stearin is first melted in an enamelled vessel, which is steam heated and from which it is supplied to the silver trough. The reasons for these precautions is to be found in the circumstance that the stearic acid acts injuriously upon the baser metals, and vessels made from them are therefore useless. Even the enamel is beginning to be eaten away at some places near the top of the pan.

Such then are the details of one of the most extensive manufactures of the present day, but the full extent of which to be realized, must be seen. Figures can convey no adequate idea of its extent, because it involves so many processes. The annual production of matches is counted by millions, which are scattered over all the known world. The waxed taper, from which the vestas are cut, is made by the mile. The hands directly and indirectly employed by the Messrs. Bryant and May, may be numbered by the thousand, and besides the works we have been describing, they have extensive warehouses in the Mile End road.

How Printing Ink is Made.

It is not very hazardous to assume that a great many persons who have handled printing ink all their working lives had no very clear idea as to how it is made. A vague notion of lampblack and varnish possesses them; but if asked just what ingredients enter into the compound, and how, and in what proportions they are put together, they usually find it difficult to give a satisfactory answer. With the purpose of dissipating the general ignorance as to a point which all printers, at least, should be familiar with, we, says the *Record* (Boston), went out to South Dedham, recently, and took a walk through the famous ink works of George H. Morrill. And a very dirty walk it was too. Lady visitors to an ink factory are advised not to wear their white piqué dresses, and gentleman will do well to put off their white linen suits before before passing the inky portals of the establishment. Another piece of sound advice to visitors is, don't touch the door handles; let your guide, who wears gloves that seem appropriate to his Satanic Majesty's fingers, do that service for you. Keep your hands in your pockets, and retain your coat tail within a limited sphere, and you will come out without serious spot or stain.

There are five separate buildings belonging to the works, the whole containing nearly one million bricks. No. 1 is called the grinding room, 30 by 40 feet and two and a half stories. Here are the Bogardus patent mills for grinding the ink, as described further on. In this building is a water wheel of 35-horse power. No. 2 is the engine room, 30 by 18 feet, containing a steam engine of 27-horse power. No. 3 is the varnish building, 45 by 40 feet, containing 14 set kettles, three of which are each of 1,200 gallons capacity, and one of 1,500. Here are also three mixers of 1,400 pounds capacity. No. 4 is used for the manufacture of oil, and contains two large stills weighing 6 tuns each, 3 kettles holding 1,300 to 1,000 gallons, and a tank holding 3,000 gallons. In building No. 4, the oil is boiled in two large iron tanks. Besides these there are eight lampblack houses, with one oil tank of 20,000 gallons capacity and five of 2,000 gallons. The oil from these is fed through a pipe into furnaces, and then burned, the flame being conducted into the lampblack houses, where the smoke is condensed and forms the lampblack, falling on the floors like a black snow storm.

The essential ingredients of printing ink are varnish and lampblack. The varnish is made by boiling or burning linseed oil, and mixing crude turpentine and gum copal. Lamp black is a fine soot gathered from the smoke of resinous substances. The substance used in Morrill's factory is resin, and a heavy petroleum oil. To the soot gathered from the flames of these is added a certain amount of spirit, on the quality of which depends the fineness of the black.

The varnish and lampblack being mixed, they are put together into mixers, and thoroughly amalgamated; the compound is then run through breaking rollers, and finally through eccentric mills, in which the ink—for it is ink, at this stage—is ground fine. It is then put into barrels and kegs, and is ready for use. Before it is turned into the mixer, the varnish is run through a strainer having 100 strands to the inch—the netting surrounding the sides of the strainer, whose bottom is perforated, so that all dirt and foreign substances sink and pass off, while the varnish passes through the strands, clear and pure. Dirty as an ink factory is, the most scrupulous cleanliness is required in handling and packing the ink—the barrels in which it is put being free from all dirt.

The color of printing ink depends on the quality of the lampblack used in its composition; the working quality depends on the varnish. So that in order to make good ink, the greatest care and skill must be exercised in the manufacture of these ingredients. Most people would naturally suppose all lampblack to be alike and of a uniform hue; but at Morrill's factory may be seen specimens of the substance, which contrast in color as strongly as a heap of sand and a raven's wing. The best lampblack is of an intense and glossy black; the poorest qualities of a dull brown. Many manufacturers use the same quality of lampblack, and a poor quality, in all kinds of ink. Mr. Morrill does not, and in consequence his fine grades of ink are recognized as the very best made in the country. There are secrets connected with his manufacture and manipulation of materials, which have an important bearing on the quality of his product; but these of course, it would not be proper to disclose. His policy, which has been so remarkably successful heretofore, is to use the best materials in the most scientific manner, and to avail himself of the knowledge acquired in long experience to make constant improvements in his modes and processes, and consequently in the character of his ink. He makes inks of various kinds, varying in price from fourteen cents to five dollars per pound. His average daily product is 2,000 pounds; but when the works are run at nights, as frequently happens, this is increased to 3,000 pounds. Extensive enlargements and improvements are now in progress, which will enable him largely to increase his product.

Embroidering by Machinery.

In the early history of almost every manufacture there is nearly always an amount of almost romantic interest that no outsiders would expect from seeing its humdrum or every, day working. This is the case with the recent and comparative new art of embroidering by machinery. In 1827-8 a certain M. Heymann, of Mulhouse, introduced into Switzerland a machine for producing sewing or longstitch embroidery work. A St. Gall merchant advanced sufficient funds for making ten or a dozen such machines; and after the usual changes and improvements, very fair results were obtained. Forty-odd years ago, however, an aversion to labor-saving machinery, even amongst comparatively well educated people, was one of the economical fallacies of the time; It was difficult to obtain labor, and many people conspired to impede the employment of the machines and their products. In the end the St. Gall capitalist lost all his fortune, becoming a bankrupt, while the machinery was taken to pieces and thrown into a heap.

Not less than twenty years later a nephew of this same Swiss merchant conceived the idea of sorting these pieces, and erecting them according to the dim memories of his childhood. After considerable trouble he at last succeeded. With much shrewdness he kept his undertaking secret, sending the embroidered work to foreign markets as handmade embroidery. By his ability and good fortune he rapidly prospered, gradually increasing the number of his machines, but keeping their construction secret, as patents are not granted in Switzerland. At last his success attracted attention. Others wished to embark in such a prosperous trade; the difficulty consisted in procuring machinery. The successful manufacturer was naturally not desirous of competition, and, in the meantime, the machine shop where the first machines had been made for M. Heymann had passed into other hands, the new people knowing nothing about it. At last, after turning their drawing office upside down, some of the detail drawings were fished up; and, with the aid of these, the construction of a machine was begun. Slowly and with much difficulty, the missing parts were bit by bit added, and the first machine was satisfactorily got to work. This proved a fortune for the machine shop. Orders for these machines flowed in, the factory was enlarged, but still could not keep pace with the demand; other shops sprang up for making them, and also got full of work. It is now estimated that there are about five thousand machines of the kind in actual work for the St. Gall market, making nothing but "*bandes*" and "*entredeux*," while many hundreds more of such machines are erected every year. On an average each machine works three hundred or more needles, which will give an idea of the power of production. This branch of manufacture has, in fact, now grown up into one of the main staples of St. Gall. Chainstitch embroidery, estimated to be five or six times as important, is still almost exclusively made by hand; and manufacturers are eagerly waiting for a machine as good as that for long stitch. The brilliant prospect has tempted many inventors; some have succeeded in making little machines with one needle, but this is not a commercial machine.—*The Engineer.*

VEGETABLE CARBOLIC ACID.—We read that a plant called the *Andromeda Leschenaultii*, growing in the Neilgherry hills, in India, has been found to yield carbolic acid. Mr. Broughton, the Government medical officer for the district, reports that it is far superior in purity to the ordinary product of coal tar, being less deliquescent and free from any admixture of noxious concomitants. As its cost is far above that of the mineral product, and as the latter can be chemically purified, the discovery has no economical or commercial value; but it is interesting as a botanical and chemical fact.

THE M. & T. Sault Company of New Haven, Conn., have had their corporate name changed to that of the Yale Iron Works, and are about to enlarge their works.

Improved Friction Clutch Pulley.

Our engraving illustrates another new claimant for public favor in the line of friction clutch pulleys. The working model, which we have seen, operates very smoothly and powerfully, without noise or jar, and the device presents a very neat compact appearance.

The following is a description of its parts and operation. A and B represent pulleys attached to a shaft, so that by the movement of the collar, C, one may be clutched while the other may be unclutched. The collar is shown in detail at the bottom of the engraving, though, as there shown, it is adapted to the clutching of a single pulley. When used for two pulleys, it has two wedge-shaped projections formed thereon, placed on opposite sides. The collar has a groove turned out in the middle, in the usual manner, for the shifting lever.

The pulley is shown in detail at L. It has a projecting rim, I, so that an annular space is inclosed between this rim and the exterior or belt rim. This pulley turns loose on the shaft, except when clutched.

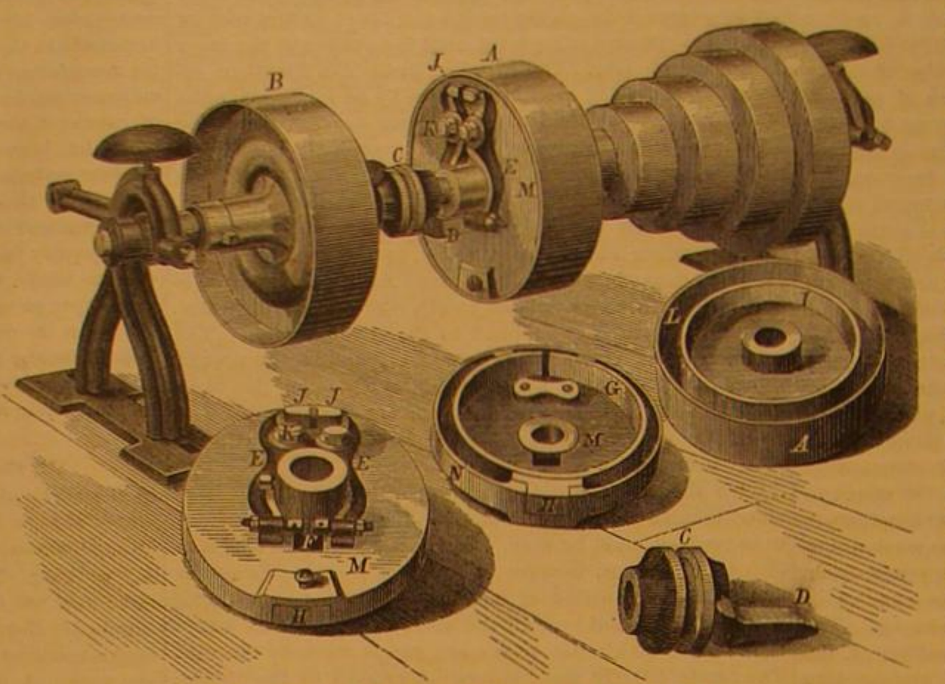
The clutching device consists of a plate or disk, shown in detail at M. It is cast with a rim, N. To this plate is attached a ring, cut apart opposite the point of attachment at H, as shown, the ends formed by cutting the ring, having projections, J, formed upon them, which pass through a curved slot in the plate, M.

On the outside of the plate, M, are pivoted, at K, two bent levers, E. At the ends of these, furthest from the pivots, are two adjusting screws, F, between the heads of which the wedge-shaped projection, D, on the collar, C, enters when the latter is actuated by the shifting lever, causing the pivoted levers, E, to compress together the projecting ends, J, of the ring, G. The plate, M, with these attachments, is keyed or held by set screws to the shaft in such a way that the ring, G, surrounds the projecting rim, I, on the pulley, L.

The collar, C, is feathered on the shaft so that it always maintains its relative position with the plate or disk, M, and at any point of its revolution a proper movement of the shifting lever will force the wedge-shaped projection, D, between the heads of the screws, F, causing the levers, E, to compress together the projections, J, on the slotted ring, G, and, drawing the latter firmly down upon the projecting rim, I, clutch the pulley.

