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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.

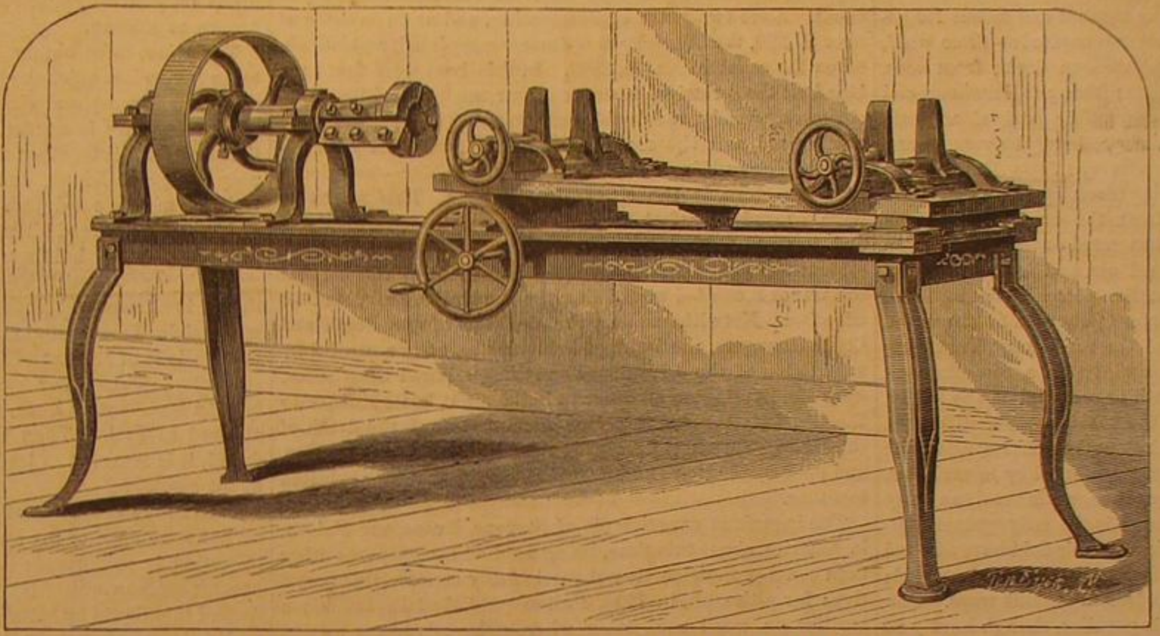
At each end of the carriage are clamping jaws drawn together by hand screws, as shown. The axle being held firmly in these jaws is fed up to the cutter head by turning the side hand wheel, as above described.

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.

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.



MACHINE FOR TURNING THE ENDS OF AXLETREES.

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

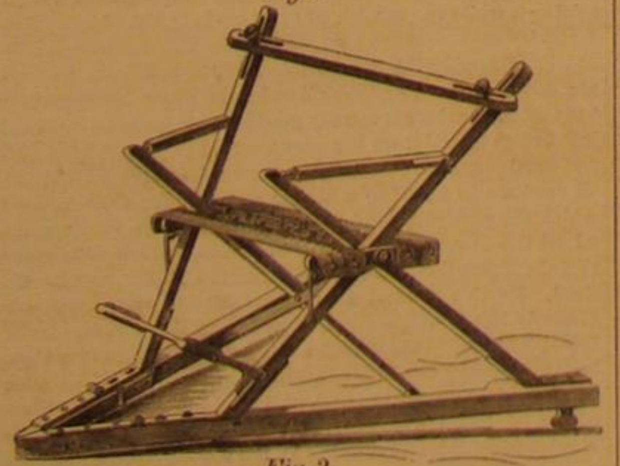


Fig 2

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 material 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 concussions.

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, revercible, 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.

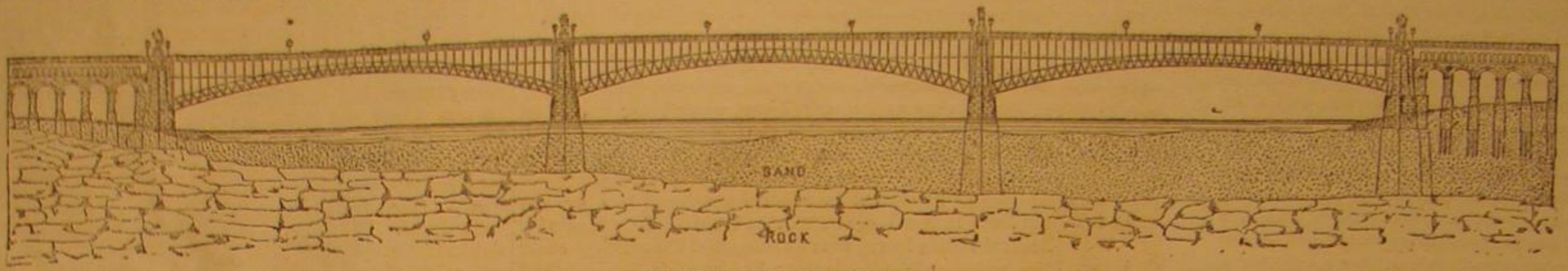
These changes consist mainly in using but one cast steel tube of eighteen inches diameter, instead of two of nine inches, in forming the upper and lower members of each one of the four ribbed arches composing each span; and in increasing the depth of each one of the arches from eight feet to twelve feet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

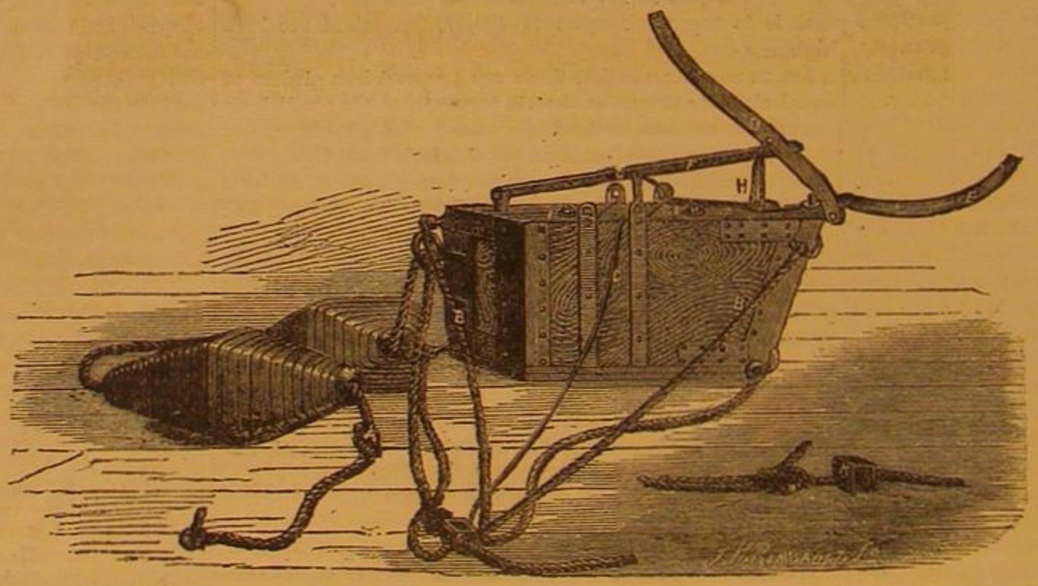


ILLINOIS & ST. LOUIS BRIDGE

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.



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.

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.

METAMORPHOSES OF THE BUPRESTIS.

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.

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 opportuuity 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 $\frac{3}{4}$ 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 $\frac{1}{4}$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. Lampblack 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 hand-made 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.

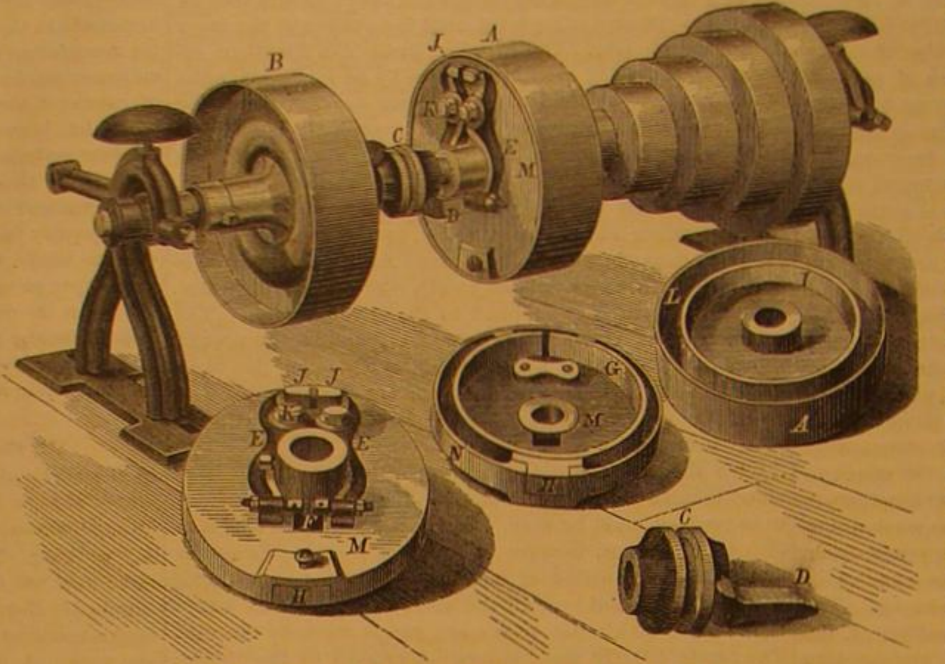
The following is a description of its parts and operation. A and B represent pulleys attached to a shaft, so that by the movement of the collar, C, one may be clutched while the other may be unclutched. The collar is shown in detail at the bottom of the engraving, though, as there shown, it is adapted 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.



ALLEN'S FRICTION CLUTCH 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.

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.

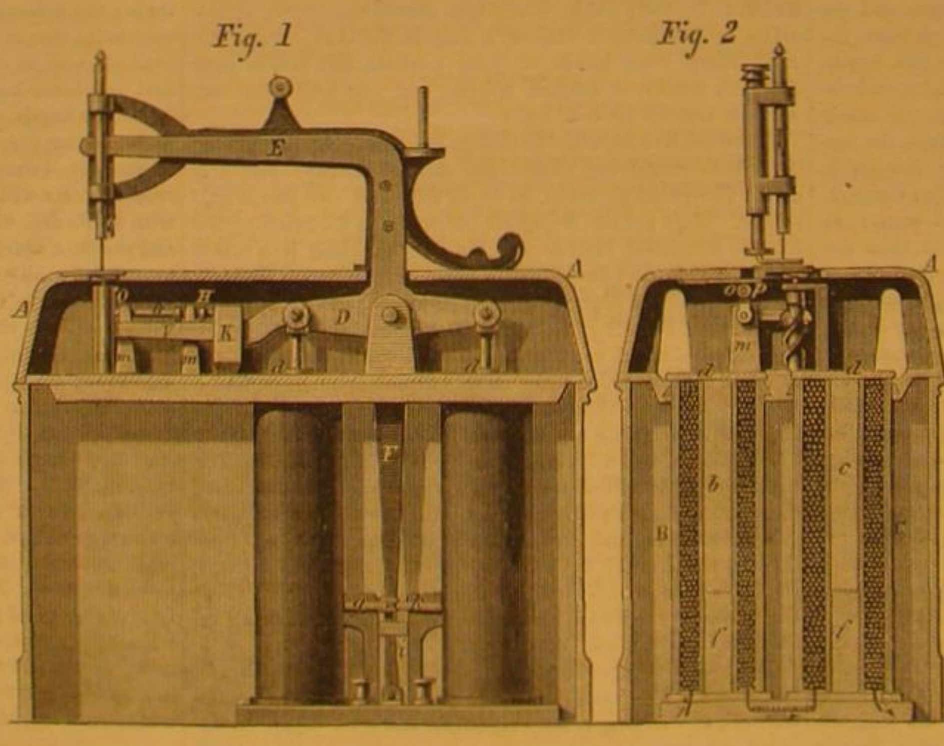
A is a case which rests upon the top of a cabinet, and serves to conceal portions of the machinery; it also serves as a table for the work; two pairs of coils, B and C, are placed so that their upper ends stand just within or at the bottom of the case, A, to which they are secured; these coils are placed 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 för 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 expr ssed 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 mean- 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.

Official List of Patents.

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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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115,597.—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.
115,624.—Fruit Peeler.—O. F. Mayhew, Indianapolis, Ind.
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.
115,629.—Plow.—J. G. Miner, Nashville, Tenn.
115,630.—Rail Joint.—G. E. Morris, C. W. Gregory, Danville, Ill.
115,631.—Boot Sole.—A. A. Moss, Philadelphia, Pa.
115,632.—Center Seal.—P. Munzinger, Philadelphia, Pa.
115,633.—Tidy Pin.—H. H. Newton, Cleveland, Ohio.
115,634.—Seal for Mains.—A. Odiorne, Springfield, Ill.
115,635.—Organ Bellows.—J. R. & S. R. Perry, Wilkesbarre, Pa.
115,636.—Carriage.—J. W. Pilkington, Bridgeport, Conn.
115,637.—Hydrant.—J. L. Pillsbury, Columbus, Ohio.
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115,794.—Stop Valve.—James Walsh, Philadelphia, Pa.
115,795.—Slotting Machine.—W. H. Warren, Worcester, Ms.
115,796.—Casting Machine.—C. S. Westcott, Elizabeth, N.J.
115,797.—Wagon.—R. B. White, Sheboygan Falls, Wis.
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. 99,768, 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.

DESIGNS.

4,970.—Range.—W. H. Burrows, New York city.
4,971.—Cooking Stove.—W. H. Burrows, New York city.
4,972.—Shot Pouch, etc.—J. T. Capewell, Woodbury, Conn.
4,973.—Billiard Table.—H. W. Collender, New York city.
4,974.—Gas Fire Logs.—T. N. Dixon, C. Friese, Phila., Pa.
4,975 and 4,976.—Stocking Fabric.—T. Dolan, Phila., Pa.
4,977.—Napkin Ring.—C. W. Goodhue, Lowell, Mass.
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4,979.—Clock Case.—E. Ingraham, Bristol, Conn.
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4,981.—Type.—John K. Rogers, Brookline, Mass.
4,982.—Type.—James A. St. John, Boston, Mass.
4,983.—Lamp Chimney.—M. Sweeney, Martinsville, Ohio.

TRADE-MARKS.

306.—Ranges and Stoves.—Abendroth Bros., New York city.
307.—Ranges and Stoves.—Abendroth Bros., New York city.
308.—Thrashing Machine.—James Brayley, Buffalo, N. Y.
309.—Baking Powder.—W. N. Hedges, Springfield, Ohio.
310.—Medicine.—T. E. Jenkins, Louisville, Ky.
311 to 313.—Nets and Lace.—A. G. Jennings, New York city.
314.—Cotton Bale Tie.—J. J. McComb, Liverpool, Eng.
315.—Umbrella.—H. T. Robbins, Hyde Park, Mass.
316.—Cigar.—Schmidlapp Bros., Memphis, Tenn.
317.—Cosmetic.—H. Schroeder, Quincy, Ill.
318.—Pistol.—American Standard Tool Co., Newark, N. J.
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.
Harvester.—W. T. B. Read, Chicago, Ill.—Letters Patent No. 17,451, dated June 2, 1857.

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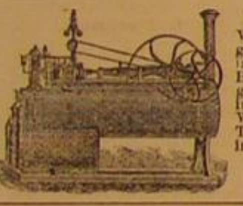

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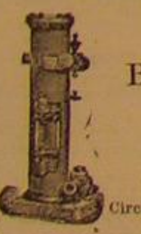

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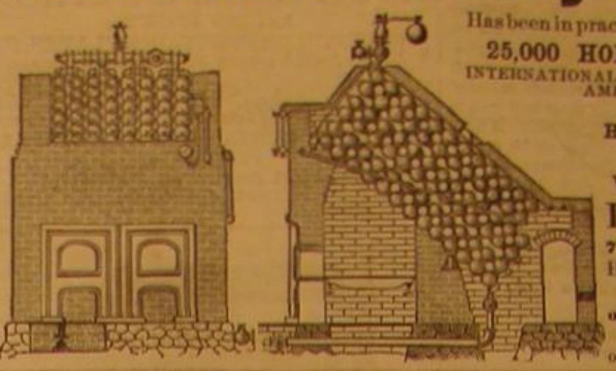

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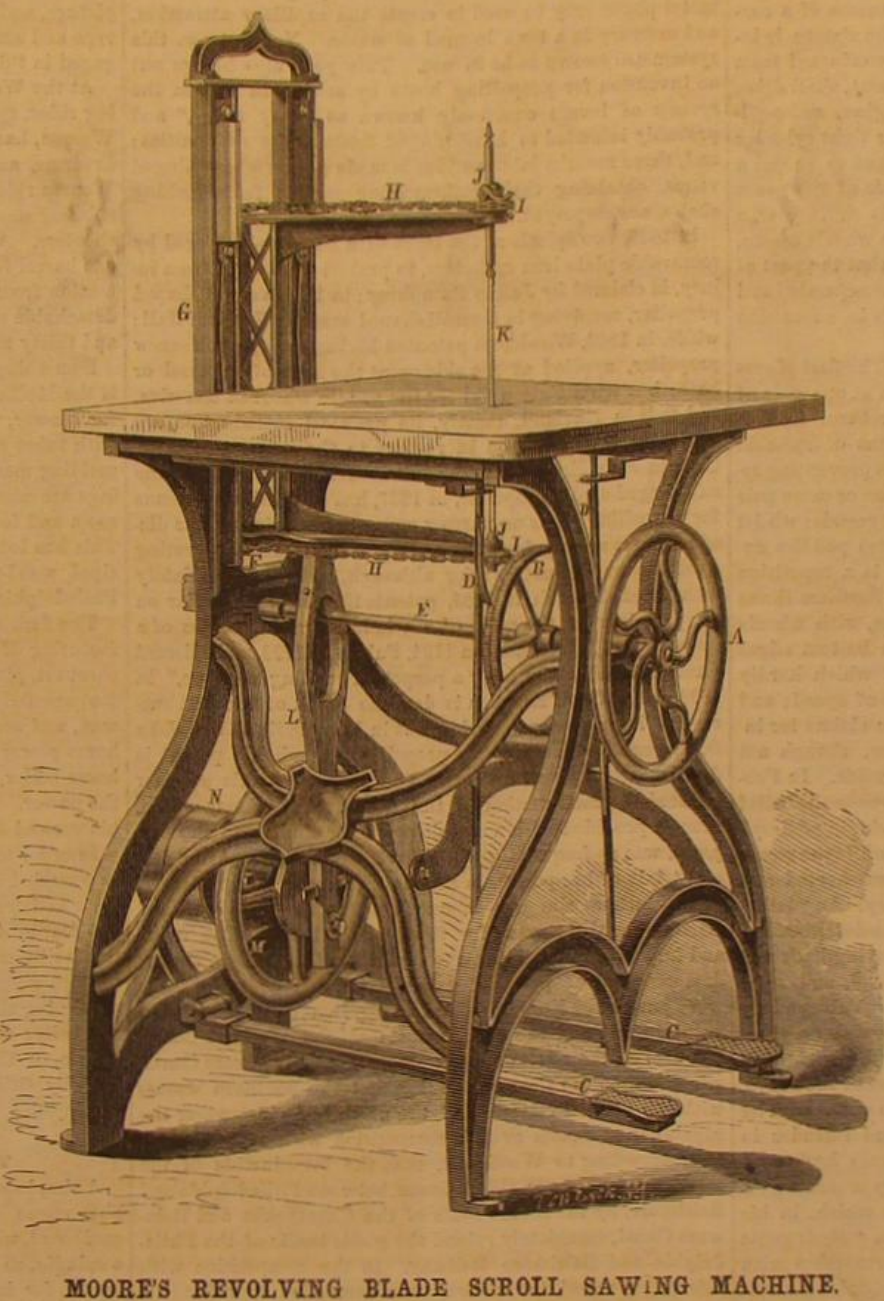
We regard this as an important improvement. With proper proportions in the design of the machine, we see no impracticability in gearing a saw in this manner, and the increased convenience secured by the invention will be apparent to all who have ever run a scroll saw on large work. For architectural purposes, it is specially adapted, and we think it is likely to become popular with those engaged in the manufacture of scroll work.