When the pulley is to be unclutched the shifting lever is reversed; the projections, J, then being relieved from pressure, the ring, G, expands by its own elasticity, and releases I.

Patented, Nov. 1, 1870, by Edwin F. Allen, of Providence, R. I. For further particulars address the Star Tool Co., Providence, R. I.



ALLEN'S FRICTION CLUTCH PULLEY

Electro-magnetic Motor for Sewing Machines.

The following is a description of an electro-magnetic motor, as applied to a sewing machine, taken from the specification of Messrs. Stevens and Hendy, of San Francisco, Cal., to whom letters patent were granted last July. The inventors claim that although they illustrate the invention as applied to a sewing machine, it is really capable of being employed in working various other machines. It consists in a novel arrangement of the apparatus which forms the motor, and which, according to the inventors, enables greatly increased results to be obtained from the coils with the same pulley power. It will be seen that the armatures drive the needle bar directly, without the intervention of levers or other mechanism; while the feed movement is also very simply arranged, and is likewise driven directly from the armatures.

Fig. 1 is a side view of the essential portions of the apparatus; and Fig. 2 is a vertical transverse section of one pair of coils, and also shows the feed motion. The following description applies to the two figures.

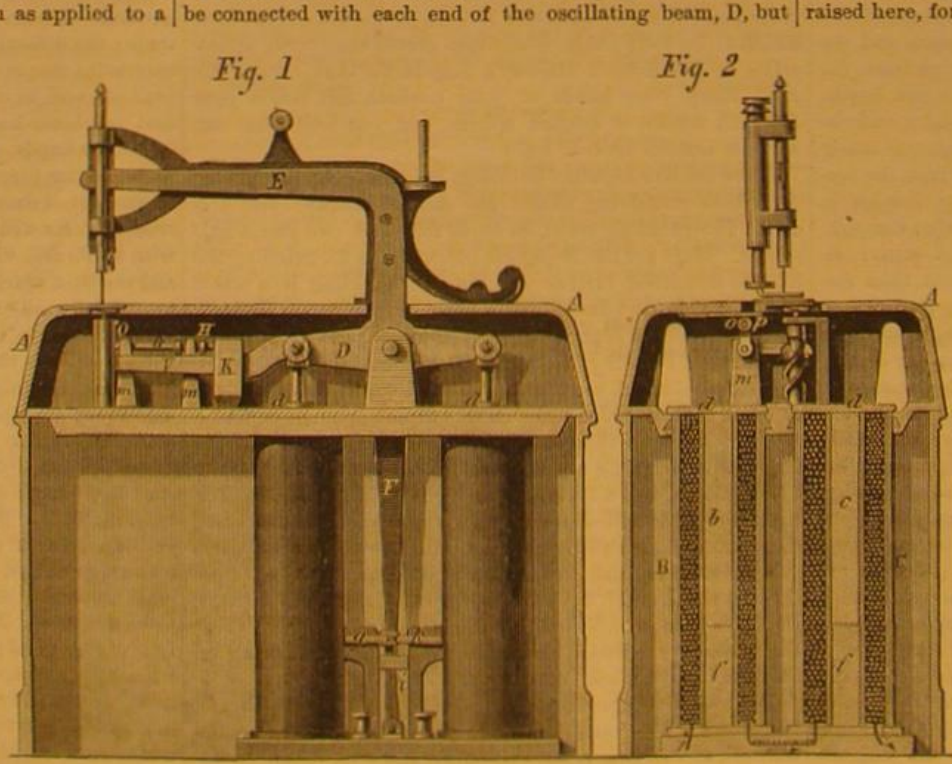
A is a case which rests upon the top of a cabinet, and serves to conceal portions of the machinery; it also serves as a table for the work; two pairs of coils, B and C, are placed so that their upper ends stand just within or at the bottom of the case, A, to which they are secured; these coils are placed at such a distance apart as to admit of the working of an oscillating beam, D, which is supported on standards over their central line; this beam is balanced so that the magnets or armatures of one pair of coils are connected to one end, and those of the other pair to the opposite end.

The coils are constructed as shown in Fig. 2, being formed of insulated wire, coiled to a suitable size, leaving an opening through the center sufficiently large to admit the magnets and their armatures. The coil is surrounded by an iron cylinder, which greatly increases the power of any given coil. Outside this cylinder another coil may be placed, and this, in turn, enclosed by another iron cylinder; this gives good results, but not so great, in proportion, as are obtained from a single coil and cylinder, which the inventors consider sufficient. The magnets, *b* and *c*, are made, as usual, of soft iron, and each pair of bars united by a plate, *d*, across the top; or they may be formed in one piece, as a U magnet reversed.

The magnets extend down into the coils about two thirds of the depth of the latter, and the armatures, *f*, arise from the bottom, about one third of the hight of the coil, this construction also adding greatly to their power. The oscillating beam, D, has one end connected to each of the plates, *d*, and from some convenient point on its length the needle bar, E, arises and extends forward to the table of the sewing machine, over which the work passes. From the center of the beam, D, an arm, F, depends, and as the beam oscillates from the alternate attraction of the magnets, at either end, this bar vibrates from side to side, striking alternately pins on a vibrating bar, *i*, which is pivoted at the bottom, and which is also caused to move from side to side. This alternately forms and breaks contact with the two pole changers, *g* and *h*, and causes the pairs of coils, B and C, to act alternately, thus moving the magnets, *b*, *c*, the beam, D, and the needle bar, E.

The feed motion is operated in the following manner: A bar or arm, V, extends forward from the end of the beam, D, and partakes of its oscillations. Two standards, *m*, *m*, support a shaft, G, which lies parallel with and a short distance from the arm, V. At one end of the shaft is an arm, H, which projects over the arm, V, and as this oscillates it moves the arm, H, up and down, thus partially rotating the shaft, G, back and forth at each oscillation. A small crank arm, *o*, is fixed to the opposite end of the shaft, G, and the upper end of this is so attached or connected to the feed plate, *p*, as to move it forward and back, raising it at the proper time.

If found more desirable, two or more pairs of coils could be connected with each end of the oscillating beam, D, but the inventors have found one pair sufficient for all ordinary purposes.



ELECTRO-MAGNETIC MOTOR FOR SEWING MACHINES.

In order to prevent noise, and diminish the force with which the magnets and armatures would meet, the arms, V, pass through a case, K, within which are placed elastic cushions, above and below, and against which the bar strikes as it moves.

The inventors also patent a form of "switch," by means of which they are enabled to control the battery power, employing either two, four, or any number of cells required. They do not, however, give any information as to the cost of operating the machine by this means.

IMPROVEMENT IN EXTRACTING SPIRITS OF TURPENTINE FROM PINE WOOD.

An invention patented by James D. Stanley, Washington N.C., consists in attaching to the retort, or still, two purifiers, each containing lime, or other substances, through which the spirits of turpentine, oil, tar, etc., are passed in the form of vapor, and after purification carried to condensers, and fixed in cisterns.

Wire gauze supports are stretched across the first purifier, to sustain or separate purifying substance or substances. The second purifier has, at one end, a perforated sheet of iron, with wire gauze stretched across it, to retain in place the purifying substance.

The condensers are of copper, or other suitable material, and of the form of a hollow cylindrical ring. They are fixed in cisterns, and kept full of cold water.

The retort having been filled or charged with pine wood, and water introduced to the depth of top of grate bars in the furnace, heat is applied, underneath the retort, the draft passing through flues, over the retort, and off through the smoke stack; or the heat may be applied by the introduction of superheated steam into the retort. The white spirits of turpentine now pass off in vapor through a valve into the first purifier, into the first condenser, and are thence drawn off purified and free from tarry odor.

As soon as the spirits begin to show color, the valve is closed, a cock opened, and the water in bottom of the retort drawn off. The remaining colored spirits, oil, tar, and gas, pass off through the second purifier into a second condenser.

The pyroligneous and acetic acids retained in the purifying substances can, it is claimed, be distilled or separated from them with less trouble and expense than by the ordinary method.

The principal advantage of this method is, however, that by closing the valve, as soon as the spirits passing through it begin to show color, the first purifier and contents, as well as the first condenser, are kept clean, so that white spirits can be run through them from subsequent charges; whereas, if colored spirits were suffered to pass through them once, they would have to be carefully cleaned (a very difficult matter) before they could run white spirits again, and colored spirits have to be redistilled several times to render them white, or nearly so.

Thus the inventor accomplishes by one process what has heretofore required several.

Jute in the United States.

A correspondent of the Agricultural Department at Washington speaks of the raising of jute for textile purposes, in the Southern States, as follows:

"I deem it almost as great an acquisition to the country as cotton itself. It yields one of the cheapest fibers which nature produces. It is raised in India, and, I presume, can be raised here, for less than one half the cost of hemp, and for one fourth the cost of cotton. It has been produced in India for one cent per pound of fiber. It is woven not only into gunny cloth and gunny bags, but enters largely into carpets and many kinds of tissues. In India, jute has been constantly gaining upon cotton. England has imported from India, of this article, more than 120,000,000 pounds in a single year; and we, last year, imported more than 19,000,000, which cost more than $3,000,000, and sold at the South for $5,000,000. It is used there, chiefly, to envelop cotton.

"If we had diverted that amount of labor from cotton to jute, we might have raised a much larger quantity at home, and at the same time have increased the value of our cotton crop.

"The jute seems to me to be a plant admirably adapted to the wants of the South. She requires it for bale cloth, also to divert labor from cotton, and to employ the operatives during inclement seasons in the manufacture of cloth.

"I presume that the mechanism used in Kentucky for spinning and weaving hemp, will be appropriate for jute."

These suggestions we regard as worthy the serious attention of Southern agriculturists. The uses of jute are annually increasing, and there is little danger of a glut of this valuable material.

Disinfectants to Arrest the Progress of Zymotic Disease.—We must strike off at once a whole class of valuable agents which will not meet the requirement of the case. The infectious matter is a vapor of fine dust, and it is hopeless to attempt to combat the virus by non-volatile disinfectants, such as charcoal, chloride of zinc, etc. What is wanted for general purposes is a liquid volatile disinfectant, such as carbolic acid, which, after acting on infected surfaces, will pervade the atmosphere, and destroy the floating virus.—*W. Crooks, F.R.S.*

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NEW YORK, SATURDAY, JUNE 17, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

Close of Another Volume.

The next issue of the SCIENTIFIC AMERICAN closes the first volume of 1871. Subscribers who commenced with the volume, and paid for half a year, are reminded that the time for which they prepaid will expire with the next number. We hope every one of these six month subscribers will renew before the 1st of July.

The safest way to remit is by draft on New York, postal order, or check on some bank, although money is seldom lost when secured in letter and properly directed. Address MUNN & CO., Box 773, New York.

THE PROPOSED CENTENNIAL EXHIBITION IN PHILADELPHIA, IN 1876.

The Forty-first Congress, at its third session, passed an act "to provide for celebrating the one hundredth aniversary of American Independence, by holding an international exhibition of arts, manufactures, and products of the soil and mine, in the city of Philadelphia, in the year 1876." The act specifies that this exhibition shall be held under the auspices of the Government of the United States, which shall be represented by a Commission, composed of one delegate from each State and Territory, to be appointed within one year from the passage of the act, by the President of the United States, upon the nomination of the governors of the States and Territories respectively. This Commission is empowered to prescribe all necessary regulations for holding the exhibition, and these regulations the President is authorized to make public by proclamation, and to communicate to the diplomatic representatives of all nations.

The project of holding a centennial exhibition was first suggested by the American Institute of New York, and strenuous efforts were made to induce Congress to make the metropolis the site for the building, but the Philadelphians carried the majority; and as the law has now been passed, it would be better for all parties to submit to its requirements, and take hold with energy upon the work. We took occasion, when the subject was first suggested, to point out the immense labor and expense involved in the undertaking.