Patented March 29, 1870. Address, for further information, Charles D. Moore & Co., Lawrence, Mass.



MOORE'S REVOLVING BLADE SCROLL SAWING MACHINE.

Improved Carriage Hub.

Many attempts have been made to construct a hub of small proportions and elegant form, and to so fit the spokes as to combine increased strength with a neater appearance. Ordinarily, so much of the wood is cut away to receive the spokes that the hub is much weakened.

The object of the invention shown in the accompanying engraving is to attain the requisite strength, and at the same time secure a hub of small size and neat appearance.

To accomplish these results, a flanged metallic collar, A, is cast with wedge shaped crossbars or partitions, B, terminating in a sharp edge at the periphery of the collar. Between each two crossbars is formed a wedge shaped socket. In each socket is driven a wedge shaped spoke, or a spoke with wedge shaped enlargements, C, Fig. 2, corresponding exactly in form to the socket, and made to fit it firmly and tightly. The shoulders of the spokes rest against each other at the periphery of the collar, as seen at D, concealing the crossbars, and are thereby rendered selfsustaining and self-tightening.

The spokes have no shoulders at right angles to rest on the wooden hub, F, but are without taper where they enter F, as shown at E. The inclined faces of the spokes rest on the inclined faces of the crossbars, and thereby make the metallic collar bear the pressure and strain of the wheel.

The collar, being solid and spread out over a considerable portion of the wooden hub, the strain and pressure on the latter is more evenly and equally distributed, and not limited, as in other wheels, to the small spaces where the shoulders of the spokes rest on hubs. So entirely do the spokes depend upon the collar and upon the support they give each other, that if all the wood between the mortices were cut away, the wheel would remain nearly as strong as before. By this arrangement, we have a spoke possessing the greatest strength at the point where strength is most needed; and the wooden hub is relieved of the strain where it is necessarily the weakest; while the spokes resting against each other are, as above stated, self-sustaining and self-tightening. The hub is susceptible of being made in any desirable shape, and capable of receiving a neat finish and polish. It is claimed that the tire can be set truer on this wheel than on any other, because it possesses more elasticity at the hub.

Patented May 3, 1870. Rights to manufacture and sell on royalty may be secured by addressing Lowndes H. Davis, Jackson, Mo.

Fig 1

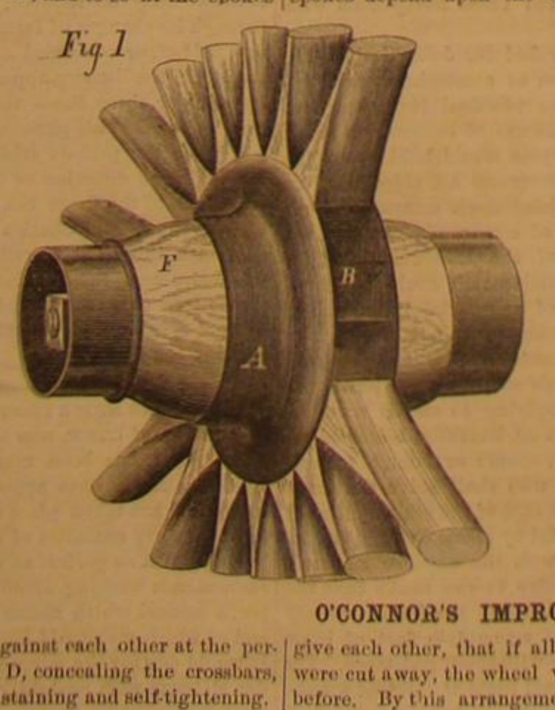
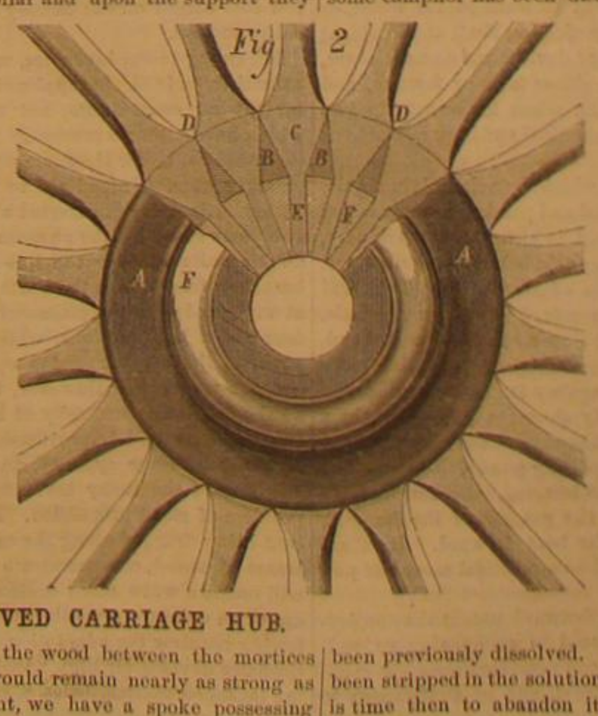


Fig 2



O'CONNOR'S IMPROVED CARRIAGE HUB.

Easy Method of Cutting Glass.

The cutting of glass, says the *Technologist*, is an operation so frequently put in practice in the laboratory, that any simple method of effecting it is sure to run the rounds of the press as soon as published. Almost all the methods in common use are very old. Of course, for cutting flat glass, such as window panes, the diamond is the best agent. For cutting rounds, or ovals, out of flat glass, the diamond is the best tool; and, if the operator has no diamond, it will always pay to carry the job to a glazier, rather than waste time and make a poor job by other and inferior means. When, however, it is required to cut off a very little from a circle or oval, the diamond is not available, except in very skillful hands. In this case, a pair of pliers, or very dull scissors, is the best tool, and the cutting is best performed under water. A little practice will enable the operator to shape a small round, or oval, with great rapidity, ease, and precision. When bottles or flasks are to be cut, the diamond is still the best tool in skillful hands; but ordinary operators will succeed best with pastiles, or a red hot poker. We prefer the latter, as being the most easily obtained, and the most efficient; and we have never found any difficulty in cutting off broken flasks so as to make dishes, or to carry a cut spirally round a long bottle, so as to cut it in the form of a corkscrew. And, by the way, when so cut, glass exhibits considerable elasticity, and the spiral may be elongated like a ringlet. The process is very simple. The line of the cut should be marked by chalk, or by pasting a thin strip of paper alongside of it; then make a file mark to commence the cut; apply the hot iron, and a crack will start; and this crack will follow the iron wherever we choose to lead it.

For drilling holes in glass, a common steel drill, well made and tempered, is the best tool. The steel should be worked at a low temperature, so as to be sure not to burn it, and then tempered as hard as possible, in either mercury or a bath of salt water that has been well boiled. Such a drill will go through glass very rapidly, if kept well moistened. A good liquid for moistening such drills is turpentine in which some camphor has been dissolved. This was the lubricator recommended by Griffin in his work on chemical manipulation, and it has been frequently published since. Dilute sulphuric acid is equally good, if not better; and we have found carbolic acid singularly efficient.

It is stated that at Berlin, glass castings for pump barrels, etc., are drilled, planed, and bored, like iron ones, and in the same lathes and machines, by the aid of sulphuric acid.

A little practice with these different plans will enable the operator to cut and work glass as easily as brass or iron.

Recovering Gold.

Gold may be stripped from articles that have been gilt by placing them in strong nitric acid, in which some salt has been previously dissolved. When a number of articles have been stripped in the solution, it begins to work slowly, and it is time then to abandon it, and use a new one. The gold may then be recovered from the old solution, by evaporating it to dryness, and fusing the residuum with a small piece of soda or potash, the gold being fused into a button. The addition of a little saltpetre will tend to make the refining process more complete. As there is some trouble connected with this process, it is scarcely worth adopting where very small quantities of gold are concerned. In such a case it is a better plan to suspend the article, from which the gold is to be removed, in the gilding bath in the place of the anode when gilding another article.

THE APPLICATION OF STEAM TO CANALS.---NO. 3.

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

In 1818, John Scott patented an arrangement by which forked poles, operated by wheels, push against the bottom of the canal, and, in case the depth is unusual, broad vanes, at the ends of the poles, thrust against the water, and are lifted into the air for the return. We also find in this year hinged floats fixed to a reciprocating chain under the vessel. Two years later, George Lilley and James Fraser recommend the application of a forcing pump to constantly supply water to a cistern upon the deck of a boat; while, by means of a condensing air pump, the pressure of the air in the cistern is increased until the force of a stream of water, conducted from the bottom of such cistern to the stern of a boat, shall drive the vessel forward. Vanes driven by an engine, and oscillating through a part of a revolution in an air tight cylinder or drum floating upon the water, are also found to propel a boat, by alternately receiving water on one side of the vanes and discharging it from the other; and, in this same year, a sanguine inventor claims applying the paddle wheels astern, or in the rear of the vessel, and so arranged that the part of the vessel which carries the machinery may be separated and applied to the stern of any number of vessels in succession to propel them.

The next year, we have four inventions. The first places the propelling wheels in a horizontal position at one side of the deck, with floats feathering as they return, folding against the periphery of the wheel by means of suitable levers, cog wheels, and inclined planes, and thus preventing resistance to the water. The second revolves one or more pair of paddle wheels in channels or sluices in the vessels; whilst the third, disdaining the aid of steam, operates paddles entirely upon the treadmill system. The last is a repetition of the endless chain and floats. In 1822, the Brothers Binns claim the application of a rotary steam engine, with wheels feathering the floats by reason of loading the bottom edges of the paddles proportionate to their surface, which hardly seems certain in action at even a medium rate of speed; and a few months after, we have one of the earlier claims for increasing speed by the use of geared engines, though not specially claimed as applicable to inland navigation. In February, 1824, Moses Isaacs, whose name inclines us to the belief that he was of Jewish extraction, patents a swinging "fiery" furnace, which alternately heats three boilers, while the steam from the cylinders is received by the boilers first heated and now cooling. This scheme is decidedly visionary. An "icthyodic oar" is next claimed by one Busk, which he describes as a wedge, between two planes under water, moving back and forward, turning on an axis through its thick end, and so as to touch with its sides each plane alternately. Valves admit the water, and close when the wedge forces the water against them. The oblique pressure of the sides of the wedge on the water propels the vessel. In a modification of the above, a wedge is caused to move up and down in the water with its thick end forward, and its edge horizontal, and includes in the specification revolving cones, with their axes horizontal and points turned towards the stern. He also presents as a novelty the pumping of water through tubes which, in his fondness for original names, he baptises as a "Hydropetic propellent," and the very next month, in partnership with James Neville, he desires protection for drawing along a boat by opening and shutting planes fixed at the bows after the manner of the covers of a book, and also claims forcing air through tubes against the water. Two months later, this same irrepressible William Busk appears as the inventor of a method of propulsion evidently taken from the action of the tail of a fish. An elastic plate, fixed at one end to an axis, is caused to vibrate back and forward in the water, or two such plates revolve from a projecting shaft at the stern; but Busk, with all his ingenuity of devices and nomenclature, does not appear to have realized either fame or fortune, and he subsides for a couple of years, when he brings up two other arrangements, quite as theoretical and impracticable as any that preceded them.

The first record of invention in which, by a chain lying in the water of the canal, fast at one end and passing round a wheel on board the vessel, which wheel is turned by machinery, the boat is propelled, leaving the chain behind on the bottom, is found in Samuel Brown's claim of March 15th, 1825, and is worthy of note, having been received at various periods, and even reported at the present time as in use in Holland. The disadvantages of this system in regard to passing locks and bends of the canal militate against it. As a modification of this principle, we were lately shown a plan whereby a heavy chain was tried on the Bridgwater Canal, but instead of using a direct pull as the propelling power, the chain was taken on board over the bow, and lowered, with considerable slack, vertically over the stern, the gravity of the hanging loop being expected to move the boat forward. It is unnecessary to add that this failed as a practical means of propulsion.

In this year John and Samuel Seaward patent the employment of a wheel or wheels placed in an opening or well through the bottom of the boat, and revolving upon the canal bottom, or against the sides thereof, and by that means to propel or draw the vessel forward. These wheels were provided with projecting knobs on their peripheries, in order to take a firm hold of the ground, or, if desired, projecting arms or radii could be used, in which latter case the arms were arranged to slide in and out of hollow spokes, so as to freely compensate for inequalities of the bottom. We can imagine some difficulties and considerable mud involved in the practical solution of this problem. Next year we have paddle wheels at the bow or stern, which lift on deck for convenience in lockage, and also the employment of kites for drawing vessels; the multiplication of these kites was to give "indefinite power," and very indefinite it would be surely, not perhaps in the sense intended by over sanguine inventors.

Congreve's device we have already mentioned. This patent issued in 1827, comprises a broad, thick band of sponge around a cylinder free to revolve in the water. The water rises into this band on one side by capillary attraction, and an endless chain compressing the band by its weight on the other squeezes the water out. The difference in weight between the two sides causes the cylinder to rotate and to draw the vessel on, or to move paddles to propel it. Glass or metal plates may be used to create the capillary attraction, and mercury in a tank instead of water. No boats on this system are known to be in use. This year also brings out an invention for propelling boats by setting in motion the system of levers commonly known as "lazy tongs," and probably intended to have hinged floats at its extremities; and, three months later, an idea is made public where hinged vanes, obtaining their reciprocating motion from rocking shafts, are employed.

In 1829, two spirals at the stern of a boat, and covered by removable plate iron cylinders, to protect the banks from injury, is claimed by Julius Pumphrey; in 1831, a scroll shaped propeller, revolving in a scroll shaped case, by William Hall; while, in 1832, Woodcroft patented his increasing pitch screw propeller, applied at the side or at the stem of a vessel or boat; but what Fulton did for the paddle wheel in America, and Bell in England, namely, its practical introduction, we must award to Ericsson in respect to the screw propeller. Captain John Ericsson, as the first actual demonstrator of the submerged screw propeller, in 1837, has afforded us a means for propelling boats on narrow water ways, without the disadvantages arising from the use of paddle wheels operating upon the water surface; for although, besides those lately mentioned, Bramah, in 1785, patented a screw propeller on the principle of the sails of a windmill or the blades of a "smoke jack," Littleton, in 1794, Fulton, in 1798, and Edward Shorter, in his claim for "a perpetual sculling machine," in 1800, yet to Capt. Ericsson is due the credit of the first successful improvement, carried out in May, 1837, on the *John O. Sergeant*, with a double propeller, though his patent is dated nearly a year previous. The success of this steamer induced the construction of the *Robert F. Stockton*, which, though provided with a double propeller similar to the *Sergeant*, was as frequently worked with one only. After several trials of her powers in England, she crossed the Atlantic in 1839, where she was at once sold to the Delaware and Raritan Canal Company for towing their boats. The value and importance of the screw to navigation having been clearly demonstrated of practical value, a number of screw boats were put on the lines of inland navigation which connected Lake Ontario and the St. Lawrence *viâ* the Welland Canal, and also on the route of the Chesapeake and Delaware Canal, which united the Chesapeake Bay and the southern waters with the River Delaware and the north. As instancing the capability of canals even in competition with railways, we find, according to Woodcroft, that the introduction of the small screw steamer, the *Ericsson*, between Philadelphia and Baltimore, by the inland route of the Chesapeake and Delaware Canal, completely ruined the goods traffic of the Philadelphia and Baltimore Railway. In the competition with this single vessel, the railway was compelled to reduce its passenger fares one half, and even with the attempted aid of the State, it lost its entire freight business. Capt. Ericsson also built, in 1839, an iron screw propeller, named the *Enterprise*, to run as passenger boat on the Ashby-de-la-Zouch Canal, but the introduction of railways prevented her being profitable for this purpose, and she was afterwards used to tow coal barges on the Mersey and Trent navigations with entire success.

Returning to our inventors, we find Sir John Scott Lillie patenting, in 1836, the application of atmospheric railways for towing canal boats, but the practical inconveniences which have hitherto prevented the use of locomotives along the canal banks for the same purpose would hold ground as strongly here. Intending to overcome all objections, an enthusiastic American started a joint stock company, about two years since, for the purpose of constructing an elevated double railway over the line of the Erie Canal and its branches, from which the boats underneath could be towed at any speed; but the estimates of cost certainly exceeding four and a half millions, while the dividends were not so positive, there yet remains opportunity for English subscribers to invest. However, this only goes to prove the awakening to the necessity of applying to canals some of the attention and improvements so liberally bestowed on all other carriage systems, and, sooner or later, a fortune will reward the lucky inventor who shall solve the great problem of canal propulsion. In case of the ordinary shaped boat being dragged along the canal by steam towage, any increase of speed, commensurate with the expense incurred, will create a wave more destructive to the banks than the use of an ordinary propeller, so that any system of railway towing requires the adaptation of a complete fleet of boats specially devised for high speeds with small resistance. For the tables on the resistance of canal boats at different speeds, and the disturbance of the water surface, reference is advised to the experiments of Stevenson in 1818, of Beran in 1832, of Palmer, as published in the first volume of the "Transactions of the Civil Engineers," with Professor Barlow's report thereon, and those conducted by McNeil on behalf of the proprietors of the Forth and Clyde Canal.

Worcester Manufacturers.

The Boston *Commercial Bulletin* keeps its readers well posted on New England manufactures. We copy from it the following items relative to Worcester (Mass.) industries

The Phœnix Plate Company are engaged in manufacturing black and patent chocolate tinted ferrotype plates, in egg shell and glossy surfaces, also japanned iron sheets in different sizes for sign painters' use. H. M. Hedder is the proprietor and patentee of the business, commencing a few years ago with three men; he now employs thirty. The iron plate is imported from England, as it cannot be produced in this country; only one firm in England knows the peculiar process for making it. It is coated with a varnish and then baked on, and is now used entirely as a substitute for a cheap picture, and is taking the place of the old style of daguerreotype and ambrotype pictures. There are only two firms engaged in this business in the United States.

At the Wesson Rifle Works are manufactured breech loading rifles, sporting guns and pistols. The proprietor, Frank Wesson, has an extensive experience in the manufacture of firearms, and claims to make an excellent article. The Wesson rifle attained a wide notoriety during our civil war, it being used to a great extent by the cavalry and sharpshooters. A new rifle, double barrel and breech loading, with one barrel for shot and one rifle bore, is attracting much attention from sporting men; also a patent target pistol, with a detachable shoulder rest. These are among their specialties; and thirty men are employed.

Something important to all wood-working establishments is the McClelland patent blower and duster. It consists of a fan blower, which can be located in any part of the building, with tubes or box pipes running from above each planing or molding machine or circular saw, by which all dust and shavings are conveyed into a main pipe and carried into the boiler room and fed under the boiler or run into a shaving room. This has long been needed, and is in use in many of the principal wood-working establishments in Burlington, Albany, Philadelphia, and other places.

The firm of Russ & Eddy has been engaged, in the manufacturing of picture frames and house moldings in walnut, chestnut, pine and hard wood, eight years, now using 250,000 feet annually of black walnut lumber. They employ twenty men, and occupy a building on Manchester street. A forty horse power engine, made by Tufts, of Boston, and a sixty horse boiler, made by Allen & Endicott, of Boston, furnish the power. They are also putting in a McClelland patent blower and duster.

In order to keep the ball rolling, R. Ball & Co. have recently occupied their new building, and will continue to make their articles of woodworking machinery. The building is 175 feet by 45, five stories, well lighted and supplied with the facilities for a large amount of work. The shafting and pulleys were furnished by Wood, Light & Co., of Worcester; a building thirty by thirty, two stories, is used as a dry room and boiler room; a new sixty horse engine, built by Charles Brown, of Fitchburg, supplies the power; the elevator was built by Otis Brothers, of Yonkers, N. Y.; and 100 men are employed.

The Phenomena of Vibration.

A simple apparatus for the observance of some beautiful phenomena can be constructed as follows: A disk of white cardboard, with apertures oblong in radial direction, is set on a spindle, so as to be rotated at any requisite speed. To examine, for instance, the flame of a gas light (in a glass tube, to prevent disturbance by air currents), place the disk in front of the light, so that the eye can see the light through each slit as it comes to a vertical position. If the speed of the disk's rotation is such that the interval of time between two slits passing the eye is just equal to the period of a vibration of the flame, the flame appears to be motionless; but if the velocity be reduced, the flame is seen to go slowly through its changes of form. If the interval be equal to, or one half of, or one third of, the period of the vibration of the light, the illusory appearance of a disk having as many, or twice or three times the number of, slits really in the disk is seen. This phantom disk will appear to be motionless when the periods coincide; but when otherwise, it revolves in one direction or the other. It is obvious that the vibrations of the flame can be easily counted by this means. The inventor, Mr. Charles J. Watson, counted, with a sixteen inch tube, 453 vibrations of the flame per second. By this instrument, the undulation of the vibrations of a wire can be seen to travel up and down the wire; and if watched by both eyes through the slits, the spiral course of the undulations can be observed.

PRESERVING STONE FROM THE EFFECTS OF DAMP AIR.—The obelisk of Luxor, now standing in the Place de la Concorde, Paris, has been much damaged in appearance, and numerous cracks have appeared on its surface. All this deterioration has taken place during the last forty years, the previous forty centuries of exposure to the dry Egyptian air having left it as perfect as when new. Dr. Robert, of Paris, recommends washing stone with a solution of a salt of copper, a method which seems to us to be practical and good, and of which we should like to know the results of a trial. It would destroy the minute lichens which disfigure our garden statuary with unsightly patches of green.

Protoplasm again.

The following paper on "Protoplasmic Life" was read on May 4, before the Royal Society, by Mr. F. Grace Calvert, F.R.S.:

A year since the publication of Dr. Tyndall's interesting paper on the abundance of germ life in the atmosphere, and the difficulty of destroying this life, as well as other papers published by eminent men of science, suggested the inquiry if the germs existing or produced in a liquid in a state of fermentation or of putrefaction could be conveyed to a liquid susceptible of entering into these states; and although at the present time the results of this inquiry are not sufficiently complete for publication, still I have observed some facts arising out of the subject of protoplasmic life, which I wish now to lay before the Royal Society.

As a pure fluid, free from life and having no chemical reaction, was essential to carrying out the investigation, I directed my attention to the preparation of pure distilled water. Having always found life, in distilled water prepared by the ordinary methods, by keeping it a few days, after many trials I employed an apparatus which gave satisfactory results, and enabled me to obtain water which remained free from life for several months.

The water had to be re-distilled three or four times before it was obtained free from germs, and it was then kept, in the apparatus in which it was distilled, until wanted, to prevent any contact with air.

Some water which had been distilled on the 20th of November, 1870, being still free from life on the 7th of December, was introduced by a siphon into twelve small tubes, then left exposed to the atmosphere for fifteen hours, when they were closed. Every eight days some of the tubes were opened, and their contents examined. On the fifteenth, therefore, the first examination was made, when no life was observed; on the 23d, two or three other tubes were examined, and again no life was detected; while in the series opened on January 2, 1871, that is to say, twenty-four days from the time the tubes were closed, two or three black vibrios were found in each field. Being impressed with the idea that this slow and limited development of protoplastic life may be attributed to the small amount of life existing in the atmosphere at this period of the year,* a second series of experiments was commenced on the 4th of January. The distilled water in the flask being still free from life, a certain quantity of it was put into twelve small tubes, which were placed near putrid meat at a temperature of 21° to 26° C. for two hours, and then sealed. On the 10th of the same month the contents of some of the tubes were examined, when two or three small black vibrios were observed under each field. This result shows that the fluid having been placed near a source of protoplasmic life, germs had become impregnated in two hours in sufficient quantity for life to become visible in six days instead of twenty-four.

Other tubes of this series were opened on the 17th of January, when a slight increase of life was noticed, but no further development appeared to take place after this date, as some examined on the 10th of March did not contain more life than those of the 17th of January.

[This very limited amount of life naturally suggested the idea that it might be due to the employment of perfectly pure water, so that Mr. Calvert commenced a third series of experiments.]

On the 9th of February 100 fluid grains of albumen from a new laid egg were introduced as quickly as possible, and with the greatest care, into ten ounces of pure distilled water contained in the flask in which it had been condensed, and an atmosphere of hydrogen kept over it. On the 16th some of the fluid was taken out by means of a siphon, and examined, and no life being present, twelve tubes were filled with the fluid, exposed to the air for eight hours and closed. On the 21st the contents of some of the tubes were examined, when a few vibrios and microzyma were distinctly seen in each field. On the 27th other tubes were examined, and showed a marked increase in the amount of life. In this series, in which a fermentable substance was employed, life appeared in five days, and an increase in ten, instead of requiring twenty-four days, as was the case when pure water only was employed.

As the weather had become much warmer, and a marked increase of life in the atmosphere had taken place, some of the same albumen solution as had been employed in the above experiments was left exposed in similar tubes to its influence, when a large quantity of life was rapidly developed, and continued to increase. This result appears to show that the increase of life is not due to reproduction merely, but to the introduction of fresh germs; for, excepting this fresh supply, there appears to be no reason why life should increase more rapidly in the open than in the closed tubes.

* During the intense cold of December and January last, I found it took an exposure to the atmosphere of two days at a temperature of 12° C. before life appeared in solution of white of egg in the pure distilled water, while as the weather got warmer the time required became less.

How many Hours Constitute a Day's Work?

Looking at the matter solely from a selfish and pecuniary point of view, says the *American Builder*, it appears that the requirement of the greatest number of hours is sometimes equally to the disadvantage of employer and employed. There are classes of work of which more can be performed in eight hours than in ten, especially work requiring great physical exertion. An instance of this was lately afforded in the construction of a railroad bridge in Missouri. There the manager of the work, wishing to compare the merits of the eight and ten hour systems, adopted each in succession, and it was found that by the first plan much more work was performed. The character of the labor was physically exhausting in the extreme, and when the men were required to work ten hours a day, they moved slowly and sluggishly, the rest of a night not sufficing to recover from the long-continued exertion; but when only eight hours were exacted, they had ample time for rest, and worked earnestly, being fully equal to the quick, heavy labor required of them. On the contrary, in many kinds of work of a less exhausting nature, there is no doubt that the hours of labor would be no more than could be performed with ease by either sex.

No general rule can therefore be given to determine the hours which may be said to constitute a working day, but could some limits be fixed, varying with the different conditions under which work is performed and intended to be a guide rather than a law, something would doubtless be achieved towards solving a problem which is now puzzling alike to employer and employed.

Milk Coolers.

A milk cooler for general use among dairy farmers should combine, if possible, the following nine points of excellence: First, it must be low priced, that all may be induced to buy and use it; second, possess the power of performing the largest amount of cooling with the least possible amount of cooling material, whether water, air, or ice, in order that all farmers may possess the means of application; third, easily kept clean; fourth, it must present ample facilities for aerating the milk, in order to allow the contained gases, or animal odor, as it is commonly called, to escape; fifth, durability, as no one will use a cooler if it must be renewed every year; sixth, it should be simple of construction; seventh, not liable to get out of repair; eighth, it must be easy of application, so that children or any body else can use it; and ninth, it must be so arranged that the cooling may be continued, or the intensity of the cold increased, so as to enable those using it to keep their milk over night during extremely hot weather. In our opinion, a perfect cooler for the use of the dairy farmer for cooling and deodorising his milk as soon as drawn from the cow, and at the same time enabling him to keep it through our hottest summer nights with safety, has not yet been brought out, neither will be, until one is constructed combining all nine of the points of excellence above written. Therefore, in selecting a cooler, our advice is to get that one which combines the most of these points, particularly the second, fourth and ninth, as its efficiency as a cooler depends so much on its perfection in these three points, that a failure in any one is a radical defect, and should condemn it at once.

There is, we presume, little need of our urging upon dairy farmers the necessity of using tin pails for milking, since so much has been already said and written in that direction; in fact, we regard utensils made of wood as being totally unfit for use about milk, and would recommend the substitution of tin, stoneware, glass, or porcelain in all places where practicable; and for ourselves we will not admit the use of wood utensils about the dairy, excepting for churns and butter tubs.

Galvanized iron and zinc utensils are objectionable, for the reason that acids act so readily and powerfully on the zinc, causing such a variety of changes through the galvanic agency thus developed, producing decompositions and recompositions difficult to control and unpleasant in results.—*Anson Bartlett.*

Formation of Gold Nuggets.

Mr. C. Wilkinson announced lately to the Royal Society of Victoria that gold when placed in a solution of its chloride undergoing decomposition by contact with organic matter, determines the deposit of much or all the liberated gold up on itself. This fact, first observed by Mr. Daintree, he assumes as accounting for the formation of nuggets. Mr. C. Wilkinson also found that copper, iron, and arsenical pyrites, galena, zinc blende, stibmite, wolfram, and molybdenite, also act as nuclei for gold thus reduced, but that brown iron ore and quartz do not. These results have been verified by a critical inquiry conducted by Mr. C. Newberry, analyst to the Geological Survey.

Mr. W. Skey, analyst to the Geological Survey of New Zealand, has communicated to the Wellington Philosophical Society a number of experiments on the same subject. He eliminated the cases of wolfram, etc., as being due to the presence of soluble proto-salts of iron, etc., and therefore had only to investigate the metallic sulphides and arsenides. On pursuing the subject, to his surprise he found that cubes of galena were perfectly gilt when placed in solutions of gold, without the intervention of any organic matter whatever. This direct reduction he has also effected by proto and bisulphides of iron, sulphides of copper, the sulphides of zinc, tin, molybdenum, lead, mercury, silver, antimony, bismuth, arsenic, platinum and gold, and among the arsenides, mispickel and arsenide of silver. While allowing therefore that organic matter has had a share in the reduction of gold, he thinks that by far the greater portion of our gold and silver deposits, especially those situated in the deeper seated rocks and lodges removed from carboniferous strata, have been wholly due to the deoxidising effects of pyritous minerals.

Manufacture of Spring Knives.

Few people, says the *Mechanics' Magazine*, have any idea through what a number of hands their pocket knives have passed in the process of manufacture. A bar of steel destined to furnish a number of blades is heated to redness. A length is cut off, and the forger speedily "moods" this, that is, shapes it roughly into the form of a pocket knife blade. Another heating is then required to fit the end for being fashioned into the tang, and yet another before it can undergo the further operation of "smithing," the last stage of which is the stamping of the mark of the thumb nail to facilitate opening. The tang is then ground, and the blade marked with the name of the firm. The slight bulge on the reverse side caused by this operation is removed by fire or the grindstone. The blade is then hardened by heating it to redness and then plunging it into water up to the tang. The tempering process follows next, the bluish yellow tint being considered as indicating that the proper degree of heat at which to immerse the blade once more in cold water has been attained. After this the various kinds of blades are classified in the warehouse, and undergo sundry grinding operations to fit them for being hafted. Twelve distinct processes have by this time been gone through, and many more are necessary before the knife is completely finished, although the number of hands which it has now to pass through depends in a great measure on the finish to be given to the handle, according to the quality of the blades with which it is fitted, and the price which the completed article is intended to realize.

Sunstroke.

Dr. Geo. H. Hope, M. D. in his little work entitled "Till the Doctor comes and How to Help Him," gives the following directions for the treatment of sunstroke until medical aid can be obtained.

SUNSTROKE.—This is a sudden prostration due to long exposure to great heat, especially when one is much fatigued or exhausted. It commonly happens from undue exposure to the sun's rays in summer, but I have seen the same effects produced in a baker from the great heat of the bake room. It begins with pain in the head or dizziness, quickly followed by loss of consciousness and complete prostration. Sometimes, however, the attack is as sudden as a stroke of apoplexy. The head is often burning hot, the face dark and swollen, the breathing labored and snoring, and the extremities cold. Take the patient at once to a cool and shady place, but don't carry him far to a house or hospital. Loosen the clothes thoroughly about his neck and waist. Lay him down with the head a little raised. Apply wet cloths to the head, and mustard or turpentine to the calves of the legs and the soles of the feet. Give a little weak whiskey and water if he can swallow. Meanwhile let some one go for the doctor. You cannot safely do more than I have said without his advice.

Prolonged Vigils.

Leibnitz sometimes passed three consecutive days and nights in the same chair, resolving a problem that interested him; an excellent custom, as Fontenelle observes, to accomplish a labor, but a very unhealthy one. The Abbé de la Caille, a famous astronomer, had a fork invented in which he adjusted his head, and in this position passed the night in astronomical observations, without knowing any other enemies than sleep and the clouds, without suspecting that there could be any more delightful way of employing those silent hours which revealed to him the harmony of the universe. Thus he contracted an inflammation of the lungs which carried him off in a short time. Girsdet did not like to labor during the day. Seized in the middle of the night by a fever of inspiration, he arose, lit the chandelier suspended in his studio, placed upon his head an enormous hat covered with candles, and in this strange costume he painted for hours. No one ever had a feebler constitution, or a more disordered state of health than Girsdet.

EXTRACT OF MEAT.—The following is the examination of the value of extract of meat, according to Professor C. Reichardt: According to Liebig 60 per cent of the weight of the extract should be dissolved in alcohol of 80 per cent. Good extract, dried at 100° C. should lose no more than 16 per cent. of its weight in water. Ether should not take up from the extract any, or at least exceedingly small, quantities of fat. The solutions should not contain any albumen, which remains as coagulated albumen in the residue which cannot be dissolved by water and alcohol. Good extract should contain from 6·5 to 10 per cent of nitrogen, and from 18 to 20 per cent of ashes which are rich in potash, 5·5 to even 9 per cent of the weight of extract, and phosphoric acid 2·7 to 6 per cent.

CHALKING JOINTS IN GLUEING END WOOD.—A correspondent in Wisconsin, a pattern maker of large experience, questions the efficacy of this method of securing a reliable joint in glueing the grain ends of wood. He says that he has tried it thoroughly years ago, and has found it not reliable, and that no method is so sure as to size the ends with glue first, and then make a smooth face before glueing permanently.

THE appointment of fire coroners to hold an inquest on every fire, to protect the public and the companies, is advocated. It is urged that if the payment of a policy were conditioned on the production of an official certificate, stating that investigation showed the loss to result from accidental fire, risks and premiums would largely fall.