Such an exhibition, in order to be successful must be administered with great executive skill; it must enlist the sympathies and coöperation of the leading minds of the nation in every department of industry. The commissioners to be appointed by the President ought to be representative men, and not politicians. What we fear is that there will be the same greedy clamor for office that there always is whenever an appointment is placed within the gift of the executive, and that persons will be smuggled in who are wholly unfit for the grave responsibility that will rest upon them.

The Legislature of each State ought to make adequate appropriations to defray the expenses of a Commission, upon which shall devolve the duty of bringing forward the best illustrations of the productions of the State. The expense ought not to be great, as most exhibitors will prefer to pay their own charges, and the chief duties of the Commission would be clerical.

There ought to be an advisory committee in each State, upon whom would devolve the selection of proper articles for exhibition. This committee could be charged with the duty of collecting statistics, and the publication, if necessary, of a report upon the productions of the State they represent.

The Commissioner recommended by the Governor and appointed by the President, ought to have the power to organize advisory committees of experts upon each specialty, and to accept or reject articles intended for the Fair, upon the decision of such advisory boards. This was the course pursued by Mr. Derby in the case of the Paris Exhibition, and nothing was forwarded to Europe unless it had been referred to the highest authority in the land. Similar action must be taken here to avoid a disorganized mob of people from monopolizing all of the space that may be allotted to each State respectively. A mere collection of mouse traps is not what we wish to see in Philadelphia, but the best products of the soil, mine, mill, and every industry that can be sent forward through the agency of a competent Commission.

The State Commissioners ought to be appointed at once in order that the work of organizing committees in each county, and advisory boards in the large towns, may be started preparatory to the collection of material and statistics.

Let each State vie with each other in the generous rivalry in order to show the world what has been the progress of the Republic in the hundred years of its existence. There is no doubt that we have "builded better than we knew," and there are vast stores of hidden wealth that we can know nothing about, until a competitive examination is made.

Where all the money is to come from to put up the requisite building in Philadelphia, we leave in fraternal kindness to the enterprise of the City of Brotherly Love. The cost of a structure large enough to hold all that our own people and the representatives of other nations will wish to send, will be something prodigious. The value of the building and its contents in Paris, in 1867, was estimated at one hundred million dollars. We do not wish to intimate to our neighbors that they will have this sum to raise, but the information is thrown out as an important statistical fact for the benefit of whom it may concern.

There is no time to be lost in the organization of the local board of managers, and as soon as they have decided upon a plan of operations, they ought to be met by the cordial support of citizens everywhere. The exhibition is intended to be a national one—it ought to be so regarded everywhere, and all local jealousies must be suppressed for the general good of the country.

REPAIRING ROADS.

This is an operation which is or should be performed immediately after the settling of the ground in the spring. In agricultural districts it is often deferred till later in the season. In this case the labor of putting a road in good condition is often doubled. It is as true of roads as of raiment that "a stitch in time saves nine," and if for the word stitch we substitute ditch, the old saw will be even more forcible in its meaning.

Winter makes sad havoc in the earth roads which intersect the country in all directions. His frosts upheave, and the springs wash out deep gulleys and ruts, and when at last the reign of frost is over, that which was straight is all crooked; level places are changed into alternate rises and depressions, stones are left on the top, and, in short, these roads become sloughs of despond in which loaded teams wallow in despair, and where wagons are left standing for weeks up to the hubs in mud, simply because it is beyond the power of horse flesh to extricate them.

If, when the mud has dried, the ruts were filled at once, and the ditches at the wayside opened, much would be gained, but as this is generally neglected, the June thunderstorms have things all their own way. Sluices are filled, bridges undermined and washed away, and, finally, when the "road master" summons the inhabitants to turn out and work on the road, they find plenty to do. The road is at last put into passable condition, and remains so till the fall rains and the marketing wagons again cut them all up, and the snow following hides them from view till the ensuing spring.

That this is only a fair picture of the majority of the roads in the Northern States, we know from experience; and those of the South and many parts of the West are even worse, if all accounts of their miserable condition during the winter rains are to be credited.

There is, perhaps, some excuse in the pressing work of spring for the delay in road repairing. We believe, however, that the custom is maintained more through habit than necessity.

An old farmer once remarked to us that there is no other work done by farmers that pays so well as road making; but there are few of them that are far sighted enough to see that the saving effected by good roads in the current expenses of repairs in wagons and harnesses, and the increase of loads which can be carried, pay liberally for the work, which they do grudgingly, when at last it is performed.

GUESS WORK AND REAL WORK.

"I guess that will work," says A. "I will try it and see." "This will work, says B, "provided that in my reasoning I have not omitted any element essential as one of the premises upon which I build my reasoning and calculations. I will try it and see whether I have omitted any essential."

A represents a large class, and B a smaller class, of men, which together make up the entire group of humanity. Individuals of the first class sometimes blunder upon successful inventions, sometimes, by lucky hits, make fortunes, sometimes entertain correct views. But in all that they do there is an element of uncertainty, a feeling of insecurity that is never allayed except by final results. In blundering along, they expend money and time, which frequently are more valuable than what they can hope to obtain by any success they can achieve. They wander off into by paths, and finding they are wrong, guess another is right, and so keep on guessing through life, sometimes guessing right, sometimes wrong, sometimes reaching that which they sought, but oftener fain to content themselves with something they did not contemplate in the outset of their career.

There are the men who expend all their capital in erecting factories, without knowing where the money will come from for stock and machinery. They are the men who, when an invention is only half completed, stake their all upon its success, regardless of future contingencies for which they can foresee no provision. They are the men who give credit without good security; in short they are the men who strew the shores of life's great sea with wrecks, broken up and helpless; to be pitied, but never repaired.

It is a pleasure to turn from this sad picture to another and brighter phase of human character, to the class, B, the members of which never count chickens in the shell; to the men who never guess but reason, step by step, to their conclusions, the men who have invented the machines and processes that have revolutionized the world's industry, the men who have developed science and art. Wherever they are found, whether in schools, pulpits, counting houses, or workshops, they are doing the real solid brainwork of the world.

They live in no fool's paradise. No false haloes cluster around the realities of life to blind them. No superstition is accepted by them as a substitute for a belief founded upon facts and reason. By them every proposition is scrutinized with rigor, and nothing bearing the semblance of truth, but false under the surface, is allowed to pass unchallenged.

They are men who, knowing truth may exist in human life and character, are not suspicious without reason, but who nevertheless are seldom deceived. Their faith in truth is not destroyed by their own falseness. They seek truth for its own sake, and search for it eagerly and long, early and late, but never guess at it. Their search is thorough, systematic, and organized. They are slow to assent to anything laid down as a general principle, but once assenting, are steadfast in their adherence, for their belief is founded upon knowledge, not guesswork.

The age is at present prolific of this class of men, and their labors are preparing the way for the final emancipation of the race from giant superstitions, and the strong chains of ignorance. The generality of mankind think the world very far advanced in civilization. Indeed, a popular but superficial writer has recently asserted that the world is suffering from over-civilization; but the class of men we have described, guessing at nothing, see that only the twilight has dawned upon the civilization of the ages to come. Knowing that their eyes shall never behold that brilliant epoch in the history of mankind, they still labor for the generations to come, blessing the present generation as well.

Well will it be when all men are no longer content with guessing, but strive to know, not in the sense of passive acceptance of creeds and formulæ, framed or thought out by others, but thought out by each individual. For when all men really think for themselves, and act upon their conclusions, there will be an end to the poverty, drunkenness, crime and most of the diseases which now curse the human race.

THE ELECTRIC LIGHT.

The light produced from a powerful current of electricity, under favorable circumstances, is the most brilliant ever yet discovered by man. By actual experiment it has been shown to possess an intensity equal to one third of that of sunlight. The light emanating from an incandescent piece of lime under the action of the oxy-hydrogen jet, well known as the Drummond light, cannot compare with it in brilliancy, nor compete with it in point of economy. Though the first cost in the preparation of an electric light may exceed that of the Drummond light, the subsequent outlay is much less.

The light is produced by passing an electrical current between two pieces of charcoal a small distance apart, one connected with the positive pole and the other with the negative pole of a galvanic battery. In order to keep these burning charcoal points always at such a distance from each other as to produce the most brilliant light, ingenious machines called "regulators" are used. The principle involved in the construction of these machines is, that the nearer the charcoal points are to each other, so much greater is the flow of electricity. Now, increase in the flow of electricity in the conducting wire will produce corresponding increase of magnetism in an iron bar which it encompasses; therefore, one of the charcoal points is inserted in an iron cylinder, which plays freely up and down in the center of an electro-magnetic coil. As this coil exerts an attractive influence upon the iron, a weight passing over a pulley is attached to it, which, acting as a counterpoise, keeps it in equilibrium. The other point remains fixed. The result of this arrangement is that an increase of distance between the charcoal points gives a decrease in the flow, and consequently a decrease in the attractive power of the coil. The weight, for this reason, overbalances the attraction of the coil, and the charcoal point is drawn up until the increasing flow of electricity, caused by the decreasing distance between the charcoal points, shall have sufficiently augmented the attractive power of the coil as to restore the equilibrium.

The regulators employed in general use are much more complicated, but their principle is the same.

A machine has been invented in France by means of which this light may be derived from electro-magnetism. It consists of eight rows of powerful horseshoe magnets arranged around a hollow cylinder and having their poles towards the axis of the cylinder. The magnets are 7 in each row, 56 in all, and are attached to a stationary frame. The hollow cylinder has affixed a set of double coils or bobbins, 112 in all, so placed that, on revolving the cylinder, the ends of the bars, which are the cores of the bobbins, are in rapid succession brought in close proximity to the poles of the magnets, alternately approaching to and receding from them, with great rapidity. This causes a succession of almost instantaneous electrical impulses to be given to the wires coiled around the bars. Connecting this machine with the charcoal points and revolving it at such a speed as to make the flow almost continuous, for the light only shines while the current is passing, a steady light will be produced.

It has been found, by experiment, that if a speed sufficient to give 200 electrical impulses per second be given to the machine, the eye no longer takes cognizance of the intervals, and an uninterrupted light is the result.

A curious example of the correlation of forces is shown in the working of this machine. The cylinder, which is hung in its bearings so delicately that it would seem possible for a child to revolve it with ease, really requires a two horse power engine, owing to certain effects produced by the action of the magnets in connection with the coils. This force expended is represented in the light produced; the machine converting force into electricity, and electricity into light; as in the case of the galvanic battery, the force resulting from the decomposition of zinc is the producer of the light.

The uses to which this light may be advantageously applied are numerous. Its peculiar penetrating power renders it unrivalled for light houses and signal lights for vessels. Let the darkness be so great that it "can be felt," its light pierces it like a great silvery needle, and falls like a ray of hope upon the seething ocean, which, but for its warning, might have been the watching sailor's grave.

It has been used with success for illuminating mines. During the siege of Paris, the Prussians were much annoyed by one of these lights, which the Parisians had constructed and placed upon Fort Mont Valérien, and which effectively prevented any hostile movement being made by the Prussians under the cover of the night.

For stage effect, illuminating halls, streets, or other public places, and for microscopic or magic lantern exhibitions, it may be used.

The application of the electric system for illuminating Bergen Tunnel, through which the Erie Railroad and Delaware and Lackawanna Railroad traverse, we believe could easily be accomplished. Its adoption would relieve the thousands of passengers, which are carried through this tunnel daily, of the apprehension of accident which is irresistible to most persons as they enter the dark and cheerless cavern.

In fact, its uses are so numerous, and its effects so brilliant, that it is a wonder that it has not been more universally adopted.

SCIENTIFIC INTELLIGENCE.

OCCURRENCE OF AMBER IN SICILY.