THE California barley this season will be an average crop, and the wheat about two-thirds. The vintage will be the largest ever known, and the other crops are good throughout the State.

FURNITURE POLISH.—One pint of linseed oil, one wine glass of alcohol; mix well together; apply to the cloth with a linen rag; rub dry with a soft cotton cloth, and polish with a silk cloth. Furniture is improved by washing it occasionally with soapsuds. Wipe dry and rub over with a very little linseed oil upon a clean sponge or flannel.

BLOWING OUT OF THE EAST CAISSON OF THE EAST RIVER BRIDGE.

[From the Report of the Chief Engineer.]

In the original design for the caisson it was the intention to make the air chamber one vast unbroken space, without dividing or supporting frames of any kind, reliance being placed upon the solid timber platform of 15 feet thickness to transfer all strains equally from the shoe inward. To diminish the work above, the masonry was to be built inside of a wooden cofferdam placed on top of the caisson.

This programme was quite feasible theoretically, provided the air pressure could be maintained at the proper standard without possibility of failure, and provided the caisson was sunk through a soft uniformly yielding material. The shoe and sides of the caisson were made strong enough to resist the overweight occurring at each low tide.

The requirements of launching however, make it necessary to introduce five heavy trussed frames to serve as launching frames; they divided the caisson into six chambers, each frame being also well braced from the sides. These frames were allowed to remain in, large openings being cut in them for passage to and fro.

Subsequent events proved the necessity not only of these frames, but of double the additional support.

Very little attention was paid to the matter of supports at first; any irregular bearing below was easily distributed by the roof, even to the extent of having entire frames unsupported at a time. The wooden blocking on which the caisson was supported, proved sufficiently elastic to yield without crushing to any extent.

As the caisson sank deeper much of the dirt coming out was dumped on top of it, filling up all spaces not occupied by masonry. This was only the beginning of the overweight to be carried ultimately. Again, at very low tides, the overweight caused by them was equal to the weight of a volume of water 168x102x7 feet, amounting to 3,700 tons alone. This overweight kept slowly increasing until, one Sunday morning about 6 A. M., the south water shaft blew out, every particle of compressed air leaving the caisson in an instant. To say that this occurrence was an accident would certainly be wrong, because not one accident in a hundred deserves the name. In this case it was the legitimate result of carelessness, brought about by an over confidence in supposing that matters would take care of themselves. The immediate cause of the blowing out lay in the washing away of the dam around the pool under the shaft. These dams washed away frequently at subsequent periods, but we had had our experience and our lesson, and were prepared for it. There was, unfortunately, no man in the caisson at the time, so that that experience is lost. Eye witnesses outside state that a dense column of water, fog, mud, and stones was thrown up 500 feet into the air, accompanied by a terrific roar and a shower of falling fragments, covering the houses for squares around. This column was seen a mile off. The noise was so frightful that the whole neighborhood stampeded and made a rush up Fulton street. Even the toll collectors at the ferry abandoned their tills. There were three men on the caisson at the time, including the watchman. He reports that the current of air rushing toward the blowing water shaft was so strong as to knock him down; while down he was hit in the back by a stone, and further than that he does not remember. One of the other men jumped into the river, and a third buried himself in a coal pile. It was all over in a minute. Both doors of the air lock fell open. The dry bottom was visible through the air and water shaft; not a particle had entered under the shoe into the air chamber, and for the first and only time the caisson could dispense with artificial illumination. As soon as possible a stream of water was passed into the shaft from above, the locks were closed, and in the course of an hour the pressure was restored to fifteen pounds, corresponding to a head of thirty-one feet.

The first entry into the caisson was made with considerable misgivings, but none of our fears were realized.

The total settling that took place amounted to ten inches in all. Every block under the frames and posts was absolutely crushed, the ground being too compact to yield; none of the frames, however, were out of line. The brunt of the blow was, of course, taken by the shoe and sides of the caisson. One sharp boulder in No. 2 chamber had cut the armor plate, crushed through the shoe casting and buried itself a foot deep into the heavy oak sill, at the same time forcing in the sides some six inches. In a number of places the sides were forced in to that amount, but in no instance were they forced outward. The marvel is that the air tightness was not impaired in the least.

The nine courses of timber forming the sides of the air chamber were permanently compressed to the extent of two inches, as was shown by protruding bolt heads and the shearing off of a number of diagonal bolts. The lower sills of the frames were also torn where they came upon boulders.

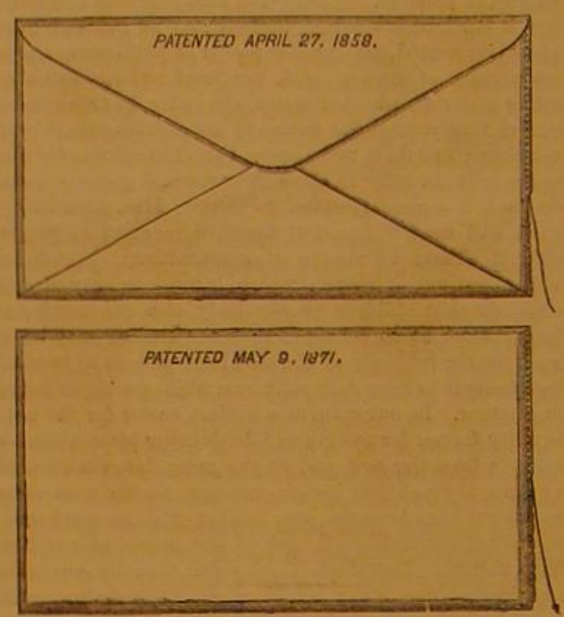
The weight of the caisson at the time was 17,675 tons. The air blew out so suddenly that this weight must have acted with considerable impact in falling through the space of ten inches. The bearing surface at the time was as follows: The four edges of the caisson, 550 feet long and seven inches wide, amounting to 322 square feet; the five frames each 100 feet long and one foot wide, resting on twelve blocks one foot wide, amounting to sixty square feet and giving a total of 382 square feet to meet the above pressure. This at the rate of forty-six tons per square foot.

But more than one half of the shoe was undermined to a depth of one foot or more, which reduced the practical bearing surface by nearly one half. At the commencement of the shock there was therefore a pressure of eighty tons per square foot, no allowance being made for impact, which may have doubled this rate. The caisson had settled ten inches. The shoe had buried itself so as to present a width of twelve inches, and through the crushing of the blocks the frames were in many places resting bodily on the ground. The settling had therefore stopped when a bearing surface of 775 square feet had been reached, giving a pressure of twenty-three tons per square foot.

VAGARIES OF THE PATENT OFFICE.

It will be seen from the following that the ever popular inquiry as to the difference between tweedledum and tweedledee has been adjudicated by the Patent Office, and that a patent has been granted for the difference.

In 1858 Charles Phelps, of Salem, Mass., obtained a patent for a letter opener, consisting of a thread placed in the crease of the envelope, as shown in the upper figure of our engraving. To open the envelope, you pull the thread so as to make it cut the paper. His claim, which is a good one, appears to cover the whole subject, and is as follows:



"I claim the application to a letter envelope of an opener therefor, said opener to be attached to, and form part of, said envelope, and to be attached and operated substantially in the manner set forth and described."

The unsophisticated mind would naturally suppose that whether one selects a thread from a spool or a knotted thread from a lady's needle, involves no perceptible difference; but the Patent Office regards the subject from a more profound point of view. If the reader will take a magnifying glass and closely scan the second figure in the cut, a small knot will be discovered on the extremity of the thread, for which knot a patent was granted to Henry K. Gregg, of Baltimore, Md., May 9, 1871. He claims an envelope made with a cord imbedded wholly in the inside of the end or side thereof, providing the cord with one or more knots on either or both ends thereof, substantially as and for the purposes described.

FLYING MACHINE.

Somebody has defined man to be a species of featherless birds. The inventor of the device illustrated herewith has aimed to supply our natural deficiencies in this respect by

the provision of wings and tail, attached and operated as indicated. We hardly think he will be able to compete with the swallows in this harness, and would advise him to start from some low point at first, so that, if he should fall down, it will not hurt him much. However, we may say that the principle of calling into play the strong muscles of the thighs to aid the arms in the movement of wings, as shown, is taking advantage of the greatest power the human body can exert, and in this respect the device is an improvement upon some other attempts. The method of connecting the rope to the various parts of the wing, is also such as gives least strain to the various parts. The machine is the invention of W. F. Quimby, of Wilmington, Del.

Resources of the North-west.

Says the *American Exchange and Review:*

Puget Sound, on the borders of which will be the future metropolis of the North Pacific coast, is an inland sea, dotted with islands, and joined to the Pacific by a gateway called the Strait of Fuca, 80 miles in length, 10 to 12 in width, and from 20 to 100 fathoms deep in all its parts. One arm of the sound extends northward from where it joins the strait, and the others southward; both divide and ramify, until the sound, with all its bays and deep water inlets, presents a shore line of 1,833 miles, and extends across two degrees of latitude. There is no obstruction at the entrance. The mouth of the strait is easily entered in all weather. For 150 miles the mid channel is more than 300 feet deep, and remarkably free from all hidden dangers. On each side of the main channel, and in the various bays which will be the real harbors and shipping ports, the water is still deep, but not too deep for anchorage. The holding ground is excellent. The waters abound with fish of great variety and excellence. The cod banks of Alaska are now known to be as extensive and productive as those of our Atlantic coast. These fisheries are necessarily tributary to the trade of Puget Sound. Besides, the climate of Washington territory offers for curing fish just the required medium of temperature—an average of 40 degrees in winter and 62 degrees in summer. The fisheries are 800 miles nearer the drying racks and the shipping ports of Puget Sound than to those of San Francisco. These advantages will govern the location of the fishing trade. The best whaling ground left to American harpooners is within eighteen days of the western terminus of the Northern Pacific railroad. The basin containing the Sound and its branches is bounded on the east by the cascade range of mountains, and sheltered on the west by the Olympian or Coast range. This depression between the two mountain ridges is about 75 miles in width, and that part which is not occupied by the waters of the Sound is mainly covered with magnificent forests, which extend to the very summit of the mountains. Here grows that Puget Sound timber of which so much has been written—fir, cedar, pine, spruce, hemlock, oak, maple, cotton wood, ash, dog wood, alder, and some of the smaller varieties. The forests of giant fir and cedar are traversed by ten rivers, which flow down from the Cascade mountains and empty into the sound, furnishing ten alluvial valleys of agricultural land, and supplying for logging purposes another thousand miles of inland shore-line. In connection with the remarkable climate (in which twenty varieties of flowers are known to be in bloom at the begining of January) the productive capacity of the soil of the Puget Sound region is great, both as to quantity and quality. Puget Sound is no exception to the wheat yield of the Pacific slope. All the other cereals are grown to perfection; oats are particularly plump and heavy. The small grains are at home in Washington territory. Pork is usually fattened upon peas, wheat, and barley, and, it is claimed, can be made as cheaply as upon corn in the Western States. Fruits of all kinds, except the peach and the grape, are raised in great profusion. Oregon and Washington apples are exported to San Francisco. Potatoes and other vegetables, grown on the north coast, are also in high favor in San Francisco market. The turnip yield will be most abundant.

Electrical Shadows and Images produced by Electricity.

In a paper contributed to the *American Journal of Science and Arts*, Professor Arthur W. Wright, of Williams College admits the possibility of the impression of outline images of objects upon the surfaces of other objects, and accounts for these singular phenomena as follows:

The formation of the electrical shadow, discussed in my former paper, as has been suggested by Mr. C. F. Varley, who has more recently obtained results similar to those there described, appears to afford a satisfactory explanation of a singular and very interesting phenomenon, which has occasionally been observed in the case of objects struck by lightning, especially of persons killed by it. A number of instances are on record where the person struck was found to have, impressed upon some portion of the body, a delineation of something near him at the time of the stroke, and a similar effect has been noticed, also, in the case of inanimate objects. Dr Franklin mentions an instance in which an exact representation of a tree was imprinted upon the breast of a man, who was standing near it when struck by lightning. A number of similar and very remarkable cases are cited in a paper presented to the Royal Society of England, by M. Andrés Poey, director of the observatory at Havana.

Mr. Varley also mentions cases, reported by sea captains, of images of certain brass numbers, attached to the rigging of a ship, being printed by the lightning upon the body of persons killed by it, and supposes the brass numbers to have acted as a negative pole in respect to the person struck. But it is unnecessary to suppose that the discharge in such cases always proceeds from the object delineated, and many of the instances recorded forbid such a supposition. The experiments in the production of the electrical shadows show that it is merely necessary that the object should interrupt the lines of action of the electricity, and that it may be at a considerable distance from the electrified cloud, the chief and indispensable condition being that the latter should be negatively electrified. We should then have the body, exposed to the lightning, perfectly electrified by induction, and, as the tension became sufficient, the dark discharge accompanied by the glow would take place, followed by the lightning stroke. If, then, any object should be in the path of the discharge, its image would be formed in the glow, and this might, in rare cases like those recorded, be sufficiently intense to leave a permanently visible impression.

Lithofracteur.

Lithofracteur—literally stone-breaker—is the patented invention of Professor Engels, of Cologne, and is composed of nitro-glycerin as a base, gun-cotton, the constituents of gun powder, some chlorates, and an infusorial earth. These substances are prepared in a special way, and blended together by special means, these operations being known only to the inventor and the manufacturers, Messrs. Gebruder Krebs and Co., of Cologne. The result of this combination is a black compound of the consistence of soft putty, which is is made up into paper cartridges $4\frac{1}{2}$ in. long by $\frac{7}{8}$ of an inch in diameter, and weighing $1\frac{3}{4}$ oz. each. When lighted in the air by ordinary means, it simply burns out, leaving a light white powder as a residuum; but when it is ignited either in the air or a closed chamber with a capped fuse, its full violence is developed. It is safe under all ordinary and even extraordinary circumstances of storage and transit, as recent experiments in England and lengthened use on the Continent have proved And here we may mention, says *Engineering*, that, although this is almost the first time we in England have heard of this substance, it has been made and extensively used throughout Germany for more than two years past. It was used by the Prussians against the French during the recent war, Herr Engels being the operator. After Fort Issy was taken, the Prussians destroyed a number of French heavy siege guns by blowing off their muzzels with lithofracteur.

A notice of this material having appeared in the German papers. the attention of the mining world in England was attracted to it, and a correspondence ensued between the manufacturer and Mr. R. S. France, the lessee of some extensive quarries in England. The result was that arrangements were made for testing the new material, Mr. France offering the use of his quarries, and Messrs. Krebs carrying out the experiments. In order that full publicity might be given to the trials Messrs. Krebs invited the attendance of a number of scientific gentleman, who lately met at Paddington and proceeded to Shrewsbury, near which town Mr. France's quarries are situated.

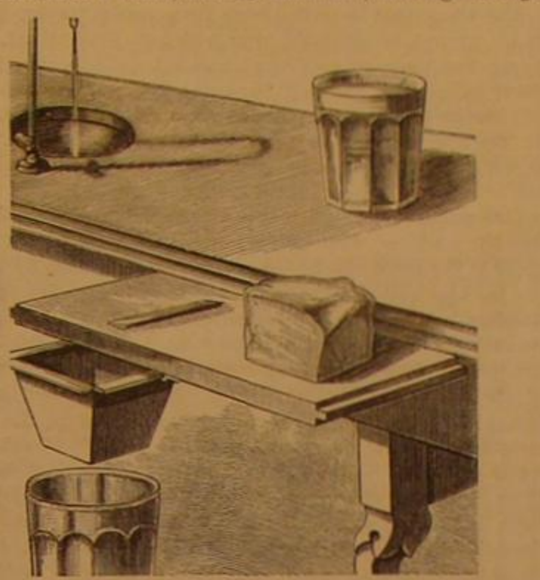
The preliminary experiment consisted in throwing a box containing 5 lb. of lithofracteur, from the top of the quarries at a hight of 150 ft. from the ground, into the plateau below. The box was smashed and the cartridges were scattered about, but not one was exploded. A cartridge was then lighted by an ordinary fusee, when it burned slowly out. Another cartridge was then placed upon a block of stone and fired with a percussion fuse, when a violent report followed, and the top face of the stone was broken off. The power of the lithofracteur when confined was then exhibited by firing charges in the bore holes of several blocks of stone, which were shattered into many fragments. The tamping in all cases was effected with water, thus proving the usefulness and reliability of the compound in workings where wet ground was met with. Another point also proved was, that if a misfire should occur—and one or two did occur in the course of the experiments—the charge could be withdrawn and another one inserted without removing the tamping. And here we may explain that the method of firing is similar to that adopted by Nobel with dynamite and Abel with pulped gun cotton. The capped fuse is simply imbedded in the lithofracteur, the paper of the cartridge being tightly tied round the fuse. The next part of the programme consisted in firing a number of shots, both horizontal and vertical, in the face of the quarry. As these were more or less repititions of each other, we need only notice a few of them, although they all gave extraordinary results. The holes were mostly bored under the direction of some of the mining gentlemen present, who, with the view of testing the compound to the utmost, selected the worst possible spots, some of which, they stated, gunpowder would not possibly touch. The first of these blasts was made with 1 lb. $1\frac{1}{2}$ oz. of lithofracteur, placed in a horizontal bore hole 3 ft. 4 in. deep, and $1\frac{1}{4}$ in. in diameter. A large quantity of stone was blown out to the front, and the face of the rock was scaled and cracked over an area of 20 ft. 6 in. wide by 13 ft. high. A couple more shots were then fired simultaneously near to the last, the bore holes were each 3 ft. deep, and were charged with $13\frac{1}{2}$ oz. and 1lb. $\frac{1}{2}$ oz. respectively, and an immense face of rock was brought down. The best blast, however, was the last of this series; it was fired in a vertical bore hole 4 ft. 6in deep, on a ledge rock, about 23 ft. from the level of the plateau below, 1 lb. $1\frac{1}{2}$ oz. of lithofracteur being used. The explosion brought down at least 20 tons of rock, and loosened an enormous mass behind the bore hole, the shot being one of the finest we ever saw made with so small a quantity of material.