It is remarkable that the Romans, who set great value upon amber, and obtained it at great expense and trouble from the Baltic, make no mention of the occurrence of this fossil in Italy. The probability is that they never discovered the locality nearer home. The first notice of the Sicily deposit was in 1808. The amber is found in clay, brown coal-like formation, and gray sandstone, referred by Hoffmann to the chalk period. In color and general appearance it closely resembles the products of the Baltic workings, the chief difference being in the species of insects found imbedded in the gum. These insects belong to the ancient inhabitants of the earth, and their race is now extinct. Well preserved leaves of plants, resembling the ferns of the coal period, have been found in the Sicilian amber. Many thousand specimens have been obtained from Catanea and Girgenti, two places famous for their mines of sulphur. A resident of Königsberg, Germany, who was recently in New York, informed us that the search for amber was now conducted upon more scientific principles, and the yield was increased accordingly. The mines are the monopoly of the governments, and the privilege of working them is leased to responsible companies. In this way, the industry assumes a business shape, and dealers in amber know what to depend upon. It is not likely that in our older geological formations we shall discover the fossil gum, but a search for it in more recent rocks may some day bring it to light. Its occurrence in a volcanic region like Sicily was unexpected, and hence the delay in finding it.

CHLOROFORM USED IN THIS COUNTRY.

Dr. Simpson, of Edinburgh, who first discovered the anæsthetic properties of chloroform, immediately wrote an account of his experiments to Dr. Charles T. Jackson, of Boston, who at once brought the letter into his laboratory, where a number of pupils were at work, and requested one of them to prepare some of it for the purpose of repeating the experiments. This was in December, 1847. One of the students prepared a small quantity, and it was administered to him on the 30th of December, 1847, by Dr. Jackson and one or two other physicians who were invited to witness the effects of the new anæsthetic. There was probably not an ounce of chloroform at that time in the United States, and it was therefore necessary to make it for this trial. Twenty-three years later, during 1870, Dr. Edward R. Squibb estimates the total quantity of chloroform sold for consumption in this country at 80,000 pounds. About one third of this amount, say 26,000 pounds, is used for anæsthetic purposes by inhalation. Next, it may be estimated that one and a half fluid ounces are used or wasted for each administration, and this would give 200,000 administrations, as a safe estimate for the whole country during the year 1870. Dr. Squibb puts down one death in 5,882 administrations in this country. No chloroform of any importance has been imported into the United States, or exported from it, within several years past, and there are but about four original sources of supply.

[The student who prepared the chloroform in Dr. Jackson's laboratory in 1847, and was the first in this country to take it for anæsthetic purposes, was Charles A. Joy, at the present time Professor of Chemistry at Columbia College, New York. —Eds.]

CARBOLIC ACID AND FLEAS.

A correspondent asks, if fleas are not insects? and if they are, why carbolic acid cannot be used to exterminate them from dogs? We must remind him of Goldsmith's elegy on the death of a mad dog:

"The man recovered of the bite,
The dog it was that died."

So many dogs have been killed by the application of too strong carbolic acid, that the remedy is looked upon as worse than the disease. In moderate quantities, it could be applied with safety, but, as we remarked on a former occasion, the torture of the poor dogs is often worse from the acid than it is from the fleas. Under any and all circumstances, carbolic acid must be used with caution, as it is a powerful poison.

DESTRUCTION OF ABBÉ MOIGNO'S LIBRARY.

Abbé Moigno, the genial editor of the journal *Les Mondes*, met with a severe loss during the siege of Paris. He says in his paper for March 2, 1871: "I had on Sunday, January 15th, written a severe article about the barbarity of the Germans in bombarding a city of two millions of inhabitants, when on Monday, the 16th, a bomb fell into my narrow apartment, and destroyed nearly everything in it, including a thousand volumes of books." It appears that he had just left his study, and his life was thus providentially saved. As a compensation to subscribers for the suspension of his journal during the siege, he proposes to send to all who request it, a copy of some of his printed works.

M. BECQUEREL, SR., NOT DEAD.

We learn from *Les Mondes*, of March 23, 1871, that the venerable Professor Becquerel is not dead, but is still actively engaged in the preparation of his work on the application of electricity to chemistry and physiology. It was the London *Athenæum* that started the report of his death, and hence the sketch we gave of his life. It is not often that a man in his eighty-fourth year displays so much industry and vigor as the senior Becquerel.

USE OF DYNAMITE IN ARTESIAN WELLS.

During the sinking of an artesian well in Holland, the borer struck a flint rock, very difficult to penetrate; and the engineers proposed to try the effects of dynamite as a substitute for the drill. A bottle, in which two copper wires were insulated by gutta percha, containing two pounds of dynamite, was let down to the bottom, and fired by a current of electricity; a loud report, and the discharge of a large volume of water from the well, indicated the force of the explosion, and it was only found necessary to repeat the operation twice to procure all the water required by the engineers.

DEATH OF PROFESSOR STAEDELER.

Dr. George Staedeler, Professor of Analytical Chemistry in Zurich, Switzerland, died on the 11th of January, 1871, at the residence of his parents, in Hanover. Professor Staedeler, in his early studies, passed through the usual routine of the pharmaceutical career, but passionate love for the natural sciences impelled him to enter the philosophical faculty at the University of Göttingen, and it was here that he laid the foundation for a distinguished sphere of usefulness. Under the instruction of Professor Wöhler, he applied himself chiefly to organic chemistry, and became a frequent contributor to the *Annals of Chemistry*, published by Liebig and Wöhler. One of his earliest papers was upon the preparation of chloral from starch. He was appointed Professor of Physiological Chemistry at the University of Göttingen in 1851, and, in 1853, received a call to Zurich as the successor to Professor Löwig. When the now famous Polytechnic School was established in Zurich, in 1855, Dr. Staedeler was transferred to the chair of analytical chemistry; and upon him devolved the task of constructing a working laboratory, in accordance with the wants of the new institution. The laboratory, built under his supervision, was at the time pronounced to be the best in Europe; and it has served as a model for nearly every laboratory that has since been constructed, either in Europe or America. Nearly ten years ago, Professor Staedeler contracted a disease of the heart, while on a tour in the Alps, and since that time his life has been a constant struggle between failing health and an impatient desire to carry forward important scientific researches. The ravages of disease finally compelled him to resign his professorship, and he returned to the house of his aged parents, where, surrounded by the friends of his youth, and watched by the tender care of his relatives, he finally passed away, after only a few days of severe illness, on the 11th of January, shortly before attaining his fiftieth birthday. His death will be a severe blow to the school where he taught, and to the science which has been so much enriched by his labors.

A GREAT SPEECH.

It is not often that such solid words of wisdom fall from the lips of man as were uttered by Mr. Peter Cooper, at the recent Annual Commencement of the institution founded by him. The occasion was one of unusual interest on account of the presentation of an address from the present and past pupils to the venerable founder of the Union. This address, unlike most similar productions, was remarkably well written, tender in the expression of affection, full of gratitude, beautiful in sentiment. It has been elegantly engrossed, and elaborately framed for preservation in the great reading room of the Institute, and is in better taste than any bronze statue or monumental device could have been. The thousands of grateful pupils say to the world "if you seek a monument look about you," and Mr. Cooper's name and fame is rendered more secure and imperishable in such a way than it could be in any other.

The remarks of Mr. Cooper, in reply to the presentation address, were full of wisdom, and deserving of preservation in a permanent form. The venerable author would blush to have his words called a speech, and yet we venture to say that a greater speech was never heard in the large hall where have been assembled, from time to time, nearly all of the wise men of our country. Writers on political economy devote many pages to the elaboration of the laws of trade, the question of demand and supply, the relations of employer and employed, the rights of property, and the duties of men of wealth, but Mr. Cooper has condensed the whole matter into a few words, and if these words could sink deep into the hearts of all mankind, we should never again hear of the rich oppressing the poor, nor of the poor destroying themselves by "lock outs" and "strikes."

We advise every manufacturer, every mechanic, every laborer to procure a copy of this address, and trade unions could not do a better thing than to have it reprinted for gratuitous circulation among their members. It ought to have the widest possible circulation, and, to this end, we propose to give the greater part of it in our columns.

Mr. Cooper celebrated his eightieth birthday by making an additional gift of one hundred and fifty thousand dollars to the Union, for the foundation and support of a free circulating library. This act was all that was necessary to round up and complete the usefulness of the Institute.

The laboring poor can now obtain gratuitous instruction in every department of practical knowledge, and when unable to attend the exercises of the school, can still profit by the benefaction by carrying home with them the book required for their information. By such acts of benevolence, and by the gift of more than a million dollars for the free education of workingmen and toiling women, Mr. Cooper has earned the right to offer advice, both to the rich and poor. He shows how to earn a fortune and how to spend it. He says: "While yet a child, I learned that 'the hand of the diligent maketh rich,' and whatever of wealth I have achieved has been due, primarily, to habits of patient industry formed at the outset of my career."

He early learned that the great part of the poverty, vice, and crime which afflict the American people was due to intemperance, and he "carefully avoided all alcoholic liquors as the greatest curse of the young, and the most deadly foe to domestic happiness and the public welfare."

He next warns against hastily contracted debts, and suggests the wisdom of trying to keep a little ready money on hand for judicious investments. Debt is a slavery which every young man ought to avoid; or, if assumed, ought not to endure for one day beyond the shortest time necessary to set him free. "By shunning intemperance, and practising rigid economy, he was able to grow in prosperity and wealth, but the opportunities of acquiring knowledge were so limited, there being no free day or evening schools, that he found it far more difficult to learn what he wanted to know than to be industrious, temperate, and prudent. Hence he decided that, if he should prosper in the acquisition of worldly means, to found an institution to which all young people of the working classes who desired to be good citizens, and to rise in life, could resort, without money and without price, in order to acquire that knowledge of their business, and of science, which, in these days, is absolutely indispensable to a successful career."

Mr. Cooper never lost sight of this resolution during a business career of nearly sixty years; and all this time, he says, that he was "cheered, comforted, sustained and encouraged by the greatest of human blessings, a diligent, wise, industrious, faithful, and affectionate wife; and by the active co-operation of his children, who justly regarded, as the richest portion of their inheritance, that part of his wealth which he desired to consecrate to the public welfare."

Having thus given an account of the train of circumstances which led to the foundation of the "Union for the Advancement of Science and Art," Mr. Cooper closes with the following eloquent words:

"I do not pretend to prescribe any standard of expenditure for others, and I am quite ready to subscribe to the doctrine that a just and faithful trustee should be liberally paid for his services, and should not be restricted in the reasonable gratification of his desires so long as the rights to others are not thereby infringed; and I desire to give the fullest recognition to the sacredness of private property and the conservation of capital, as for the best interests of society and all the members thereof; but I cannot shut my eyes to the fact that production of wealth is not the work of any one man, and that the acquisition of great fortunes is not possible without the co-operation of multitudes of men, and that therefore the individuals to whose lot these fortunes fall, whether by inheritance or the laws of production and trade, should never lose sight of the fact that, as they hold them only by the will of society, expressed in statute law, so they should administer them as trustees for the benefit of society, as inculcated by the moral law.

"When rich men are thus brought to regard themselves as trustees, and poor men learn to be industrious, economical, temperate, self-denying, and diligent in the acquisition of knowledge, then the deplorable strife between capital and labor, tending to destroy their fundamental, necessary, and irrefragable harmony, will cease; and the world will no longer be afflicted with such unnatural industrial conflicts as we have seen, during the past century in every quarter of the civilized globe, and latterly on so great a scale in this country, arraying those whom nature intended to be firm allies and inseparable friends into hostile camps in which the great law of love and mutual forbearance is extinguished by selfish passions. The law of force, whether expressed in trade associations, preventing other men from exercising their unalienable right to labor where they can find work, or in combinations of capitalists seeking by lock outs to close the avenues of labor, are equally reprehensible and should never be allowed, under any provocation whatever, to take the place of the divine law: 'Whatsoever ye would that men should do unto you, do ye even so unto them;' nor will such an unnatural and criminal substitution ever be possible, if poor men will remember that it is the duty and therefore the right, of every poor man to strive to become rich by honest, intelligent and patient labor, and if rich men will remember that the possession of wealth, which is the fruit of the general effort, confers no right to its use as an engine of oppression or coercion upon any class which is concerned in its production. Let me then record that, during a long life passed in active business, I have never known any but evil consequences to all classes, and especially to the innocent, to result from strikes, lock outs, or other forcible measures designed to interfere with the steady and regular march of productive industry, and I feel justified in an earnest appeal to both workmen and capitalists henceforth to regard each other as equals and friends; and to imitate the great example, so recently set by the enlightened governments of Great Britain and the United States, in the submission of their differences to arbitration; and not to expect to reform social evils by combinations designed to force either side into the acceptance of unpalatable terms, by the stern logic of starvation and indiscriminate ruin. Reform, to be of any permanent value, must be based upon personal virtue, not force; and it seems to me that the millenium will not be far off, when each individual shall set about reforming himself rather than society, and conforming his life to the great law of loving God and his fellow-men. While I thank you, my young friends—I had almost said my children—for this manifestation of your respect and gratitude, so touching because so full of love, let me ask you to accept of this feeble but heartfelt reply as a kind of last will and testament of the garnered experience of an old friend, whose days are almost numbered, and who asks only to be remembered as "one who loved his fellow men."

KLINKERFUES' APPARATUS FOR IGNITING GAS AND OTHER LIGHTS.

This new apparatus, devised by Professor William Klinkerfues, of the University of Göttingen, was very briefly noticed in our last issue. It has, however, so many points of scientific interest, especially bearing upon the mysterious phenomenon known as catalysis, that we this week give a full account of the invention, as well as the principles upon which it is based.

The invention consists in the arrangement of a vessel containing a liquid, which, when brought in contact with a pair of galvanic plates suspended within said vessel, will close an electric circle and produce a current, whereby a piece or pieces of platinum wire, held in electrodes that connect with the said galvanic plates, will be excited to produce catalytic action and ignite combustible matter with which they may brought in contact.

The catalytic effects of platinum in its spongy, pulverous, or porous state have been frequently proposed as a means of lighting gas and other flames; but, if the short-lived success of the Doebereiner apparatus be excepted, no practical results have as yet been attained.

In these peculiar forms platinum is too liable to change to admit of the long and frequent use required by the exigencies of domestic applications, at least in any of the manners hitherto proposed. Nor does, in fact, spongy platinum, freshly prepared, ignite common illuminating gas.

These considerations lead naturally to the idea of employing more durable forms of platinum, such as wire or plate, and producing the same catalytic power by means that will not be subject to new objections. Still, there do not, thus far, seem to have been any proposals or experiments brought forward in this direction.

The experiments undertaken by Herr Klinkerfues for the purpose of ascertaining the temperature at which compact platinum, brought into the shape of wire or plate, acquires sufficient catalytic power to ignite illuminating gas, showed that not even a red heat was required. A platinum wire inserted between the poles of a very small galvanic pair of zinc and graphite, without showing the slightest emission of light in the dark, ignited a jet of glass almost instantaneously. It is evident, in this case, as the red heat of the wire is only an effect of catalytic action, that the galvanic circle is acting in a very different manner from the former methods, which effect ignition by the direct action of the electric spark.

This circumstance and the hydraulic closing of the galvanic circle are the principal characteristics of the new contrivances, whose practical value has, it is asserted, been tested by numerous experiments; for if a stronger action of the galvanic current were required, the power of the battery would be exhausted in a far shorter time; and indeed it would be impossible to employ an apparatus of small interior resistance, such as zinc and graphite, with a solution of bichromate of potassa and sulphuric acid, or chloride of silver and zinc with a solution of salt, for months without renewing the filling. At the same time the hydrostatic manner of closing and breaking the galvanic circle affords the easiest and simplest means of instantly producing the desired catalytic action, and afterward stopping it again at will, for the sake of economizing the materials.

On this principle of imparting catalytic power to platinum in its compact forms, by means of the galvanic current, the inventor has had several kinds of gas lighting contrivances constructed, for which patents have been obtained through the Scientific American Patent Agency.

The first apparatus consists of a thin, hollow, glass cylinder, of suitable size, closed at the bottom, and covered by a plate, bearing on the inside a galvanic pair of zinc and graphite plates of small size.

These plates are respectively connected with electrodes that project from the outside of the plate, holding an inserted bit of platinum wire. The liquid filling consists preferably of the well known mixture of bichromate of potassa and diluted sulphuric acid, which will be active for a long time.

In order to light gas flames for domestic purposes with this simple apparatus it is only necessary to incline it sufficiently, and, at the same time, hold the platinum wire before the jet of the gas that escapes from the burner. But when the apparatus is placed upright, the plates not touching the liquid, no galvanic action takes place, and consequently no material is consumed by electric action, so that, it is claimed, a mixture of the value of a few cents suffices for many thousand repetitions of the operation.

When the mixture is comparatively fresh, the platinum wire becomes so far red hot as to ignite a paper match impregnated at one end with chlorate of potassa.

The second application of the same principle is intended to supply a kindling apparatus for rooms not furnished with gas.

Doebereiner's principle for the evolution of hydrogen gas is worked by the pressing down of a lever, which, at the same time, immerses a small galvanic pair of zinc and graphite plates in a mixture of bichromate of potassa and sulphuric acid, and thus excites catalytic power in a platinum exposed wire, to the hydrogen gas jet.

The working of Mr. Klinkerfues' apparatus is said to be very reliable, rendering it far preferable to Doebereiner's with platinum in the spongy form.

The third of the proposed contrivances is intended to be applied to street gas lights for the purpose of simultaneously lighting and extinguishing a number of lamps from a single station with the smallest possible loss of gas or other material.

Important reasons forbid that the shutting off the gas supply should be placed far back of the mouth of the burner, and make it necessary to devise some means for opening and cutting off the supply from a distance. At first sight the simplest way to effect this would seem to be by stop cocks, connected with electro-magnets, to be worked by galvanic action from a common station. But, in the first place, it would hardly be possible to guard against loss of gas and the entrance of atmospheric air into the pipes.

Another consideration presents itself in the fact that galvanic batteries intended for the production of caloric must be of weak resistance, and are, therefore, incompatible with great lengths of conducting wires, as well as long duration of galvanic action, if a frequent renovation of the filling is to be avoided. It is, therefore, proposed to furnish each lamp post with its own galvanic apparatus, and to make the galvanic pair touch the liquid only during the short time of lighting up.

An hermetically closed vessel is provided with a compartment or bell, open at the bottom, so as to communicate with the main vessel, and having a galvanic pair of zinc and graphite fixed to the cover in such a manner that the solution of bichromate of potassa with sulphuric acid, contained in the lower part of the vessel, is not reached by them when the apparatus is in its usual inactive state. A pipe leading to the burner of the gas flame, passes, air-proof, through the cover of this vessel, and is immersed in the liquid, thus shutting off the outward air from communication with the upper part.

The latter is filled, above the above named liquid, with illuminating gas supplied from the gas works, and as the pipe which passes through the cover is of sufficient length to hold the hydrostatic column raised by the small and nearly constant pressure usual in gas pipes, it takes the place of the last stop cock in the supply pipe.

By another pipe leading to the bell from a station at any required distance, the air in the upper part of the bell can be rarefied, and thus the liquid in the hermetically closed vessel can be sucked up, lowering the surface so that the escape of the gas through the pipe leading to the burner is first opened, and then, on continued suction, the zinc and graphite plates are reached by the liquid.

At this point the galvanic circle is closed, and the platinum wire over the mouth of the pipe leading to the burner becomes heated, and acquires sufficient catalytic power to kindle to a flame the hydrogen contained in the gas jet.

After this is effected, a slight remission of the sucking power in the pipe is made to sink the level below the galvanic plates in order to avoid unnecessary exposure, but without shutting off the escape of the gas.

In order to make sure of this effect on all the lamps a model apparatus must be placed at the station, corresponding in all respects to those of the lamps.

The putting out of the light is effected by opening the sucking pipe to the access of atmospheric air, thus restoring the previous state of equilibrium, and, at the same time, preventing differences of temperature in different parts of the sucking pipes to cause partial suckings, and thus stop the correspondence in the working of the apparatus on the different lamps.

This apparatus may be attached to any ordinary gas pipe, and is easily removed, when required, for the purpose of a revision.

To guard against interruption in the hydraulic connection of the galvanic circle by the effect of low winter temperature, in either freezing the water of the filling or causing the bichromate of potassa to be crystallized from the solution, it is necessary to employ, during the winter months, a solution containing a greater quantity of sulphuric acid and less of the chromate, a mixture that practically is best prepared on cold winter days.

Let in the Sunlight.

Mrs. Henry Ward Beecher, in an article in the *Christian Union*, on mistakes in our houses, specifies the "exclusion of sunlight" as one. She says:

We wish the importance of admitting the light of the sun, freely, as well as building these early and late fires, could be properly impressed upon our housekeepers. No article of furniture should ever be brought to our homes too good or too delicate for the sun to see all day long. His presence should never be excluded, except when so bright as to be uncomfortable to the eyes. And walks should be in bright sunlight, so that the eyes are protected by veil or parasol, when inconveniently intense. A sun bath is of far more importance in preserving a healthful condition of the body than is generally understood. A sun bath costs nothing, and that is a misfortune, for people are deluded with the idea that those things only can be good or useful which cost money. But remember that pure water, fresh air, sunlight, and homes kept free from dampness, will secure you from many heavy bills of the doctors, and give you health and vigor, which no money can procure. It is a well established fact that people who live much in the sun are usually stronger and more healthy than those whose occupations deprive them of sunlight.

Silver Ores from Utah Territory.

It is proposed to erect in Pittsburgh, smelting works of sufficient magnitude to reduce the silver ores from the West, and so save the heavy transportation charges to and from England or Germany, in which countries the ores are chiefly at present smelted. A project of this kind is not likely to lack encouragement from the Pittsburgh capitalists, and the operation is expected to commence in the present month. Thus will be added another important manufacture, and a new source of prosperity, to the varied and important industries of Pittsburgh.

Mr. R. J. Anderson recently brought to Pittsburgh, some specimens of silver ore, which had been taken from the earth under his personal supervision. The yield of silver from the mines in question has been as high as eight hundred dollars per tun of ore; besides a very large percentage of lead, enough, indeed, to pay all the expenses of mining, freight to Pittsburgh, and the cost of smelting.

How to Banish Fleas.

The *Maryland Farmer*, a most excellent monthly, published in Baltimore, gives the following useful recipe for exterminating fleas:

"The oil of pennyroyal will certainly drive these pests off; but a cheaper method, where the herb flourishes, is to throw your dogs and cats into a decoction of it once a week. Mow the herb and scatter it in the beds of the pigs once a month. Where the herb cannot be got, the oil may be procured. In this case, saturate strings with it and tie them around the necks of dogs and cats, pour a little on the back and about the ears of hogs, which you can do while they are feeding without touching them. By repeating these applications every twelve or fifteen days, the fleas will flee from your quadrupeds, to their relief and improvement, and your relief and comfort in the house.

Strings saturated with the oil of pennyroyal and tied around the neck and tail of horses will drive off lice; the strings should be saturated once a day.

An Useful Invention on Shipboard.

Not long ago there was seen on board the timber laden ship *Henry Woolley*, lying in the Victoria Dock, Leith, a useful but unusual piece of machinery, so far as ships are concerned. The vessel was making water, and to save the crew the heavy labor of pumping her, a windmill, with simple machinery was connected with the pumps. When the wind was blowing high, recently, the mill was revolving with great velocity, and doing the work well. Such an appliance was lately adopted with marked advantage on board an Aberdeen guano laden vessel, which sprung a leak when she was a month out at sea, on her voyage from Callao to Leith. A handy carpenter, who was on board, set to work at the suggestion of the captain, and rigged up a windmill which relieved the crew of their extra work, and enabled the crew and the ship to arrive safe in port. The use of the windmill for pumping barges is very common in this country. They are employed on most of the North River ice barges that ply between this city and the up country ice establishments.

TERRA COTTA IN GEORGIA.—A correspondent informs us that terra cotta of the finest quality is found near Atlanta, Ga., and is now being worked into drain pipes, chimney tops, building ornaments, flower vases, garden statuary, fountains, etc.