Some experiments were next made with the view of showing the disruptive effect of lithofracteur on iron, and for this purpose a 4 ft. length of 75 lb. double headed rail was laid on its side, being supported at each end at a hight of 3 in. from the ground. A charge of 1 lb. 3 oz. of the compound was placed in a lump on the centre of the rail, and tamped with paper, three old sleepers being placed on the tamping, and fired with a percussion fuze. A startling report ensued, the fragments of the sleepers being sent in all directions, and on examination the rail was found much bent, and with one head cut through, and 11 in. of the web blown away in the center. Had the supports been a little higher, so as to have left room for a greater angle of bend in the rail, both heads would doubtless have been cut through.

So far, with the exception of one or two experiments at the first, the power only of the lithofracteur has been put to the test. It was now proposed to carry out an idea, which originated with Mr. France, to put the compound to the severest possible test in order to prove its behavior under the conditions of a railway collision. To this end, he had an old railway wagon placed on the rails at the bottom of the incline whilst at the top was another, in front of the buffers of which were fixed two cartridges, one on each buffer. Each wagon weighed about $1\frac{1}{4}$ tons, the buffers of both being of wood. The upper wagon being released, started on its journey of 500 yards on an incline of 1 in 8, the speed being of course very great when it reached the bottom. On arriving there the buffers fairly met, and both wagons were in a few seconds lying a heap of splinters and fragments, wood and iron being alike smashed up. On examining the wreck, the lithofracture was found smeared on the buffer heads and other parts of the wagons, no explosion having of course occurred.

ICE SHAVING MACHINE.

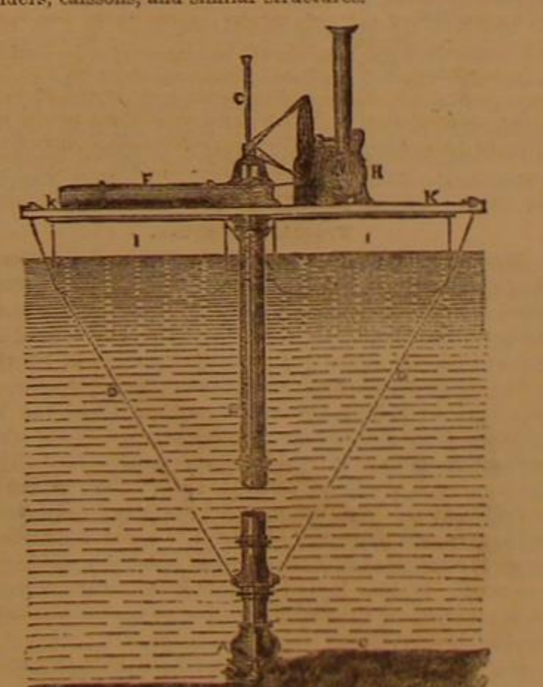
Our engraving illustrates an ice shearing machine for soda fountains, bars, etc. It is constructed on the principle of the carpenter's plane. The block of ice is moved upon the surface of a board, and its under side, meeting the edge



of the cutter, is pared away, the cuttings falling into a suitable receptacle, from which they are taken for use. The implement is the invention of Robt. Gilliland, of Hudson, Mich.

DREDGING AND EXCAVATING MACHINE.

The accompanying engraving illustrates a simple arrangement of machinery which has been adopted by the Lords of the Admiralty for use in Her Majesty's Dockyard, at Chatham, England. Its use is for making excavations under water in the construction of sea walls or harbor works, and for removing accumulations from docks, harbors, and rivers. Besides these purposes, it is available for raising sunken ships, or removing water, earth, sand, and gravel from foundations, cylinders, caissons, and similar structures.



In our engraving, A is a casing containing a revolving disk, which is faced with steel, and has a steel screw, B, affixed to the end of the revolving shaft. This screw loosens, stirs up, and agitates the materials, as shown by the bank of mud or earth, C. A vertical discharge pipe, E, up which the loosened material is carried, is stayed by the chains, D. The head, A, is raised and lowered by ropes worked from the deck, K, laid on the pontoons, I I, and on which the engine and boiler are placed. F is a continuation of the discharge pipe, E, and delivers the materials and water discharged by the excavator into barges. G is the vertical shaft of the revolving wheel, which slides through the driving pulley, the latter being secured by a sunken key to the shaft. H is a portable engine for driving the apparatus. This machine can be so modified that it can be used for separating and elevating small coals, ores, gravel, lime, grain, seed, and other similar substances, and at the same time it can be used for washing or freeing the substances from earthy or other impurities. To enable the machine to be readily raised or lowered, or the length of the vertical discharge pipe to be increased or diminished, a telescopic or sliding pipe is inserted in its length, regulated by chains from the top, thus affording facility for lowering the apparatus to and working it at any desired depth below the surface.

NEW EXPEDITIONS TO THE ARCTIC REGIONS.

A Swedish North Pole expedition, under the direction of Professor Nordenskiold, has sailed from Stockholm. It consists of the ships Gegegard, Captain J. W. von Otter, and Gladan, Captain P. M. von Krusenstjerna.

The U. S. expedition, authorized by Congress, under the auspices of Captain Hall, of Arctic fame, is nearly ready for a start and will shortly sail from New York. The vessel selected is the *Polaris*, and in the *Patriot*, of Washington, where the ship was fitted out, we find the following particulars:

The steamer is about 400 tuns measurement, considerably larger than the Advance, in which Dr. Kane undertook his famous voyage, and about the same size as the Germania, which left Bremen two years age on an expedition to the Arctic Seas. She has been planked all over her sides with six inches of solid white oak timbers, and has throughout been nearly doubled in strength; her bows being almost a solid mass of timber, sheathed with iron, and terminating in a sharp iron prow with which to cut through the ice. Her engine, which was built some years ago at Messrs. Neafie & Levy's works, in Philadelphia, is exceedingly powerful and compact, taking up but comparatively little space, and being peculiarly adapted for hard and severe work; and the propeller is arranged in such a manner, that it can be unshipped and lifted up on deck, through a shaft or "propeller well" in the stern, which is a great advantage when the vessel is under sail or surrounded by floating ice that might easily damage the blades. And, even in the worst case, a supply of extra blades has been provided, so that if one should by accident be broken, it can always be replaced. There is also an extra rudder on board, and several suits of sails and sets of spars of all dimensions. Of the two boilers, one is supplied with an apparatus to use whale oil for the generation of steam, as this will, in all probability, have to be relied upon when other fuel gives out, not only to furnish the propelling power, but also to heat up the vessel throughout by steam, which will, of course, be necessary as soon as the cold and wintry regions have been reached.

Steam will merely be used as an auxiliary, as the *Polaris* is rigged as a foretopsail schooner, and is fully able to sail and steer under canvas only. A novel and interesting feature in her construction is a new sort of life preserving buoy, which is placed on the outside of the vessel, in the stern, and can be lowered into the water, by touching a spring which is placed near the pilot-house. By touching another spring, an electric light, which is fixed upon the buoy about two feet above water, is ignited by completing the circuit of an electric current from a galvanic battery on board; and no matter how dark the night, or how obscure the arctic winter, the buoy can always be distinctly seen, and the man who has fallen overboard will know in what direction to swim for hope and help. Another excellent and peculiar part of her outfit is a canvas boat, the invention of Mr. John Hegeman, of Saratoga county, N. Y., by whom it has been patented, and from which Capt. Hall expects great results. As yet but one of these boats has been received, but another and smaller one will be added before the vessel leaves New York. The boat that we saw is 20 feet long, four feet wide and two deep, has a carrying capacity of four tuns, weighs only 250 pounds, and can carry with perfect ease and safety 20 men. It consists of an interior frame, built of hickory and ash woods, over which is stretched a canvas cover that has been previously soaked in a preparation to render it perfectly waterproof; and the whole boat can be taken apart and folded together in a space less than one eighth of its original size, in about three minutes, and by the assistance of a couple of men only. When folded up it is perfectly flat, and can be transported on a sledge across the ice without the least difficulty. When open water is reached the order of things is exactly reversed—the boat is unpacked and spread out, and the sledge and its contents taken on board, dog team and all.

As to those who are going to be the principals in this adventurous and dangerous expedition, they are all told, 29 men. There is not a man among them whose qualities and character have not been well tested, from the captain down to the cook. The leader and commander in chief is of course Capt. Hall; next in the command comes Capt. S. O. Buddington, of New London, an old whaling master of 30 years' experience, 21 of which were spent in the Davis Strait and Baffin's Bay. He is an old and trusted friend of Capt. Hall, who has implicit faith in his long experience and acknowledged ability. The second officer is Mr. H. C. Chester, also a whaling man, of 12 years' experience among the ice; and the third officer is Mr. William Morton, who was Dr. Kane's trusted friend and companion, and is the only living mortal to whom it was ever permitted to look upon the open Polar Sea. He had the sad privilege to accompany Dr. Kane to Havana, and to bring his remains from there to Philadelphia for interment. Mr. Emil Schumann occupies the post of first engineer, and the scientific corps will consist of three gentlemen, one of whom, Dr. Emil Bissells of Heidelberg, Germany, will attend the expedition as a surgeon naturalist. A student from the observatory at Ann Arbor, Mich., will probably be the astronomer; and an officer of the Signal Service Department will be aboard in the capacity of meteorologist Beside these, there will be a blacksmith, carpenter, steward, and 14 sailors, besides the Esquimaux interpreter, Joe, and his wife, Hannah. This latter interesting couple, with their little daughter, are genuine specimens of the Esquimaux, but having been in constant company with Capt. Hall for eight years past, they speak very good English, and have acquired civilized manners. Joe is a famous hunter and "sealer," and his little wife is quite an accomplished woman in a "small" way, with considerable talent for languages and for music. Their little daughter, who will accompany them, is five years old, and has been for some time at school in Connecticut, where her parents have been lately residing, the guests of Capt. Buddington. They will join the ship at the Brooklyn Navy Yard, and a nice cosy little cabin has been fitted up for the exclusive use of them and their child. They are glad to visit once more their native fields of snow and ice; and it is not at all certain that they will again return with the expedition.

Although Capt. Hall expects to accomplish his purpose of penetrating into the great Polar Basin, if such an one really exists, and visiting the North Pole, in less than three years, the Polaris has been provisioned for four years, which can be extended to six with a little economy and judicious distribution of rations. The great staple of provisions is the so-called "pemmican," which is composed of three parts of selected dried meat to one part of the best suet, mixed with some other ingredients. The food is both nourishing and wholesome, and there is no danger of scurvy through the absence of salt—that pestilence of Arctic travelers—to be feared from its use. It is packed in 45 pound tin cans, hermetically sealed, and of this there is no less than 10,000 pounds stowed away in the hold, the manufacture of which consumed and condensed 23,000 pounds of ordinary beef and 5,000 pounds of suet. Besides this, there is any quantity of dried and dessicated vegetables, such as potatoes, tomatoes, onions, etc., and a large stock of flour, biscuits, sugar, coffee, tea, condensed milk, canned fruits, and all other necessaries for a protracted voyage. Capt. Hall, however, expects to be able to economize these provisions to a very considerable extent by substituting in their place the meat of the reindeer, musk ox, walrus, and other game of the regions he is about to explore. Everything has been done to make the quarters of both crew and officers as comfortable as the rather limited space would permit; and the between decks and cabins are perfect models of cleanliness. The state rooms, for the officers and scientist, are plain, but gotten up in good and convenient style, and the cabin aft is a perfect drawing room in miniature. Handsome chromos decorate the walls, and a fine cabinet organ, a present to Capt. Hall from the Smith American Organ Manufacturing Company of Boston, promises cheer during the long arctic night. A handsome carpet covers the floor, and there is an air of calm comfort about this little room

Correspondence.

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

Paine's Electro-magnetic Motor.

Messrs. Editors:—Some years since, I made the discovery that when hydrogen gas was treated by simple contact with turpentine, it was rendered highly luminous without any perceptible waste of the turpentine. The gentleman occupying the position of scientific editor in your office, at the time, in noticing my announcement of the discovery, among other complimentary remarks was pleased to say that if he had made such a statement "he would hide his head under a toadstool." So absurd did my statement seem, that, although it was backed by the testimony of some of the best chemists living, your scientist was at a loss for words to express his contempt for myself, and pity for the infatuated persons who endorsed my experiment. And yet, this unbeliever, in less than a month after his adverse criticism, published a full vindication of my discovery, from the pen of George Mathiat, United States Metallurgist, and also gave it his personal endorsement.

In your journal of June 10, you are pleased, in noticing my electro-motor, to introduce again the "toadstool" argument; and, allow me to assure you, with the same results. If you are acquainted with the gentlemen who are associated with me in this enterprise, you will know that they are men fully competent to judge of the facts in the premises, and men that you or I cannot mislead.

The engine you refer to has been in constant operation for eight months, running nine hours per day, doing a duty of 67,000 foot pounds, at an expense of three ounces zinc per day, of nine hours. The engine for four months was open to public inspection, no one being restricted from examining the same. On the formation of the company you allude to, it was deemed necessary to the interests of the same that the engine be withdrawn from general exhibition.

As regards the statements of what is to be done by the 4th July, allow me to remark that I propose to achieve a success even beyond that which you burlesque; but the question of date is an open one.

And now, having had my fling back, permit me to say that for thirty years I have been a practical experimentalist in electro-dynamics, that I am familiar with the experiments of Grove, Carpenter, Mayer, Faraday, Liebig, and a host of others, relative to the doctrines of correlation and conservation of forces. Therefore, I am no tyro, but the peer of any authority you may quote: and as such I unqualifiedly assert that instead of the miserably small result of 67,000 foot pounds, at a cost of three grains of zinc, we should realize 67,000,000 foot pounds.

The forces developed by the action of a single Bunsen quart cell, if utilized, and converted into power, would drive the largest ship afloat with a velocity only limited by the strength of the ship's frame; and you and I will live to see the day, if our lives are lengthened to the usual term, when this statement will be verified, and that, too, without involving the question of perpetual motion.

I propose, with your permission, in a future paper, to dispose thoroughly and effectually of all the learned disquisitions, which have suddenly occupied the scientific journals, going to disprove the practicability of electricity as a motive power. To do so, I shall not require any of Paine's theories or engines, the only illustrative objects being the common electro-magnet and the Bunsen cell.

Newark, N. J. H. M. Paine.

Potato Diggers Again.

Messrs. Editors:—Since the publication of the article entitled "Potato Diggers a Failure," I have looked in vain for a denial, but as the glove is not taken up, I must maintain the heading.

I would say to J. H. M. (in May 27th), that he is asking entirely too much when he calls for a machine to "detach them from the vines, weeds, stones, and dirt, and deposit them in a proper receptacle." Let us examine the operations in detail.

The vines must be pulled from the potatoes, leaving them in the ground, or separated after both have been raised. To clamp the vines by machinery, and lift quickly, would lift many hills entire, and pull the tops off others, leaving stubs of vines on the potatoes; but as vines fall in all directions, no machinery can pick them up so as to pull them. To separate the vines from the potatoes by machinery, after the hill is loosened or dug, is still more difficult.

Man power is not sufficient to drive a potato digger; therefore the machine must go by horses; consequently, it will move at the usual rate of horse machines, and must lift from one to three bushels of potatoes, and from twenty five to one hundred bushels of dirt per minute. To do this, and deposit its contents in the rear of the machine, I think is possible; but to separate potatoes from vines, weeds, stones, and lumps of dirt, ready for bagging, is not. Many vines will hang, lumps of dirt and stone will mix and be so near in size and weight that no machinery can separate them. J. H. M. asks for "a machine that will uproot each hill separately, and detach them from the vines, weeds, stones, and dirt, and deposit them in a proper receptacle;" and thinks it could be done, if the field were planted regularly. Allowing the hills to be all of equal distance apart, a machine so made as to dip or scoop up each hill separately, leaving the spaces between them, must be worked by an operator on the machine or automatically.

If J. H. M. thinks he can work a machine that must be moved as often as once in an average of two feet, at the rate of a team's pace, let him try it. I have done so, and find it very difficult to do. But I presume he would have it worked automatically, and will adjust it at the end of the row; but he will soon find that the unevenness of the ground and the crooked driving will make it strike in the space or center of the hill, as the machine happens to gain or lose. Again, no point or shovel blade, large enough to take up a hill of potatoes, can be repeatedly pushed into the soft ground covered with weeds and vines, as the average potato field is. Its point soon becomes loaded with vines and weeds.

Although the required points mentioned by J. H. M. are all desirable, I think he should be contented if he could find a machine that can be driven over the field like a mower. He can then go on and pick up his potatoes, even if he has to separate them from the vines and stones, and if he gets them all without having them cut, bruised, or peeled by the machine, he should be satisfied. H. B. Norton.

Traction Engine.

Messrs. Editors:—A communication headed "Traction Engines," in the Scientific American of April 29, 1871, replied to by E. McKenzie, May 27, 1871, may make a word from the inventor, of the road steamer, G. H. Craft, of interest, as evidently one of the parties is incorrect in his views.

In practice, the steamer after passing an obstruction such as a brick or stone is elevated to correspond with the hight of this obstruction; and after passing over it with the wheels, rather than falling (as would ordinary wheels), if it did not go forward, it would be suspended upon the pushing legs standing at an angle of forty-five degrees; consequently, without power from the engine, it is eased forwards and down to correspond with the angles at which the pushing legs are set, the pushing legs of each set being balanced against each other, hence the machine cannot go backwards without raising the legs.

Our practical tests exhibit a most gratifying amount of traction power in proportion to the weight of machine; and should our larger machines come up to our expectations, we believe we will be enabled to use a total weight of machine to the amount only of 3,500 pounds to get full traction power, or the use of two cylinders six by ten, carrying 135 pounds of steam, making 250 revolutions and a plow speed of three miles per hour; or a power of steamer twenty horse, weight one and three quarter tuns. It will be but a short time before we shall have these questions definitely solved.

Our enterprise seems to move slowly, but to make personally twenty-seven complicated and intricate models in the period of two years and a half, and to attend the patent business connected therewith, to attend to the farm of 127 acres with 4,500 fruit trees, and still have time to read the Scientific once a week, makes me look forward with more than ordinary interest to the coming time when I can cultivate more than a mere speaking acquaintance with my family.

New Albany, Ind. M. N. L.

Steam on the Erie Canal.