WE are glad to hear of the recovery and repair of one of the Anglo-Atlantic telegraph cables. The British steamer *Scanderia* is now fishing for the second cable, and we shall probably soon announce its restoration to efficiency.

THE use of torpedoes for killing fish for manure, on the coast of Florida, has driven the shoals of fish from the shore, and has naturally been resented by the inhabitants of the seaboard of that State.

Business and Personal.

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

Queries.

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

1.—Mounting Chromos.—I wish to mount some chromos and engravings on canvas for framing. Should the canvas be dampened before being tacked on to the frame? If it should, then must the picture be dampened also, and applied to the canvas before the latter is dry? Or must the canvas be perfectly smooth before the picture is pasted on to it? Does the canvas require to be sized with anything? What kind of paste is best? and should it be spread upon the canvas or the picture? I would like full instructions for doing the work.—T. E. C.

2.—Turning Metals.—Will some one give, from practical experiments, the proper speed for the surface in turning brass, copper annealed cast iron, cast iron unannealed, wrought iron, malleable cast iron, annealed cast steel, cast steel unannealed, cast steel tempered to a blue, and chilled cast iron rolls? A. H. G.

3.—Roaches.—Is there any sure poison for roaches, that may be used without danger to children or domestic animals?

4.—Pigment for Glass.—I wish a pigment for glass, something similar to collodion used by photographers, that will dry quick and hard, and that will not peel off in water. If possible, something that can be put on with a brush and stencil plate.

5.—Cisterns and Chimneys.—What should be put into a cistern of rain water to keep it pure and fit to drink when necessary? What will prevent chimneys emitting a sooty odor? Will sweeping obviate it?—E. E. H.

6.—Grading Ditch.—I intend making a fish pond, and for the purpose have to tap the river several hundred yards above. Will some one advise me how to grade the ditch?—O. C. H.

7.—Gun Barrel.—Will any one tell me how to prove a gun barrel to be London fine twist?—H. B.

8.—Sour Well Water.—Can any of your readers tell me the cause of sourness in well water? The well is removed from drains and impurities, but in the spring it has an acid taste resembling tartaric acid. At all times it is very hard, and will turn tea very black, more like black dye than tea; it will make white cloth turn yellow, if left in a few hours. The upper soil is sand, and the bottom of the well is quicksand. Is the acid hurtful, and what will correct it?—H. B.

9.—Circular Saw.—Which will run the easiest (*i.e.*, with the least power), an eight inch circular saw one eighth of an inch thick, and sixty teeth, or one, one sixteenth of an inch thick, and thirty teeth?—E. A. M.

10.—Dissolving Rubber.—I should be glad to find out, through your columns, how I can dissolve india rubber, so as to make it form a component part of a printer's roller composition, and what is the best kind of rubber to use. I have tried rubber in wood naphtha, and failed.—P. E. M.

11.—Stained Clothing.—How can I remove the stain of tincture of iron and quinine from clothing?—J. J. W.

12.—Fireproof Whitewash.—Wanted—a whitewash for inside of covered railroad bridge, to render timbers spark proof?—A.

13.—Cheap Battery.—I tried A. G.'s directions to make a cheap battery. I first procured a gallon stone jar, and placed a cylinder of sheet zinc in it. I then took a flower pot, and placed a cylinder of sheet lead in it, and filled it with a solution of sulphate of copper, and the outside with a solution of common salt. I then put brass wires through holes in the lead and zinc; at first it did not work, so I cleaned my zinc with sulphuric acid, and tried again. It worked at first, so that it made an electro-magnet slightly magnetic, but the next day it would not do that. I finally concluded to take it to pieces. I evaporated the solution of blue vitriol, and expected it to crystallize, but it did not. On straightening the lead, I found it covered with copper about one thirty-second of an inch in thickness, which was so brittle that it broke very easily, and would not soften when I heated it, and put it in water. Will A. G. explain?—G. M. A.

14.—Restoring Steel.—Will some of your correspondents give me the recipe for renewing steel, after it has been burned or heated too hot in working?—A. T. L.

15.—Soldering Old Ware.—Can some one of your correspondents tell me how to make an acid to solder old tinware, copper, etc.? Being a tinner, I find out that something that will not eat the tinning of the iron is more desirable than the old style of zinc and muriatic acid, as every time there is any old greasy thing brought to the shop, acid must be used; and just as sure as it is, you must tin the iron as soon as it is done. Something that won't have any effect on the iron would be better to use.—L. E. A.

NEW BOOKS AND PUBLICATIONS.

Hit. By Mary E. Walker, M.D. New York: American News Company.

This book is a remarkable proof of the dispersive power of the writer's mind. Probably never before was so little matter dilated into an average sized book. While containing nothing that is calculated to disturb our habits of thought, and little that will induce us to exercise the powers of memory, which are, like other mental faculties, much overtaxed in these days, there is a simplicity in the manner in which the trite sentences are repeated, which is innocence itself; and the utter absence of any pedantic elaboration or references to recondite authors, either for facts or illustrations, hightens our idea of the writer's *naivete*. The only remarkably original thing in the book is a statement that the Orleans dynasty was expelled from France in consequence of the death of the Duke of Orleans. It is generally believed that the revolution of 1848 was created by the obstinacy of Louis Philippe, which was so great that the popularity of his wife, sons, and daughters could not save him from public indignation; but we do not desire to lay ourselves open to a charge of ungallantry, and so will not insist upon accuracy.

Answers to Correspondents.

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

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

H. F., of Md.—The following, relative to the invention of the link motion, from Auchincloss' work on "Link and Valve Motion," answers your queries: "The first form was invented by Mr. Howe, in 1843, and applied to the locomotives of Messrs. Robert Stephenson & Co. It is, in fact, the representative link motion, which, excepting slight modifications in the mode of suspension, remains unchanged by the accumulated experience of a quarter of a century. Simultaneous with the appearance of this motion was that of the second, the discovery of Mr. Daniel Gooch. It accomplishes perfectly analogous results, and has met with much favor throughout Great Britain and the Continent. The 'Allan' combines the characteristic features of the Howe and Gooch link motions in such a manner that the parts are more perfectly balanced, consequently it dispenses with the counter weight or spring peculiar to the former of these motions. The Walschaërt motion is extensively applied in Belgium, but probably will not receive much attention from locomotive engineers, beyond the limits of that kingdom, unless future designers succeed in reducing the number of its connections."

Liquid Glue.—Fill a vessel (I use a glass jar) with broken-up glue of best quality, then fill it with acetic acid. Keep it in hot water for a few hours, until the glue is all melted, and you will have an excellent glue always ready.—F. W. S.

Millstone Dress.—If J. A. P. will put fourteen quarter dress, four inches draft, with three short furrows intersecting the leading ones in his buhrs (supposing them to be of medium porosity), and crack the face parallel with the furrow, say after every five or six hundred bushels are ground, keeping the furrows deep at the eye, with same width of furrow (not allowing the stones to run empty), running the stone from one hundred and sixty to one hundred and eighty revolutions per minute, he will find his mill will grind faster, cooler, and make better flour. The trouble is, he has not leading furrows enough in his nine quarter dress, and the short furrows cross each other at too great an angle. J. A. Mc., of Ind.

Pounding of Piston.—Steam is elastic, and consequently an excellent spring or cushion for a steam cylinder, between the piston and cylinder head. Adjust your eccentric so that enough steam will enter the cylinder to cause a gentle pressure to reach the wrist pin as the latter arrives at the center or dead point. Thus the steam begins to impart its power at the first opportunity, without any concussion or pounding in any of the connecting joints. Although some of the connecting joints may be a little loose, yet the lead may be so nicely adjusted that the wrist pin will pass the centers without any concussion, pounding or jarring, provided the governor works right, and the steam is dry.—W. W. C.

Horoscope.—E. T., in query No. 13, June 10, asks the meaning of tracing the horoscope. The horoscope of the astrologers was the aspect of the heavens at any particular time, and was consulted by those wise men to obtain knowledge of the future weal or woe of the person or undertaking then under consideration. Thus, the position of the stars at the time of the birth of a child was its horoscope, and believers in the obscure science discovered all sorts of destinies for the infant, by inspecting the firmament. The science (?) of astrology is very ancient, and its existence can be traced in the writings of the Chaldeans. It is perhaps the only quackery, ancient or modern, that has had a systematic and consistent plan. I trust that no readers of the Scientific American are believers in such an imposture.—D. B, of N.Y.

Fixing Lead Pencil Marks on Paper.—Let J. H. R. stretch his drawing tightly on a board, with drawing pins, and pour a little pure milk (if he can get it) on the paper, turning the board about till the milk has flowed all over the drawing. The turning must be done at once as the milk must not be allowed to rest on the paper. When the whole surface is wetted, let the milk drain off, and leave the board with the drawing in the air to dry.—D. B., of N.Y.

Copying Ink.—A. S. can make copying ink by dissolving powdered refined sugar in ordinary ink. He should use just enough sugar to make the writing look slightly glossy when dry.—D. B., of N.Y.

Cloth Rollers.—R. A. D. will find that rollers covered with coarse emery will answer his purpose. Put a thick coat of glue on the roller, while it revolves slowly; then sift on the emery, let it dry, and then put on more glue; keep it revolving until dry, and then put it in the loom. O. K., of Miss.

Noisy Gears.—I would advise S. R. to grease his noisy cogs with tallow every morning, and, if they are properly geared, it will prevent the noise.—S. N., of Ohio.

Boils.—I advise W. E. to drink tea made from the root or leaves of the burdock, a pint or so a day for several weeks, which will cleanse and purify his blood, and prevent boils.—S. N., of Ohio.

J. C. F., of Pa.—Your plan of propelling wheels by tidal flow into and out of rivers, estuaries, etc., has been employed in all its essential particulars, with success, in Europe and India. We think it has also been used to some extent in this country.

J. H. P., of N. Y.—It is not unusual for concentrated maple syrup to deposit crystals like the specimen sent. There is no difficulty in making a perfectly white loaf sugar from maple sap by proper purification and draining. For purification, the process employed for refining the ordinary cane sugar would be appropriate.

J. H. S., of Pa.—All else being equal, it will take more power to drive a large shaft than a small one, principally on account of increased friction.

C. H. R., of N. Y.—You will find answers to your queries, if you follow with care what we have published and are now publishing on the subject of Canal Boat Propulsion.

T. D. L.—Your proposition for the propulsion of boats b forcing water through a longitudinal channel, with a pump or screw, is an old device.

W. B. W., of N. Y.—Your query is answered on page 209, current volume.

R. M. S., of Ill.—We know of no book specially devoted to the manufacture of grape sugar from starch. You will find the necessary information in various works on chemistry and chemical manufactures under the subject of sugars.

W. G R., of Mass.—The term "hydraulic lime" means the same thing as "meager lime," "water lime," "water cement," etc., comprising the cements sold in market for hydraulic purposes. These cements are made from limestones, containing in various proportions, alumina silicate of alumina, carbonate of magnesia, or oxide of iron.

G. S. C., of Texas.—The mineral you send is lignite of the tertiary age, but the specimens show an inferior quality. Still it may be of value in your section, if the bed be extensive, easily accessible, and near to market. But it would never compete with bituminous coal.

J. P. G., of Me.—The minerals you send are not apatite (phosphate of lime) but appear to be silicate of alumina.

J. W. M., of West Va.—The substance is comminuted quartz, and, no doubt, if it can be obtained of uniform quality, may be useful as a polish for certain purposes.

Recent American and Foreign Patents.

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

PRINTER'S FURNITURE.—In this invention a chase is used with side sticks having inclined planes upon one side, which are worked to clamp the types by other movable sticks, with counter inclines operated by screws, friction rollers being used between the inclined planes. It is the invention of W. H. Windsor, of Little Rock, Ark.