Messrs Editors:—I wrote you a few days ago on the subject of canal (steam) navigation. Since then, I have seen your issue of the 3d inst. in which you treat of the numerous experiments with steam apparatus. This city, being so much interested in canal navigation, cannot say a word in favor of enlarging the canal, or in fact doing anything to facilitate or improve its navigation, without bringing down the denunciations of Chicago, Montreal, and other rivals.

You speak of the swell or wave, created by side wheels or screws, when applied to canal steamers. Now it is a truth that a stern screw, placed in a canal boat, does not create a swell or wave; the wave proceeds from the bow, never from the stern; there is there a sort of under-tow. This is a fact, as proved in numerous experiments made by Erastus Prosser, David Bell, and Seymour & Wells, of this city, who jointly built perhaps ten first-class steamers during 1858, 1859, and 1860, and gave them a fair trial.

They failed because the machinery took so much from the carrying capacity of the boats, which were of bluff models. With sharper models, of course more would have been taken from the carrying capacity. The only remedy for all this would be greater length and breadth.

Is it not idle to talk of improved machinery? What is better than the stern screws? Are not millions of money invested in ocean steamers driven by screws placed in the sterns of vessels? Now, if there were any better plan of propulsion, would not these people adopt it? and are not all mechanical engineers everywhere doing their best to invent improved methods? This thing of "invention" comes, as it were, accidentally. Ages may pass and nothing better than we have, be found out. In the meantime, we should not stop and wait for the new invention, but take the best we have now.

Another idea: If we had 600 ton canal steamers, we could profitably voyage from the lakes to the Chesapeake, and then through the Dismal Swamp canal to Wilmington, N. C.; and with a few comparatively inexpensive internal improvements, along into the St. John's river of Florida, and up it to the extremity of the peninsula, a navigation extending from lat. 26° to lat. 43° on the lakes, all inland.

Buffalo, N. Y. Forwarder.

H. G. as a Steam Plowman.

Messrs Editors:—A few days since I was at Magnolia Plantation, about forty miles below the city of New Orleans, when I saw the old philosopher, Horace Greeley, riding on one of John Fowler & Co.'s English steam plows, guiding and driving the plow, the shares being *twenty-six inches deep* in the soil. It was working as easily as a small two horse plow in light land; and plenty of pocket measures were used by the lookers-on, to verify the measurement. The soil was stiffer and harder to work than any land south of Mason and Dixon's line. Then I saw the old man get on and drive the cultivator, which was drawing seven lines about thirty inches deep, breaking up the ground between the cane rows

The "old man eloquent" can now go home, and in his paper, and in the new edition of "What I know about Farming" which he will issue, he can tell his readers what he knows and saw about steam plowing in Louisiana.

I have read much, in all the scientific and agricultural papers for the past ten years, about what farmers require; and the need is stated to be a small, light, cheap steam engine, that will go over the ground, and break up and cultivate the soil to a depth of from twelve to twenty-four inches. Have you scientific northern men little machines which you can fasten on a plow? You can calculate to a fraction the resistance, and how much power will be required to work stiff land two feet deep. Will you tell the agricultural world if a man or men can make a steam traction engine to plow two feet deep, and drag the plow behind it, and whether it is practicable or not? I think it is as easy to make it as to find the philosopher's stone.

You, Messrs. Editors of the foremost mechanical and scientific journal, the honorable Commissioner of Agriculture Capron, and a few of your foremost practical farmers and journalists, should come to the State fair in Louisiana, in the fall of this year, and see the practical daily working of two or three large English steam plows, near this city. I have not the least doubt that they can be greatly improved upon. But dispel the idea that small cheap steam engines can ever be made to do fabulous amounts of work, digging, breaking up, and plowing ground two feet deep, and dragging the plows behind them.

The time has arrived when the great prairies of the country and all the large farms must be worked by steam machinery. Get your inventors and farmers on the right track, and before ten years have passed, there will be thousands upon thousands of steam plows in use all over this great country. *Brains* are wanted at this time.

Brashear City, La. Speed the Plow.

American Improvements Wanted in the West Indies.

Messrs. Editors:—We are anxious to introduce into our industrial schools, and among our small settlers, some inexpensive hand power machinery; and would be glad to obtain some information about a good washing machine, cider mill and press, seed huller, grinder and oil press, fiber-cleaning machine, coir cleaner, improved rotary pump, and the United States brick-making machine.

A descriptive catalogue with prices might help us in determining what is best calculated to suit, and what might be profitably sent to this market. Jno Wood,

Kingston, Jamaica. First Asst. Inspector of Schools.

To clean silver door plates, use a weak solution of ammonia in water, applied with a wet rag. This wash is equally useful for silver plate and jewelry.

ADDRESS OF PROFESSOR MORSE, AT THE CEREMONY OF UNVEILING THE STATUE IN CENTRAL PARK, NEW YORK.

FRIENDS AND CHILDREN OF THE TELEGRAPH: When I was solicited to be present this evening, in compliance with the wishes of those who, with such zeal and success, responded to the suggestion of one of your number that a commemorative statue should be erected in our unrivalled Park, and which has this day been placed in position and unveiled, I hesitated to comply, not that I did not feel a wish in person to return to you my heartfelt thanks for this unique proof of your personal regard, but truly from a fear that I could use no terms which would adequately express my appreciation of your kindness. Whatever I may say must fall short of expressing the grateful feelings, or conflicting emotions, which agitate me on an occasion so unexampled in the history of inventions. Gladly would I have shrunk from this public demonstration, were it not that my absence tonight, under the circumstances, might be construed into an apathy which I do not feel, and which your overpowering kindness would justly rebuke.

But where shall thanks begin, if, looking through all intervening instrumentalities, the Great Author of the gift of the telegraph to the world be not first of all acknowledged? "Not unto us, not unto us, but unto God be all the glory." When I consider that He who rules supreme over the ways and destinies of man, often makes use of the feeblest instruments to accomplish His benevolent purposes to man, as if, by grandest contrast, to point the mind with more marked effect to Him as their author, I cheerfully take my place on the lowest seat of His footstool. It is His pleasure, however, to work by human instrumentality. You have chosen to impersonate, in the statue this day erected, the invention rather than the inventor, and it is of no small significance that, in the attitude so well chosen and so admirably executed by the talented young sculptor whose work presents him so prominently and so favorably before you, he has given permanence to that pregnant and just sentence which was the first public utterance of the telegraph: "What hath God wrought!" Little did that young friend, 27 years ago, (and whose presence here to-night I most cordially greet,) in the artless innocence of a devout heart, dream of the far-reaching effect of that first telegram which she indited, upon him who transmitted it. While, as if by inspiration, she struck the key-note of the invention, placing its real Author upon the throne, it at the same time struck a responding chord within this bosom which still vibrates to temper, with its ringing note, any proud aspiration of a selfishness that, unchecked, might be disposed to exclaim: "Is not this great Babylon which I have built by the might of my power?" Yes, little did that young friend dream that she had thus furnished me a substantial retreat from the conflicting elements, which public and private praise at home, and the gratulations of foreign nations, stir into activity in the human heart unless is kept in just prominence the Supreme Author of the gift.

You have chosen to impersonate in my humble effigy an invention which, cradled upon the ocean, had its birth in an American ship. It was nursed and cherished not so much from personal as from patriotic pride. Forecasting its future, even at its birth, my most powerful stimulus to perseverance through all the perils and trials of its early days—and they are neither few nor insignificant—was the thought that it must inevitably be world-wide in its application, and, moreover, that it would everywhere be hailed as a great American gift to the nations. It is in this aspect of the present occasion that I look upon your proceeding as intended, not so much as homage to an individual as to the invention "whose lines" from America "have gone out through all the earth, and their words to the end of the world." In the carrying out of any plan of improvement, however grand or feasible, no single individual could possibly accomplish it without the aid of others. We are none of us so powerful that we can dispense with the assistance, in various departments of the work, of those whose experience and knowledge must supply the needed aid of their expertness. It is not sufficient that a brilliant project be proposed, that the modes of accomplishment are foreseen and properly devised; there are, in every part of the enterprise, other minds, and other agencies to be consulted for information and counsel to perfect the whole plan. The Chief Justice, in delivering the decision of the Supreme Court, says: "it can make no difference whether he" (the inventor) "derives his information from books or from conversation with men skilled in the science,"—and "the fact that Morse sought and obtained the necessary information and counsel from the best sources, and acted upon it, neither impairs his rights as an inventor nor detracts from his merits."

The inventor must seek and employ the skilled mechanician in his workshop to put the invention into practical form, and for this purpose some pecuniary means are required, as well as mechanical skill. Both these were at hand. Alfred Vail, of Morristown, N. J., with his father and brother, came to the help of the unclothed infant, and with their funds and mechanical skill put it into a condition creditably to appear before the Congress of the nation. To these New Jersey friends is due the first important aid in the progress of the invention. Aided, also by the talent and scientific skill of Professor Gale, my esteemed colleague in the University, the telegraph appeared in Washington in 1838, a suppliant for the means to demonstrate its power. To the Hon F. O. J. Smith, then Chairman of the House Committee of Commerce, belongs the credit of a just appreciation of the new invention, and of a zealous advocacy of an experimental essay, and of the inditing of an admirably written report in its favor, signed by every member of the committee. It was nevertheless thrown aside among the unfinished business of the session; and now commenced days of trial. Years of delay were yet before it. It was not till 1842 that it was again submitted to Congress. Ferris, and Kennedy, and Winthrop, and Ayerigg, McClay, and Wood, and many others in the House, far-seeing statesmen, rallied to its support, and at length, by a bare majority, the bill that was necessary was carried through the ordinary forms, and sent to the Senate, where it met with no opposition, and was passed the last night of the session.

Now commenced a new series of trials, to which it is unnecessary here to more than allude. To Ezra Cornell, whose noble benefactions to his State and the country have placed his name by the side of Cooper and Peabody, high on the roll of public benefactors, is due the credit of early and effective aid in the superintendence and erection of the first public line of telegraph ever established. Notwithstanding the success of the experimental essay, another important step was necessary ere the invention could demonstrate its vast utility. It was not until the skill and experience of the best Postmaster General that ever held that office, the Hon. Amos Kendall, were brought into requisition, that, amid many discouragements, the various companies were organized, and in the hands of such enterprising men as Sibley, who united the Atlantic and Pacific, and Swain, and Wade, and a host of determined men whose names would read like the pages of a dictionary, this vast country, from the northern boundaries of Canada to the Gulf of Mexico, and from the shores of the Atlantic to the Pacific, was webbed with telegraphic wires.

Another grand stride was yet to be taken ere international communication could be established. In October, 1842, the first submarine telegraph cable was laid by me in one moonlight night, in the harbor of this city, which proved experimentally the practicability of submarine telegraphy, and from the result of this success I ventured, the year after, in a letter to the Secretary of the Treasury, to predict the certainty of the Atlantic Telegraph. It was then believed to be a visionary dream; and had the individual carrying out of so bold an enterprise depended upon me alone, it might still have been a dream. But at this crisis another mind was touched with the necessary enthusiasm, admirably fitted in every particular, by indomitable energy and perseverance and foresight, as well as financial skill and influence, to undertake the novel attempt. To Cyrus W. Field, more than to any other individual, belongs the honor of carrying to completion this great undertaking. Associating with himself Cooper, and Taylor, and Roberts, and White, and Hunt, and Dudley Field, and others on this side the Atlantic, and, two years later, Peabody, and Brett, and Brooking, and Lampson, and Gurney, and Morgan and others in Great Britain, making the ocean but an insignificant ferry by his repeated crossings, undaunted by temporary failures and unforeseen accidents, he rested not till Britain and America were united in telegraphic bonds—the Old and the New World in instantaneous communication.

If modern progress in the arts and sciences has given unprecedented facilities for the diffusion of the telegraph throughout the world, back of all are the former discoveries and inventions of the scientific minds of Europe and America—Volta, Oersted, Arago, Schweigger, Gauss and Weber, Steinheil, Faraday, Daniell, and Grove, and a host of brilliant minds in Europe, with Professors Dana and Henry in our own country, in the past, and the more modern discoveries and inventions of Thompson, of Whitehouse, of Cooke, of Varley, of Glass, and Canning, and numerous others. These all, in a greater or less degree, contributed to the grand result. There is not a name I have mentioned, and there are many whom I have not mentioned, whose career in science or experience in mechanical and engineering and nautical tactics, or in financial practice, might not be the theme of volumes, rather than of brief mention in an ephemeral address.

Tonight you have before you a sublime proof of the grand progress of the telegraph, in its march round the globe. It is but a few days since that our veritable antipodes became telegraphically united to us. We can speak to and receive an answer in a few seconds of time from Hong Kong, in China, where ten o'clock tonight here is ten o'clock in the day there, and it is perhaps a debatable question whether their ten o'clock is ten today or ten tomorrow. China and New York are in interlocutory communication. We know the fact, but can imagination realize the fact? But I must not further trespass on your patience at this late hour.

I cannot close without the expression of my cordial thanks to my long known, long tried, and honored friend Reid, whose unwearied labors early contributed so effectively to the establishment of telegraph lines, and who in a special manner, as chairman of your memorial fund, has so faithfully and successfully and admirably carried to completion your flattering design. To the eminent governors of this State and the State of Massachusetts, who have given to this demonstration their honored presence; to my excellent friend, the distinguished orator of the day; to the mayor and city authorities of New York; to the Park Commissioner; to the officers and managers of the various, and even rival, telegraph companies, who have so cordially united on this occasion; to the numerous citizens, ladies and gentlemen; and, though last, not least, to every one of my large and increasing family of telegraph children, who have honored me with the proud title of "Father," I tender my cordial thanks.

IMPROVEMENT OF THE MISSOURI RIVER AT ST. JOSEPH, MO.

A preliminary survey of the Missouri river, in the vicinity of St. Joseph, with a view to determine the practicability of constructing a bridge with a draw, and of protecting the banks from the action of the current, and controling the direction of the channel, in such a way as to secure a constant steamboat channel along the levee, in front of the city, has been made by Mr. E. D. Mason, C. E., whose report contains some interesting information relative to the character of the river at this point. As a navigable river, the Missouri is one of very great importance, affording an outlet for the products of an immense area of great fertility, and rich in mineral wealth. Such a work as this survey anticipates is of more than local importance, and we therefore give place to some facts concerning it.

The area drained by the river is over a half million square miles, and four fifths of the water collected from this water shed passes St. Joseph. The average annual rainfall, on that part of the basin drained by the river above the city, is nineteen and a half inches; but six tenths of this water passes during the months of June and July. The river is, therefore, during these months, a swollen, rapid torrent, making havoc in its banks, cutting out new channels and filling up old ones, and, it is needless to say, so changing its channels that, in the subsequent low water, navigation is interfered with, and the approach of steamboats to the levee is difficult. Mr. Mason states that, during an ordinary spring flood, 170,000 cubic feet of water pass per second, with a velocity of three and eight tenths miles per hour, while, at low water, the mean flow is reduced to 18,000 cubic feet per second, and the velocity to two and six tenths miles per hour.

The following extract from the report will serve to exhibit better the necessary results of this enormous difference in flow, and the engineering difficulties to be overcome in the proposed improvements:

A survey was made of the river, from the rock bluffs near Belmont, extending seven miles, to a point below the city, and its low and high water channels carefully examined. The fall in the low water channel, for that distance, was found to be uniformly 82-100 of a foot per mile. This channel is very tortuous, crossing the bed of the high water channel four times within the space surveyed. The axis of the current at high water is much shorter than at low water, and has a fall of over one foot per mile. Although the mean velocity is as stated above, there are threads of the current which probably flow with nearly double that speed, at both high and low water. At low water, the channel opposite the city is from 400 to 500 feet wide, and from fifteen to thirty feet deep. The difference of level between extreme high and low water is found to be twenty-three feet. At the greatest flood, the narrowest channel opposite the city will be 1,420 feet wide. Rock is found at an average depth of forty-three feet below low water, and at no point deeper than forty-eight feet. The bed of the river is fine sand on top, with layers of clay or mud and coarser sand nearer the bed rock. The Missouri shore, in the vicinity of the hereinafter proposed bridge site, is composed of tough clay, or "gumbo," having considerable power to resist the action of running water. Its line has changed comparatively little within the memory of the oldest settlers. The Kansas shore is alluvium, in alternate layers of fine salt and silt, of small specific gravity, and very easily moved by an impinging current. The sand in the bed of the river is almost as easily moved by running water as is the material composing the Kansas shore; and trifling obstructions to the current are sometimes the beginning of important changes in the direction and depth of the channel, making a rapid river with its bottom but a few feet above the rock where a few days before was dry land at ordinary high water. With these facts in view, any bridge across the Missouri river at St. Joseph, to be considered permanent, must be built upon the hypothesis that the river is at flood the whole width, from bank to bank, its channel bed on the rock, and the current running at its swiftest speed.

In connection with the improvements designed to maintain a channel along the levee, the protection of the Kansas shore, to prevent the destruction of valuable arable lands, is considered. Mr. Mason thinks this might be accomplished by sloping the bank and covering it with rip-rap, constituting a paved levee the whole distance from St. Joseph to Wathena; but he thinks piers to deflect the current from the shore a better plan, as well as cheaper. These piers would not only protect the Kansas shore, but accomplish the desired end of throwing the current over and along the levee at St. Joseph, keeping the channel clear and open.

The proposed bridge will be 1,450 feet in length, having four fixed spans, each 260 feet in length, and a draw of two spans 225 feet each. Its estimated cost is $765,000.

SCIENTIFIC INTELLIGENCE.

QUANTITATIVE DETERMINATION OF IODINE.

William Reinige proposes a new method for the quantitative determination of iodine, founded upon the decomposition of the permanganate of potash by iodide of potassium. As neither chlorine nor bromine exhibits the same reaction, this method would appear to be the best for the quantitative analysis of iodine compounds. Take a solution of an iodine salt, add a little sulphuric acid to neutralize the excess of alkali, or render slightly alkaline by means of carbonate of potash or soda; then heat to gentle boiling in a beaker glass, and gradually add a solution, composed of 2·5 grammes permanganate of potash dissolved in 497·5 grammes distilled water, until all of the iodide of potassium is decomposed. The quantity of permanganate consumed will give the amount of iodine, for every gramme of it represents two milligrammes of iodine. The accuracy of the analysis is not destroyed by the presence of bromine or chlorine in the solutions.

A NEW GAS BURNER.

A new lamp, similar to a Bunsen burner, and called a forge lamp, has been introduced in London, by Delheid & Bergé. It consists of a candle burner, over which is put a tube as in the Bunsen burner, but with this difference, that the cylinder is larger and always ends below the opening of the gas jet, so that the air enters below the jet, and on all sides of it. As soon as the gas mixed with air is lighted at the top of the cylinder, a powerful draft is at once produced, giving the effect of a blowpipe flame. To obviate the flickering of the flame, an outer cylinder is soldered to the inner, in such a way that the air, before it reaches the inner tube, must pass through the outer. This serves the double purpose of keeping the apparatus cool and of heating the air before it mixes with the gas, by which the caloric effects are largely increased. The gas is entirely consumed, and the draft of air is said to be as great as if produced by a bellows. The heat is much greater than in an ordinary Bunsen burner, and the apparatus is remarkably simple.

SUITABLE MUCILAGE FOR PARCHMENT PAPER.

The difficulty of pasting edges of parchment paper together has seriously interfered with the employment of this material for many purposes. The enormous consumption of the celebrated pea sausage during the recent war in Europe, occasioned an unusual demand for suitable packing cases. As 100,000 sausages were manufactured daily, the supply of entrails was wholly inadequate to meet the demand, and many experiments were made with parchment paper, until Dr. Jacobsen succeeded in inventing a glue that would withstand hot water, and was entirely suited for the purpose of making watertight joints. One firm is reported to have made more than a million cases in the course of a few months, and as many as 150 workmen are kept constantly employed. Several layers of parchment paper are placed upon each other, and in this way imitation parchment is prepared for bookbinding. It is also probable that elastic gas tubing could be made of the same material, and that an extensive use would at once arise for paper bags impervious to moisture, and for wraps for all kinds of delicate goods. It would be well for some of our inventors to study up this subject.

IN recompense for the short duration of life entailed by some occupations, it must be regarded as a consoling, almost a sublime fact, that labor, in general, does not tend to shorten life, but rather, by strengthening the body, to lengthen it; while idleness and luxury are productive of the same results as the most unhealthy occupations.

Improved Feed Cutter.

The combination of devices, shown in the annexed engraving, renders the machine illustrated a most efficient, as well as simple and durable, implement. We have seldom met with an agricultural machine which seemed, in all respects, more adapted to the purpose it was intended to subserve. The feed cutter is a machine that should be on every farm, and the inventor of the one we are about to describe has evidently comprehended the requirements of farmers in this respect. The feeding apparatus is one of the principal features of the invention. Its operation is as follows:

A lug, A, is attached to the knife plate. As this plate is actuated by the hand in cutting the forage, the lug lifts the end of a pivoted bar, B. To the bar, B, is pivoted a ratchet bar, C. This bar is bent at right angles and toothed, as shown, so that the teeth of one end engage the upp r ratchet wheel, D, and the lower teeth actuate the lower ratchet wheel. These wheels are respectively attached to the feed rolls. The effect of this arrangement is, that the operator can gage his feed exactly as he wants it while cutting, the amount of feed being regulated by, and depending upon, the motion of the knife plate. The higher the latter is lifted, the greater will be the feed, and *vice versâ*.

The upper feed roller is held down upon the hay or other material to be cut, by means of a wooden spring, E, which acts through a crosshead and vertical bars, F.

The feed rollers are furnished with suitable blades and points with which to grasp and carry forward the materials to be cut, and also to hold them firmly so that they will not be drawn out of place by the pressure of the cutting knife.

The cutter bar, at the point where it is pivoted to the fulcrum, is compressed between an armed washer of large size secured by a nut, and a friction compress tightened by a thumb screw, so as to force the knife always to move close to the face plate, allowing no chance for it to spring off from the substance to be cut.

The advantages gained, in addition to those already stated, are, a broad guide plate for the knife; the closeness with which the knife holds itself to the face plate; and the automatic feed arrangement, by which the danger and labor of feeding by the hand of the operator is avoided.

The machine is covered by two patents, obtained through the Scientific American Patent Agency, dated respectively Dec. 1, 1869, and Nov. 15, 1870. Address the patentee, G. S. Garth, for territorial rights and further information, at Mill Hall, Clinton Co., Pa. Pa., Md., and D. C., are not for sale.

RE-VACCINATION--GLYCERIN LYMPH.

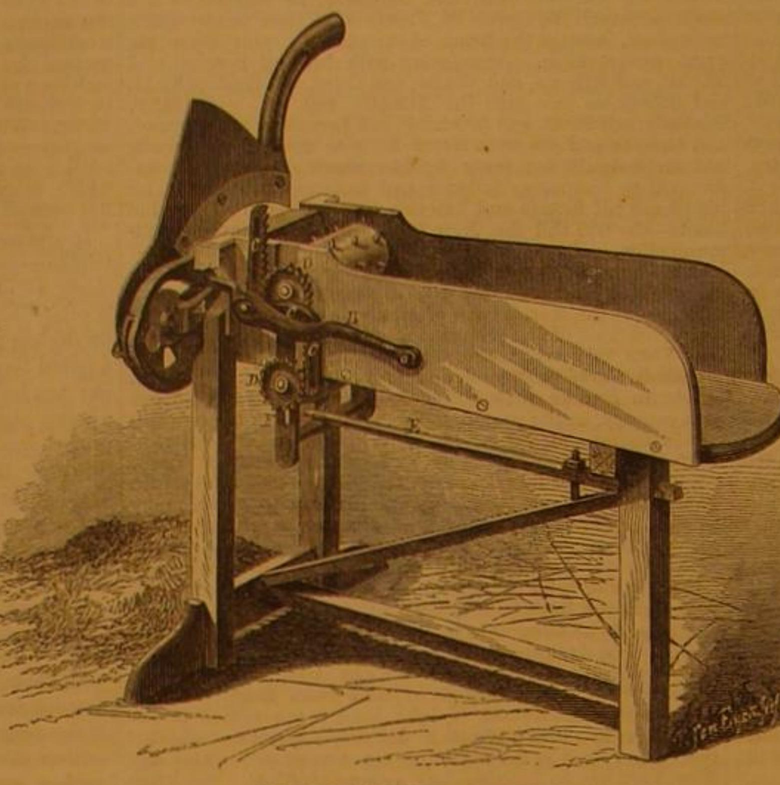
The great prevalence of smallpox in Europe and this country, at the present time, has led to a re-examination of the statistics of vaccination. It has been found that no re-vaccinated person has been admitted into the London hospitals, a fact which speaks volumes in favor of the practice.

Another peculiarity is now recognized, and that is, that vaccination previous to the age of puberty cannot be relied upon as a protection afterward, and that therefore children should be re-vaccinated when they have passed the boundary between childhood and adult age.

Prussia is avowedly the country where regular re-vaccination is most generally practised, the law making the precaution obligatory on every person, and the authorities conscientiously watching over its performance. As a natural result cases of small pox are very rare. It has, however been objected, there as here, that lymph is scarce. To make the most of such lymph as there is, Government has tried its application when mixed with glycerin, and the result was so successful as to lead to a public recommendation of the mixture to official vaccinating surgeons. The manner in which the glycerin lymph is prepared is thus described by the *Reichsanzeiger:* The pustules of a healthy vaccinated person are opened with a needle, and the effluent matter carefully removed by means of a lancet, the same instrument being gently applied to assist the efflux. The lymph is then best placed in the hollow of a watch glass, and there is mixed with twice its quantity of chemically pure glycerin and as much distilled water. The liquids are thoroughly well mixed with a paint brush. The mixture may be preserved for use in capillary tubes or small medicine glasses. The lymph thus procured is considered equal in effect to pure lymph; care must, however, be taken to shake it before use. As the same quantity that now suffices for one is thus made to suffice for five, the discovery ought to be extremely useful in crowded cities like ours.

Electrotypy---Imitation of Leather.

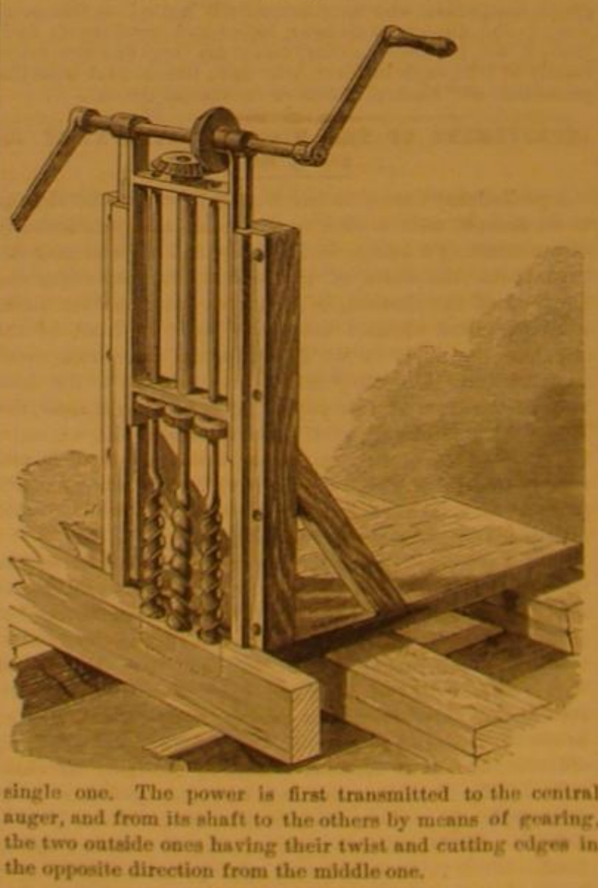
There is not a doubt but that this is an age of imitations; and the sham is so often taken for the real that even judges themselves have been misled. In manufactures there is such a constant demand for something new that the best energies are severely taxed to meet the requirements of the hour, and it is surprising to many how promptly this craving is satisfied. As an instance of the extending power of the imitator's art, we have noticed that Messrs. Elkington and Co., of Birmingham, have arranged to produce, by the electrotype process, imitations of the choicest grains of leather. They say that the system of producing leathers in exact facsimile of morocco, seal, and other skins, by means of electro deposited copper rollers, has now become an established branch of leather manufacture. The fine grain of the most rare and valuable skins can by this process be reproduced at a merely fractional cost, as compared with the ordinary inferior imitations. The system may be briefly described as follows: An ordinary machine roller is fitted with a mandrel, upon which is deposited, by a new process, the copper facsimile. The latter is an exact copy of any rare or choice skin required to be reproduced, and it is only by a recent improvement in electrotyping that the difficulty of depositing from such a substance as leather has been surmounted. An ordinary skin can thus be impressed with the beautiful surface of morocco skin, even to the finest variations of grain, and several thousand may be copied by one deposit. In all cases the actual skin required to be copied must be sent. These rollers are supplied ready for the machine: or, if preferred, manufacturers may send their own mandrels and have the facsimile deposited thereon.



GARTH'S FEED CUTTER.

BORING AND MORTISING MACHINE.

Our engraving is a good representation of a boring and mortising machine, invented by Arthur O'Neal, of Hyde Park, Mass. As will be seen, it is simply the adaptation of an old principle to driving a gang of augers instead of a single one. The power is first transmitted to the central auger, and from its shaft to the others by means of gearing, the two outside ones having their twist and cutting edges in the opposite direction from the middle one.



Tremendous Earthquake in China.

The neighborhood of Bathang, in the district of Sechuen, the central western province of China, has been devastated by one of the most appalling earthquakes of modern times. On April 4th, the earth trembled so much that houses and public buildings were thrown down and destroyed. Volcanic fire burst forth from fissures in the ground, and tempests of wind increased the destructive power of the flames. The subterranean thunder continued to be heard for three days, and the whole district was rocked like a vessel at sea. The disturbance lasted for ten days, after which the motion subsided. Besides large public buildings, a temple containing 350 rooms, and six smaller ones, as well as nearly 2,000 houses, were utterly broken in pieces. The deaths are known to amount to 2,298 people. The influence took a circular direction, and covered 400 miles of ground. Our readers will understand the effect of this visitation on such a people as the Chinese, whose superstition and credulity are proverbial.

THE GOVERNMENT OF NEW YORK CITY.

The rapidity of the growth of population and wealth in New York city naturally makes its inhabitants anxious that its administration be conducted in the best, wisest, and most economical manner. All Americans are proud of the Empire City, and we natives especially hope to see it the best governed city in the United States.

Of the importance of the city, and the magnitude of its interests, the annual message of the Mayor, just published, gives us opportunity for judging. The population is declared to be 942,252 souls, the amount of property, real and personal, valued for taxation is $1,075,000,000, and the taxes for the year, $23,300,000. The imports from other countries amounted to over $300,000,000, and the customs duties collected to over $140,000,000. The exports from the port of New York were about $300,000,000. These are imposing figures, showing that the commercial interests of New York will alone suffice to place the United States high in the category of nations.

For the comfort and well being of its vast population, 460 miles of streets, 340 miles of water pipes, and 275 miles of sewers, have been constructed; 19,000 gas lamps have been erected; and nearly 1,300 cars and omnibuses, and 94,000 carriages, licensed and private, traverse the streets daily.

The area of New York city comprises about 22 square miles, with a frontage to the Hudson and East Rivers of 29 miles. Of the necessity for the reconstruction of the whole water frontage, we have spoken at length in a recent article, as well as of the plans under consideration, and the manner of carrying them out. In respect to public improvements generally, the Mayor states that the city could be liberally ornamented and beautified, as well as rendered more subservient to the public convenience, by an expenditure of $20,000,000 during the next three years, and that the increased value of property would lighten the pressure of taxation by better distribution of its incidence. The property belonging to the city is stated at $267,000,000, while the outstanding debt is only about $80,000,000. There is no wonder, then, that the savings banks and other monetary institutions in search of unquestionable investments, which are accustomed to prefer securities that are backed by real estate, invest largely in bonds of the City of New York.

The Marks from Small Pox.

The painful and malignant disease, which has lately, thanks to uncleanliness and the disregard of the most ordinary precautions for the preservation of health, made such a change in the bills of mortality in this country and in Europe, calls to mind several of the remedies which are reputed to have the virtue of preventing the disfiguration of the skin. Among others, the *Sarracenia purpurea* was introduced into England. This plant is familiar to the natives of South Carolina, and is used by them internally, in the form of infusion, or decoction, for the cure of the same disease. It is a tonic, slightly stimulating, and is useful in cases of dyspepsia, waterbrash, and abdominal distension. There is another, well known in India, the leaves of which are used by the natives to cover the bodies of sufferers for the above mentioned purpose. Dr. Wright says that "the leaves, beaten into a pulp and externally applied, act like a charm in removing the most intractable form of psora and other pustular eruptions." This plant is the *Melia Azadir-achta* of Linnæus, and is called *pride of India, pride of China*, or *bead tree*. It is found, also, in our Southern States. It is, when taken internally, cathartic, emetic, and a powerful vermifuge; but its use, as described by Dr. Wright, does not appear to be known in this country. We look with interest for the results of experiments with it for the purpose of lessening the terrors of small pox.

SINGER'S SEWING MACHINE IN ENGLAND.—Arrangements have been made for the extension on a large scale of the Singer Sewing Machine Company's manufactory in James street, Bridgeton. Building operations have already been commenced, and the additions contemplated will give about 25,000 square feet of extra floorage, thus affording employment to 300 additional hands. The new premises are expected to be finished and ready for occupation by August. The factory will then be capable of turning out fully 1,400 machines per week, being nearly double the present average production; while the total number of hands employed will be very little short of 1,000. These extensions will necessarily involve a large addition to the existing plant, and a lot of new machinery is about to be introduced for the medium or No. 1 machine. It is said that the Singer machine factory at Bridgeton is now the largest in the United Kingdom, and, in its enlarged form, it will compare favorably with some of the colossal establishments on the other side of the Atlantic. —*Engineering*.

Scientific American.

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NEW YORK, SATURDAY, JUNE 24, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

The present 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 this 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.

CLOSE OF ANOTHER VOLUME.

The present number completes the Twenty-fourth Volume of the New Series of the SCIENTIFIC AMERICAN.

As we write, our subscription list is larger than at any other period in the history of our popular journal, and it is still growing steadily and healthfully, without any special exertion on our part, except that always made to render our paper the best popular scientific publication in the world.

By comparing the index of the present volume with those of preceding volumes, it will be seen that a considerably greater variety of subjects has been discussed than in any other volume. We have labored earnestly to please and instruct our readers in the selection of topics as well as in their treatment, and we have every reason to believe we have succeeded.

The hearty friendship to our enterprise, evidenced in the warm praises received from our numerous correspondents, encourages us again to appeal to our readers for their cooperation in extending the usefulness of the SCIENTIFIC AMERICAN, by inducing others to subscribe for it. While our paper is, we believe, the best of its class, we know it to be the cheapest; and no man can invest money more profitably than in securing such a fund of practical and useful information as we annually furnish.

The departments of "Queries," and "Answers to Correspondents," is, under the present plan of conducting it, eliciting a large amount of practical information upon the whole range of industrial arts. We hope our correspondents will continue their favors and aid us in ultimately making this one of the most valuable features of our paper.

With these remarks we pass on to the next volume, pledging that our efforts shall be put forth unremittingly to maintain and increase the value of the SCIENTIFIC AMERICAN and to sustain its reputation.

THE LAST SIX MONTHS OF CHEMISTRY.

In turning over the leaves of our last volume, to see what has been done in the line of chemistry, we do not come across the record of any startling discoveries, but we find a very satisfactory condition of things in the various laboratories of the world, and there is abundant proof of unusual industry among scientific men. It is pleasant to see that the ranks of scientific laborers have not been so largely thinned by death as they were a year ago. Very few men of distinction have been summoned away during the last six months, and the biographical sketches of these few have found suitable place in our columns. Conspicuous among those who have closed their labors may be mentioned Professor Wetherill, William von Haidinger, and Professor Staedeler.