HYDROCARBON VAPOR BURNER.—Thomas Ward and Henry C. Hunt, of Chicago, Ill.—In this burner, jets of vapor are deflected downwards by a concave flange, and, when again ignited, heat the body of the burner, which latter conducts the heat down to the reservoir, and vaporizes the liquid. The jets issue from apertures pierced through the bottom of a groove formed in the body of the burner, immediately below the concave flange. The groove serves to intensify and retain the heat.

HOT AIR FURNACE.—A new general arrangement of smoke passages, air pipes, openings, and covering domes, is employed to regulate and to produce more or less heat, and to economize fuel. Invented by James M. Blackman, of Decorah, Iowa.

FEEDING BLAST FURNACES.—An improved valve arrangement is employed by the inventor, to distribute coal ore and fluxes more evenly than has been heretofore done. A V-shaped circular shell, consisting of two conical, bottomless cup-shaped vessels joined at the smallest ends, is made to fit the top or throat of the furnace. A valve apparatus of peculiar construction works at the bottom of this shell and in the throat of the furnace, to accomplish the objects above set forth. Patented by Leven S. Goodrich, of Waverly, Tenn.

WASHING MACHINE.—By means of a lever and a series of links or toggles, the inventor, John Brown, of West Manchester, Ohio, squeezes the clothes between pivoted beaters, working in a metallic tub heated by a suitable furnace.

WATER WHEEL.—This invention consists of improvements in a wheel patented in 1869, being a horizontal wheel taking water on one side and discharging on the other. It has for its object an improved arrangement and operation of the gates, and improved general arrangement of the parts of the wheel, which are claimed to add to the efficiency of such wheels. Invented by William J. Thompson, of Springfield, Mo.

BOBBIN WINDING MACHINE.—This invention provides certain devices in connection with the faller wire or guide and the driving mechanism for the band cylinders, so that under one adjustment the yarn may be wound in the required conical form upon cylindrical bobbins, and by another adjustment it may be wound on bobbins having conical bases. The combination is an ingenious and useful one, and increases the capacity of this class of machines. It is the invention of Warren A. Tolman, of Richmond, Ind.

ARBOR FOR SAWS AND GROOVING TOOLS.—Jacob Rand, of Boston, Mass., has invented an arbor for saws and grooving tools, by which it is designed to adapt arbors for holding tools for grooving, rabbeting, matching, sash-sticking, and beading, so that the one arbor table and driving gear may be utilized for various kinds of work, the tools only being changed. The neck of the arbor is made longer between the fixed collar and the screw threaded part, by which the clamping nut is applied, and when the saw is to be used, a long sleeve or washer is applied between the nut and the loose collar. The neck has a radial mortise through it next to the fixed collar for the application of grooving, beading, rabbeting, or other tools of like character, which are passed through the mortise and clamped against the fixed collar, by the clamping nut screwing directly against the loose collar, the washer being removed to compensate for the thickness of the tools. These tools vary considerably in width, so as not to fill the mortise in the neck; consequently a clamp screw is placed in the end of the arbor for holding the tools temporarily after being adjusted, and until the collar can be screwed up.

SCROLLS FOR OPERATING THE CARRIAGES OF SPINNING MULES.—This invention consists in a variable or adjustable scroll of peculiar construction on which the carriage-operating cord works over pins in the side of the wheel, which are adjustable towards or from the center at any part of the said wheel, which makes about one revolution for moving the carriage out or in. By shifting the pins at different points around the wheel towards or from the axis of the wheel, the carriage may be made to move fast or slow at any part of its movements out or in, as may be required by the nature of the work in hand. William Bond, of Windsorville, Conn., is the inventor of this improvement.

GRAIN BINDER.—This invention relates to a new attachment for binding grain on the harvester immediately after it has been cut, and without any more attention than is necessary to throw the twisting and binding mechanism into and out of gear. A band gatherer and twister is used, which takes the straw from the sheaf and forms it into a band. This twister is a sliding carriage, which, by and during its longitudinal movement, first pulls the straw from the sheaf and then feeds it back during the winding of the band around the sheaf. The twister contains a rotary shaft which twists the straw into the band while pulling it from the sheaf. A pivoted cradle in which the sheaf is deposited during the entire band making and winding operation is also employed. This cradle holds the sheaf in line with the shaft of the twister while the band is being made, and carries it at right angles thereto to let the band be wound around the sheaf. The cradle is provided with a claw frame or pair of tongs for retaining and finally releasing the sheaf. The machine is the invention of Charles G. Dickinson, of Poughkeepsie, N. Y.

STOP MOTION FOR WARPING MACHINES.—This invention relates to improvements in stop motions for warping machines. It consists in a novel arrangement of apparatus for throwing off the belt shipper, to be set in action by a hook or detector of wire let fall when a thread breaks upon a revolving grooved roller. A novel construction of a friction ratchet wheel is applied to the roller for driving the warp beam, and used, together with a holding pawl, to be let fall upon it by the shipper lever at the same time that the latter is thrown off to arrest the said roller and warp beam as soon as may be after the belt is thrown off. Invented by Paul Wilson and James Hunter, of Manchester, N. H.

WATER COOLER.—Thomas J. James, Petersburgh, Va.—This invention consists in an apparatus for cooling drinking water by means of a comparatively small quantity of ice placed in a separate chamber beneath the water reservoir, through which chamber passes a small pipe from the reservoir which conducts water through the ice chamber without discharging any water into the latter, said pipe emptying into a second reservoir below the ice chamber, the bottom of the latter forming the top of said second reservoir, and said bottom being of sheet metal, and in shape an inverted cone, from the apex of which the melted water from the ice drips into a pan beneath the lower reservoir; the water in the latter being cooled by contact with said conical bottom.

BROADCAST FERTILIZER DISTRIBUTOR.—James P. Machen, Centerville, Va.—This invention consists in a series of scrapers which rest on the upper part of a the distributing cylinder of a broadcast sower, and are hinged to a bar at the side of the same, which scrapers clean the surface of the cylinder as the latter revolves, while, at the same time, they present but a very trifling obstacle to its rotation.

FEEDING MECHANISM FOR SEWING MACHINES.—A novel arrangement of toggle levers, etc., is employed to give a sudden upward movement, but only a gradual horizontal adjustment of the feed, so that the change from each horizontal stroke will be quite rapid and effective, while the stroke itself is quite gradual. This obviates the objections to a curvilinear motion of the feed, which prevents it from taking proper hold at the beginning and end of the stroke. Invented by Philip Diehl and Ludwig Oehring, of Chicago, Ill.

FORCE PUMP.—James A. Sinclair, Woodsfield, Ohio.—This invention relates to a pump, in which a chamber of peculiar construction is placed within the well, above the surface of the water therein, for the purpose of receiving water therefrom, and in which a globular reservoir is employed, the same being placed outside the well, but connected with the chamber aforesaid by means of a pipe.

LADDER STAND.—Daniel R. Burkholder, Plainfield, Pa.—This invention consists of a stand for holding a ladder of any hight and at any inclination, by the foot solely, no support at the top being required, so that a ladder resting on this foot may be used for ascending into the air where there is no building, or for going up by the side of a wall that is too weak to sustain the weight of a ladder.

BROADCAST FERTILIZER DISTRIBUTOR.—James P. Machen, Centerville, Va.—This invention relates to sundry improvements in a machine, whereby fertilizers are distributed broadcast upon the land, said improvements having special reference to the combination of the distributor, cleaner, sieve, and stirrer; also to an arrangement whereby hard substances are ejected from the receiver without injury to the distributor, and to other arrangements, all of which tend to increase the efficiency of the machine.

SLIDE VALVE.—Joseph M. Coale, Baltimore, Md.—This invention has for its object to reduce the friction of the slide valves of steam engines to its minimum by the interposition of anti-friction rollers between the valve and a supporting bridge which prevents undue pressure of the valve upon its seat.

FIREPLACE FENDERS.—This improvement consists simply in the attachment of casters to fenders, by means of screw threaded shanks extending up through ears, the shanks having nuts screwed thereon. It is the invention of Charles C. Alger, of Pittsburgh, Pa.

REVOLVING URN STAND.—This invention provides a convenient and tasteful revolving stand for hot water urn, spices, sugar glasses, spoons, etc., used in preparing mixed drinks in bar rooms. Patented by William John Evans, of New York city.

CUPS FOR BOBBIN WINDING MACHINES.—John W. Vaughan, of New York city, has made in this invention an attempt to obviate the friction on the side walls of the slots of the glass cups on bobbin winding machines. He does this, he says, successfully, by so mounting the cups that they have freedom to be moved by the thread. He says in his specification: "I have found, in practice, that when mounted in this way they are kept in such rapid vibration as to agitate the air and induce currents, which, acting against the cups, take away the heat, so that I have no difficulty in winding the most highly colored threads which, up to this time, it has been exceedingly difficult, if not impossible, to wind without scorching or greatly damaging them by heat."

TOBACCO PIPE.—William G. Ruge, of Holstein, Mo.—This invention consists in making the bowl of a tobacco pipe reversible, so that when a charge of tobacco is nearly smoked out, the bowl may be again charged, and then reversed, so that the fire may ignite the new charge.

CULINARY BOILER.—This is a device for keeping cooked food warm, as long as requisite. It consists of a vessel designed to hold hot water, and to be set upon the top of a stove, while it has upper compartments, in which the articles to be kept warm are placed. Invented by Frederick Meyer, of New York city.

COMBINED VISE AND ANVIL.—This is a novel combination of a vise and anvil. The vise is made in the usual manner of a bench vise, and let into a dovetail in the butt end of the anvil, where it is held by a suitable bolt. Harvey V. Brown, of Warren, Ill., is the inventor.

CLAMP FOR THILL COUPLINGS.—William Boyd, of Hartford, N. Y.—The object of this invention is to provide a simple and convenient implement for drawing the eye of a thill iron into place, in a thill coupling, against the elasticity of the rubber used to deaden the sound, so that the coupling bolt can be readily inserted. The inventor accomplishes the end sought, by means of a lever with adjustable claws, which in use are hooked upon the eye of the thill iron, the lever having pivoted to it a slotted bar, which engages the rear end of the clip yoke.

BAGATELLE.—The general principle, or character, which distinguishes this parlor bagatelle from others hitherto known to the public, consists in combining gravity with muscular power, to act as antagonistic forces; the one impeling against the action of the other until the muscular power is spent, when gravity moves it until arrested. This is accomplished by inclining the table at an angle to a horizontal plane. A tension spring is applied to a piston that propels the ball, whereby the desired quantity of force may be given and graduated by the eye. Central cups, of courts, prevent the approach of the balls to the cups except in one direction, and create difficulty in counting at these points. Gates in front of the courts break the force of the momentum acquired by the ball in descending the declivity. Invented by Montague Redgrave, of Cincinnati, Ohio.

APPARATUS FOR ILLUSTRATING TRIGONOMETRY.—This is an instrument containing all the parts used in plane trigonomety, scaled alike, and so constructed that as the secant moves around the quadrant, and settles at any degree, and the other parts are placed in their relative positions, their scales announce the lengths of all, and, compared with the theory as taught in standard works, give the same results, thus showing to the eye what causes these changes of proportion, thereby fixing the theory in the mind. The instrument is made so that the limbs will slide on the radii, and the secant will turn on the center, and that a suitable connection of the secant with the co-tangent will be made, where they traverse each other, that will admit of the turning of the one and the sliding of the other, and extensions of the sine and co-sine, connected together at the ends which meet at the junction of the sine and co-sine. They are confined to the latter by clips, which admit of their sliding freely. The scale on it is nine parts to the inch, each part being eleven and one ninth hundredths; hence, by using it by attaching to any place on the sides, any decimal can be obtained. The parts are all scaled on one edge, as on the sides, and each limb is marked positive for that quadrant, but negative for the other; that is, on sine, secant, and tangent of the quadrant shown, is marked, on opposite sides, the co-sine, co-secant, co-tangent, and *vice versa*, so that a positive line on one quadrant may be a negative on the other, and so on around the circle. This instrument assists in explaining the expressions used in the text books, and does by actual work what is claimed for imaginary lines. By the use of the secant line and radius, it determines latitude and departure of any course and distances, as the traverse table of the standard works, and these sides show to the learner what is meant by the expressions "Dist.," "Lat.," "Dept.," and "Degree of the tables." It can also be used in measuring lines to inaccessible objects, and getting hights of any altitude, and the degrees of any ascent, by using the instrument as a theodolite, or for getting railroad curves of any radius or degree. In the hands of the student of mathematics, all the theory is obtained for transit and chain work, the secant representing the line of vision or direction of lines, the radii the points of the compass, and the scaling the distances required. Those familiar with trigonometry will, by comparing this description with the figures usually employed to illustrate definitions, be able to comprehend the use and operation of the instrument. Edwin A. Hickman, inventor, Independence, Mo.

WASHING MACHINE.—This invention consists in a roller, or shaft, covered with sponge, and a fluted or ribbed roller arranged together in a case, or tub for passing the clothes between them, the fluted or ribbed roller being so arranged as to compress the sponge at the same time that it presses the clothes upon it, in such a manner that the water is forced through the clothes in a way claimed to be very efficient in cleaning them. Invented by Nathan Booth, of Cheshire, Conn.

TASSELS.—This invention relates to that class of tassels which has the blocks made of glass. They have heretofore been made in a number of parts, or sections, held together by a metal tube inserted through them, and strung, like beads, upon a string passing through the tube. These sections, and the flanged metal tube that holds them together, make them very expensive to the manufacturer, and, of course, correspondingly so to the public. Again, the perforations necessary to be made in them, and the joints between the sections, are receptacles for dirt. In order to clean them, they must, each time, be taken apart, and each piece cleaned by itself. Again, moisture penetrates the joints and rusts the metal tube. This invention overcomes these objections by making this ornamental block weight of solid glass. Invented by James Norman, of Brooklyn, N. Y.

RAILROAD CAR STARTER.—An arrangement of gears and shifting apparatus with one of the axles and a spring, causes the spring to arrest the car, the spring being stretched by the winding of a cord or chain on a drum, and when starting, the gears being properly shifted, the power thus stored up is expended to set the car in motion. Arthur Amory, of New York city, is the inventor.

WAGON AXLE.—Combined wrought and cast metal journals are made by casting an outer wearing surface upon an inner wrought iron extension of the axle, by which a hard-chilled wearing surface strengthened by a wrought iron core to protect it against breaking, is obtained. An arrangement of the cast metal part for bracing the wrought iron part at the junction with the cast metal by the wood part of the axle when wood, is also employed. The extension of the wrought or rolled iron part of an axle may comprise the iron part of a combined iron and wood axle, or the whole of an iron axle for light wagons. This extension is made smaller than the hole in the wheel and an outer wearing part is cast around it for the axle, and chilled in the casting to form a more durable journal than the soft iron would, and a stronger one than cast iron alone. A collar is formed on the cast metal part, and extended along the wrought metal some distance, for strengthening the latter, and in case a wood piece, such as is common in heavy wagons, is used, a groove is made in the upper side of the extension with a slanting bottom, and the wood piece is fitted thereby for bracing the wrought iron part. The extension is provided with spurs for locking the cast metal on it. John and Peter Herrmann, of Tell City, Ind., are the inventors.

APPLICATIONS FOR EXTENSION OF PATENTS.

CORN SHELLER.—Andrew Dillman, of Joliet, Ill., has petitioned for an extension of the above patent. Day of hearing, August 23, 1871.

MOWING MACHINE.—George C. Dolph, West Andover, Ohio, has petitioned for an extension of the above patent. Day of hearing, August 23, 1871.

CHAIN MACHINE.—Lauriston Towne, Providence, R. I., has petitioned for an extension of the above patent. Day of hearing, October 4, 1871.

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115,555.—BOLT HEADER.—J. R. Abbe, Providence, R. I.
115,556.—WHIP SOCKET.—W. R. Allen, Stockton, N. J.
115,557.—GAS METER. A. W. Almqvist, F. W. Ofeldt, New York.
115,558.—SHOOTING IRON.—W. A. Andrews, Columbus, Ohio.
115,559.—FURNACE.—J. P. Arey, Georgetown, Colorado.
115,560.—FLY BRUSH.—H. E. Aughinbaugh, Harrisburgh, Pa.
115,561.—SEPARATOR.—A. H. Balch, W. D. E. Nelson, Montreal, Canada.
115,562.—CARBURETING AIR.—J. F. Barker, Springfield, Mass.
115,563.—SWAGE.—Eleazar Bless, Indianapolis, Ind.
115,564.—DRYING SALT.—G. C. Briggs, Boston, Mass.
115,565.—CLEANING PRIVIES.—H. C. Bull, New Orleans, La.
115,566.—BOOT AND SHOE.—D. H. Campbell, Scotland, and E. Woodward, Charlestown, Mass.
115,567.—SHOE PEG.—D. H. Campbell, Scotland, and E. Woodward, Charlestown, Mass.
115,568.—HOE.—J. S. Carroll, Covington, Ga.
115,569.—MOLDING GLASS.—D. Challinor, Birmingham, Pa.
115,570.—VARNISH.—C. V. Chapin, Collinsville, Conn.
115,571.—SHEARS.—John Christy, Clyde, Ohio.
115,572.—EVAPORATING LIQUIDS.—G. Clark, Buffalo, N. Y.
115,573.—PURIFYING BRINE.—G. Clark, Buffalo, N. Y.
115,574.—EYE GLASS.—Isaac Clements, Fort Ann, N. Y.
115,575.—SWAGE.—B. Coddington, La Fayette, Ind.
115,576.—GAMES.—G. A. Coffin, Cincinnati, Ohio.
115,577.—VALVE.—W. A. Cogswell, Rochester, N. Y.
115,578.—WATER WHEEL.—A. D. Cole, Toronto, Canada.
115,579.—MEAT CUTTER.—F. Covert, Farmer Village, N. Y
115,580.—EARTH CLOSET.—R. A. Cowell, Cleveland, Ohio.
115,581.—BOOT HEEL.—A. O. Crane, Boston, Mass.
115,582.—SCREW DRIVER.—J. P. Curtiss, New Britain, Conn.
115,583.—WAGON SEAT. J. A. and W. F. Dann, New Haven, Ct.
115,584.—OAR.—Nelson Davenport, Troy, N. Y.
115,585.—CORK SCREW.—Walter Dickson, Albany, N. Y.
115,586.—GAS RETORT. C. F. Dieterich, A. Schussler, New York.
115,587.—CUTTER.—R. H. Dorn, Port Henry, N. Y.
115,588.—METAL PIPE.—J. T. Fanning, Norwich, Conn.
115,589.—CONVERTING MOTION.—L. S. Fithian, Brooklyn, N. Y.
118,590.—GRATE. D. A. Flood, D. W. Brown, Woodbridge, N. J
115,591.—GAS MACHINE.—T. B. Fogarty, Brooklyn, N. Y.
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115,596.—GAS MACHINE.—T. B. Fogarty, Brooklyn, N. Y

115,597.—Gas Machine.—T. B. Fogarty, Brooklyn, N. Y.

115,598.—Camp Stool.—Henry Free, Lewiston, Me.

115,599.—Gig Saddle.—G. D. Gillett, Meridian, N. Y.

115,600.—Millstones.—J. T. Gilmore, J. S. Crane, Lake Village, N. H.

115,601.—Billiard Table.—L. A. Grill, New York city.

115,602.—Bearing.—A. W. Hall, New York city.

115,603.—Tenoning Machine.—E. P. Halsted, Worcester, Ms.

115,604.—Smoothing Machine.—Hugh Hamill, New York.

115,605.—Milk Cooler.—J. F. Harly, Cleveland, Ohio.

115,606.—Milk Cart.—John Harris, New York city.

115,607.—Lamp Tube.—E. K. Haynes, Boston, Mass.

115,608.—Lamp Burner.—E. K. Haynes, Boston, Mass.

115,609.—Hand Car.—J. C. Hearne, Pleasant Hill, Mo.

115,610.—Danger Signal. S. C. Hendrickson, Brooklyn, N.Y.

115,611.—Expanding Wheel. D. Hitchings, Litchfield, N. Y.

115,612.—Enameled Plate.—W. Hoge, J. R. Peck, Washington, Pa.

115,613.—Pump.—C. W. Isbell, New York city.

115,614.—Shuttle.—Thomas Isherwood, Stonington, Conn.

115,615.—Atomizer.—C. P. Janes, Boston, Mass.

115,616.—Shutter.—J. W. Jedkins, Monmouth, Me.

115,617.—Soldering.—I. Kaylar, Jersey City, N. J.

115,618.—Lubricator.—W. Kenworthy, J. H. Pollitt, Birmingham, Pa.

115,619.—Caster.—Joseph Kintz, West Meriden, Conn.

115,620.—Smut Machine.—Jesse Lautz, Wheeling, W. Va.

115,621.—Book Binding.—R. G. Lowey, Brooklyn, N. Y.

115,622.—Separating Oil. R. B., W. W. Lucas, Cleveland, O.

115,623.—Carriage.—George Martienssen. Brooklyn, N. Y.

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115,625.—Weather Strip.—S. McFall, Blandinsville, Ill.

115,626.—Oven.—Duncan McKenzie, Brooklyn, N. Y.

115,627.—Coupling.—E. D. Meier, St. Louis, Mo.

115,628.—Whistle.—M. Miller, Brooklyn, N. Y.

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115,796.—Casting Machine.—C. S. Westcott, Elizabeth, N.J.

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115,798.—Carbureting Gas.—S. Whitney, Flushing, N. Y.

115,799.—Mixer.—G. W. Wilson, Chelsea, Mass.

115,800.—Cooking Range.—C. J. Wood, Baltimore, Md.

REISSUES.

4,411.—Crozing Staves.—H. Elliott, E. Smith, S. S. Gray, Boston, Mass.—Patent No. 86,912, dated Feb. 16, 1869.

4,412.—Lock Nut.—P. L. Gibbs, Dunleith, Ill.—Patent No. 96,218, dated Oct. 26, 1869.

4,413.—Lamp.—H. Halvorson, Nashua, N. H.—Patent No. 25,506, dated Sept. 20, 1859.

4,414.—Bedstead.—F. Layaux, Monroe, La.—Patent No. 106,842, dated Aug. 30, 1870.

4,415.—Corset.—C. D. Rutherford, Brooklyn, N. Y.—Patent No. 60,425, dated Dec. 11, 1866.

4,416.—Cheese Vat.—Ezra H. and W. A. Stuart, Cedarville, N. Y.—Patent No. 112,090, dated Feb. 21, 1871.

4,417.—Treating Petroleum.—J. A. Tatro, Hartford, Conn.—Patent No. 99,748, dated Feb. 8, 1870; reissue No. 3,867, dated March 1, 1870.

4,418.—Paper Pulp.—H. Voelter, Heidenheim, Wurtemberg.—Patent No. 21,161, dated Aug. 10, 1858; antedated August 29, 1856; reissue No. 3,361, dated April 6, 1869; extended 7 years.

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4,971.—Cooking Stove.—W. H. Burrows, New York city.

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4,983.—Lamp Chimney.—M. Sweeney, Martinsville, Ohio.

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319.—Fertilizer.—Walton, Whann & Co., Wilmington, Del.

320.—Candy.—F. M. Whitelaw, Cincinnati, Ohio.

EXTENSIONS.

Method of Printing in Colors.—R. Croome, Brooklyn, N. Y.—Letters Patent No. 17,319, dated May 19, 1857.

Fire Alarm.—W. F. Channing, Providence, R. I., and M. G. Farmer, Boston, Mass.—Letters Patent No. 17,355, dated May 19, 1857.

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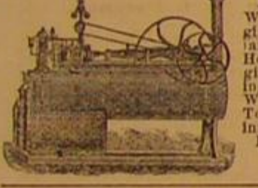

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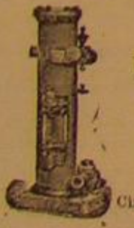

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