The efforts of chemists have been chiefly directed towards increasing our knowledge of the properties of substances previously discovered. This is in accordance with the humanitarian spirit of the age. The tendency now always is to make practical use of everything—in other words, to turn it to good account—and in this pursuit the chemists have been unusually successful since the commencement of the year. We can not occupy the time of our readers with a repetition of the accounts already given of the leading investigations, but it may be worth while to recall to mind a few improvements that have been made, in order to encourage original workers to make renewed exertions to round up and complete certain desired inventions.

A cheap method of making hydrogen was suggested by Du Motay, the same chemist who has enriched our knowledge of the manufacture of oxygen, which consists in heating slaked lime with some carbonaceous material. It looks like a cheap and easy way of procuring a gas that would have extensive application in the arts, if it were available in unlimited quantity. When we have hydrogen in abundance, we can easily carburet it, and it would be a singular thing indeed if some day our illuminating gas were to be made out of water combined with slaked lime, and the distillation of coal were to be confined to the production of tar derivatives and aniline colors.

Our knowledge of hydrate of chloral has been much extended. A good deal of contradictory testimony exists in reference to it, and we are now going through the doubtful stage, in which the skeptical refuse to believe, and the credulous are much disturbed in mind. We have taken pains to give both sides a fair hearing, and the summing up of the evidence lead us to think that as a hypnotic the hydrate of chloral is one of our most useful remedies; but it ought never to be applied without the knowledge and consent of the best medical authority. The employment of chloral as a reducing agent, in many chemical processes, is novel, and bids fair to become a very important one. The incidental products growing out of its manufacture on a large scale, have also found an use in the dye vat, so that our knowledge of this subject has decidedly increased during the past six months.

The increasing demand for albumen has occasioned more than the usual activity in the search for new sources of supply. While merchantmen look to far off islands, frequented by wild birds, the chemist examines home products, and finds in the blood a supply of albumen, that ought to be better economized and more largely used than it has hitherto been. Blood albumen is becoming a large article of manufacture, and some specimens we have seen are but little inferior to the best product of the egg. The sugar refiner, the photographer, the calico and aniline printer, consume large quantities, hence the attention bestowed upon this branch of industrial chemistry.

Beet sugar and grape sugar, two industries of the first importance, have received extraordinary attention of late, and they are likely to develop into sources of wealth to those who enter upon them with adequate knowledge and proper caution. In a country where corn is grown in such enormous quantity as on the prairies of the West, grape sugar made from starch ought to become an article of export. Its uses in the arts have increased wonderfully, and the demand for it is likely to advance just in proportion as a popular knowledge of its value is further disseminated. Beet sugar is undergoing experimental examination, as we have shown, and bids fair to assume importance in this country as well as in Europe.

The artificial production of cold by chemical means has been considerably studied, and we have published all that has been made known on the subject. The most successful agent thus far appears to be ammonia, and it is peculiarly fortunate that this chemical product can now be obtained very cheaply and in large quantities. Ammonia, as a motive power and as a refrigerating agent can justly claim the attention of all experts. It is only a few years since the first organic compound was made by artificial means. The announcement of the discovery was everywhere greeted with profound attention, as the thought was near that at some future time we should be able by synthesis to make such rare and valuable medicines as quinine, morphine, codeine, and narcotine. Within a few months we have been able to give an account of the artificial production of coniine, one of the alkaloids, and this discovery offers encouragement that we are making progress towards the grand result indicated above.

The use of chlorine gas in metallurgical operations, although suggested some years since, has recently been brought more prominently before the public in connection with the toughening and refining of gold. As the production of chlorine gas can now be economically accomplished on a large scale, more particularly by Deacon's process, the attention of chemists is more than ever directed towards it, and there appears to be little doubt that it will obtain extensive use in the separation of many metals. The rare elements, silicon and aluminum, are more readily obtained from chlorine compounds than in any other way, and it is probable that gold will hereafter be refined by the use of this gas.

The applications of glycerin have gone on increasing, and especially for nitro glycerin and dynamite we note for it an unusual demand. The chemical nature of glycerin, its boiling point, its solvent properties, and the temperature of its distillation, have been made the special subjects of inquiry during the present year, and much progress has been made.

Another chemical product, called carbolic acid, has been subjected to numerous experiments until it has become an important article of commerce.

From this hasty summary, it will be apparent that chemists have not been idle, but have contributed a fair share of our general stock of useful knowledge.

PAINE'S ELECTRO-MOTOR.

We recently published a series of engravings illustrative of the above improvement, together with such information as had reached us concerning its actual and anticipated performances. We were a little fearful that our estimates, although derived from good sources, might be considered by the parties in interest as somewhat overdrawn. But it appears from a letter from Mr. Paine, which we elsewhere publish, that instead of over-estimating we have greatly underrated the capacity and merits of his alleged discovery.

He states that the electric engine now running at Newark, N. J., has been in constant operation for eight months, running nine hours a day, doing a duty of 67,000 foot-pounds (a little over two horse-power) with a consumption of only three ounces of zinc per day—a cost of less than two cents.

In previous articles in our columns bearing upon the subject of electro-motors, calculations have been given, showing that the mechanical equivalent for twenty-two pounds of zinc, or the consumption of that quantity of zinc in such a manner that its total mechanical effect could be realized, would be a duty of two horse-power maintained for nine hours. Between these calculations and Mr. Paine's statements, there is, consequently, a very wide difference.

Mr. Paine further tells us that he expects to realize from his new engines a force of sixty-seven millions of foot-pounds, or two thousand horse-power, at a cost of three grains of zinc; and that he will be able to drive the largest ship afloat (the *Great Eastern*, we suppose) by means of a single Bunsen quart cell, with a velocity only limited by the strength of the vessel. One hundred and fifty miles an hour will be a moderate velocity, according to Mr. Paine's science, for the future speed of the great ship.

With these wild dreams for a basis, it would seem like a difficult undertaking for the Paine Electro-Magnetic Engine Company to find purchasers for their scrip. But Mr. Paine assures us that he has secured a chosen band of adherents, composed of "men that you and I cannot mislead." We conclude that every bubble, like the dog, must have its day.

We have not space to discuss Mr. Paine's turpentine light which he gives us to understand still flickers, although, as a sensation, it long ago burned out.

THE INAUGURATION OF THE MORSE STATUE.

We do not believe there was a single right feeling individual in the entire civilized world who did not feel a glow of pleasure when it was announced that the telegraph operators of this country intended to erect a statue in Central Park, in honor of the venerable Professor Morse.

They gave their dollars, and procured the statue, and the inauguration took place last week, too late for notice in our last issue.

The ceremonies were of great interest. Speeches—of which that of the venerable Professor himself, which we give in another column, was the best of all—together with poetry and music, crowned the occasion, and thousands gathered together to show their appreciation of the event, and of him in whose honor the statue was erected.

The following was the order of exercises in the Park:

1. Music by the U. S. Band, of Fort Columbus.
2. Introductory address by Gov. Hoffman.
3. Unveiling the statue by His Excellency, Gov. Claflin, of Massachusetts, and Hon. William Orton.
4. Music.
5. Inaugural address: William Cullen Bryant.
6 Reception of the statue by Hon. A. Oakey Hall, Mayor of the City of New York.
7. Music.
8. Prayer by Rev. Stephen H. Tyng, D. D., rector of St. George's, N. Y.
9. Doxology, by band and people.

In the evening, the Academy of Music was crowded by interested citizens. Hon. Wm. Orton presided. Professor Morse sat at the right of the stage, the observed of all observers. After speeches by Messrs. Orton and Dr. George B. Loring, of Boston, the following telegram was dispatched to the telegraphic fraternity throughout the world:

"*Prof. Morse sends greeting to those of the telegraphic fraternity throughout the world. 'Glory to God in the highest, peace on earth and good will to men.'*"

Miss S. E. Cornwell, who transmitted the first message ever sent by the Morse system also transmitted this message, and Prof. Morse telegraphed his own signature, as the closing act of his telegraphic career. The utmost enthusiasm prevailed, and a more fitting tribute of a grateful people to a public benefactor never took place in this city.

FLYING MACHINE.

The famous old Novelty Works, in this city, once a scene of constant activity, now present an aspect of desolation. The machinery is all removed, and the entire floor of the principal building is empty, save that in the center stands a flying machine.

We know not who is the inventor of this machine. The watchman of the premises told us it had been left to its own devices for six weeks or more, and, strange to say, that it had proved a failure. A watchman's judgment, however, is not generally very reliable on such matters, and as our questioning failed to elicit any knowledge of the principles of the device, we examined it minutely ourselves. As many of our readers are interested in the subject of aerial navigation, we place before them a description of the mechanism.

It is designed to be driven by steam. A two-horse power vertical boiler is supported in a light frame at the bottom of the machine. At one side of the top of this frame is placed one of Root's rotary engines. On the shaft of this engine is a miter gear, which meshes into two others, one at the top and another at the bottom of the gear on the engine shaft. The two driven gears are respectively keyed to a solid shaft and a hollow shaft, the former rising vertically through the latter. Thus equal but reverse motion is secured in the two shafts.

Each shaft carries a propeller screw made of light metallic frame work, with blades of canvas stretched over skeleton frames of iron. The arms of the wings or blades are of hollow brass tubing, tapering from their junction with the shafts to the extremities of the wings. They are braced laterally and vertically by small iron rods. We judge the diameter of the counter propellers thus formed to be about twenty feet.

The object of giving them reverse motion is evidently to prevent the machine from spinning around on its vertical axis, as would be the case if only one propeller were employed.

These propellers must, if revolved rapidly, exert considerable elevating power, but the weight of the machine is evidently greater than their capacity, unless they are revolved at a velocity that would break some part of the machinery.

We long ago said that the solution of the problem of flying machines would be found in the discovery of materials of combined strength and lightness, yet unknown to science, and also in the invention of a motor having a power, in proportion to weight, comparable to that of the pectoral muscles of birds. Those who seek success in aerial navigation must first solve these preliminary problems, which, as every experiment in artificial flight demonstrates, are yet without solution.

THE EAST RIVER BRIDGE.---REPORT OF THE CHIEF ENGINEER.

Each step in the progress of this great structure increases public confidence in its ultimate successful completion, and demonstrates the ability of the controling mind in charge of the work. It is evident that the mantle of the late John A. Roebling, to whose genius the plan of the bridge is due, has fallen upon the shoulders of his son, Col. W. A. Roebling, who is now the Chief Engineer.

The reports made by this gentleman are characteristic of the man. They are like him in the absence of all attempt at vain display of technical knowledge, and in reliance upon the merits of actual performance as a basis for enduring reputation. When errors have been committed, they are frankly acknowledged; and where successful experiments have been tried, they are set forth in a moderate statement of facts, without undue elaboration, or any attempt at self-glorification, all the more praiseworthy as coming from a man who, though comparatively young, is building a monument to his own genius that will rank as one of the greatest, if not *the* greatest, of the gigantic works of the age.

One of the topics discussed at greatest length in the report, is that of the blowing out of the east caisson, "the legitimate result," as Mr. Roebling himself states, "of carelessness, brought about by an over confidence in supposing that matters would take care of themselves."

Our readers will find the account of this occurrence in another column, extracted from the report. As a graphic description of a very exciting and alarming event, it is scarcely inferior to anything we have met with.

We shall, as occasion offers, give further extracts from this interesting document.

Whitewash for Outside Work.—Slake half a bushel of lime with boiling water, keeping it covered during the process. Strain, and add a peck of salt, dissolved in warm water; three pounds of ground rice put in boiling water, and boiled to a thin paste; half a pound of powdered Spanish whiting, and a pound of clear glue, dissolved in warm water; mix well together, and let the mixture stand several days. Put it on hot.

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.

Inventions Patented in England by Americans.

May 16 to May 23, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.

Battery Gun.—A. H. Townsend, Georgetown, Col.
Car Coupling.—J. Crane, Cranford, N. J.
Carpet Linings, etc.—J. R. Harrington, Brooklyn, N. Y.
Covering Leather.—G. W. McDaniel, Georgetown, D.C.
Decolorizing Sirups.—J. Brough, W. H. Gilson, New York city.
Dressing Leather.—H. C. Havemeyer, New York city.
Electro-magnetic Engines.—H. Paine, Newark, N.J., and M. S. Frost, New York city.
Fertilizer.—C. Morfit, Baltimore, Md.
Firearm.—H. Berdan, New York city.
Generating Gas.—C. D. Elmer, Southold, N. Y.
Hollow Ware.—N. Thompson, Brooklyn, N.Y.
Hulls of Vessels.—E. M. Strange, New York city.
Insulating Wire.—A. G. Day, Seymour, Conn.
Lamp.—J. W. Bartlett, New York city.
Nitro-glycerin.—H. D. Berrett, Washington, D. C.
Paddle Wheel.—E. Pratt, New York city.
Paper Pulp.—V. E. Keegan, Boston, Mass.
Picking Waste.—G. Palmer, Rochester, N.Y.
Preventing Incrustation.—J. Perkins, Baltimore, Md.
Printing Telegraph.—G. B. Field, E. W. Andrews, New York city.
Railway Car Wheels.—R. M. Allen, L. W. Kimball, Pittsford, Vt., and W. H. Mallory, E. L. Butterfield, New York city.
Reaping and Mowing Machine.—W. A. Wood, Hoosick Falls, N.Y.
Refining Sugar.—R. W. Bender, Boston, Mass.
Steam Engine.—G. H. Babcock, New York city.
Steam Engine.—J. Brandt, R. Lehr, Baltimore, Md., and C. G. Fisher, T. C. Brecht, Washington, D.C.
Transporting Liquids.—W. G. Warden, Philadelphia, Pa.

Foreign Patents.

The population of Great Britain, is 31,000,000; of France, 37,000,000 Belgium, 5,000,000; Austria, 36,000,000; Prussia, 40,000,000; and Russia, 70,000,000. Patents may be secured by American citizens in all of these countries. Now is the time, while business is dull at home, to take advantage of these immense foreign fields. Mechanical improvements of all kinds are always in demand in Europe. There will never be a better time than the present to take patents abroad. We have reliable business connections with the principal capitals of Europe. A large share of all the patents secured in foreign countries by Americans are obtained through our Agency. Address Munn & Co., 37 Park Row, New York. Circulars, with full information on foreign patents, furnished free.

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.

Liquid Glues.—S. F. (query No. 8, May 27th) can make an excellent liquid glue by dissolving his glue in nitric ether. The ether will only dissolve a certain amount of the glue: consequently he need have no fears about making the solution too thick. The glue thus made is about the consistency of molasses, and is doubly as tenacious as that made with hot water. If a few bits of India-rubber, cut into scraps the size of a buck shot, be added, and the solution allowed to stand a few days, being stirred frequently, it will be all the better; and will resist dampness twice as well as glue made with water. The best liquid glue that I have any knowledge of is made as follows: Take of gum shellac three parts, caoutchouc (India-rubber) one part, by weight. Dissolve the caoutchouc and shellac, in separate vessels, in ether free from alcohol, applying a gentle heat. When thoroughly dissolved, mix the two solutions, and keep in a bottle tightly stoppered. This glue is called marine glue, and resists the action of water both hot and cold, and most of the acids and alkalies. Pieces of wood, leather or other substances, joined together by it, will part at any other point than at the joint thus made. If the glue be thinned by the admixture of ether, and applied as a varnish to leather, along the seams where it is sewed together, it renders the joint or seam water tight, and almost impossible to separate. The natives of the Maldive and Lacadive Islands, and the Malays, of the coasts of Borneo and Sumatra, have a glue which they make as follows: They take the scales of a kind of fish, called by English and American sailors, salt water trout (identical with the salt water trout of the Gulf of Mexico), and after thoroughly washing them, place them in a glazed earthen jar, which they stopper tightly, and weight so that it will remain under water. They put this jar in a pot of water, and boil it until the scales are reduced to a semi-transparent viscous mass. This requires several hours boiling. Care should be taken that no water or extraneous matter, fluid or solid, be allowed to get into the jar with the scales. The glue thus made is the most tenacious, and at the same time, the most transparent and beautiful that I have ever seen. I have made it in this country from the scales of perch, trout, and bass. I am informed that a similar glue is made from the bladders of various fishes.—F. L. J., of Ark.

Leather for Vise Jaws.—C. A. W. wishes to know the best material for sticking leather to vise jaws. I have used, for years, pulverized rosin on the flesh side of clean dry leather, with entire satisfaction.—E. J. O., of N. Y.

Noisy Gears.—If S. R. will make one of his large gears with wooden teeth, keeping the wooden teeth well lubricated with tallow, he will find that in place of a noisy gear, he has something that will run smoothly. I have seen large bevel gears, running very quietly, made in this way.—A. G., of Mass.

Moths.—If E. A. T. will use gum camphor, red cedar shavings, or spirits of turpentine, around the edges of his room under his carpet, he will find it a preventive against moths.—A. G., of Mass.

Boils.—W. E. asks for a preventive for boils. He will find it in the beech drop, (*Epiphagus Virginiana*) a curious little plant found only under beech trees, as it is a parasite of the root of the beech. It is about one foot high, leafless, with a root covered with short brittle fibers, and appears only a short time before frost, which destroys its properties. Make a tea of the whole plant, and drink warm or cold instead of other drinks. If used liberally, it will remove boils, even after they have become painful, and is excellent whenever the blood is impure.—H. S., of Ohio.

Boils.—If when W. E. first sees the little hard red bunch appear, he will take a sharp penknife, and cut into it, he will not have further trouble; at the same time keeping his bowels open (not with the knife) but by some kind of aperient. I like the saline effervescing aperients the best. I am not a physician, but I speak from experience.—F. C., of Mass.

More Boils.—Apply a little dampened saleratus, about the size of a kernel of wheat, when the boil first shows itself; let it remain an hour or thereabouts.—J. G. C. P., of N. Y.

Noisy Gears.—Let S. R. fill his gears tightly with some soft wood between arms, hub, and rim, and their noise will not trouble him.—G. D., of Va.

Noisy Gears.—I would say to S. R. that it is a difficult matter for any one to tell the cause of the noisy gears, unless he is provided with diagrams of at least three teeth of each wheel. To test the gears properly, it is as well to know the number of teeth on each wheel, or their respective diameters and the depth they are geared at.—J. W., of Pa.

Plumb Rule.—To your "Maine Carpenter" it is only necessary to say that the question was "how to make a plumb rule," not whether there was anything better. At the risk of being called *ancient*, I will say that at times I prefer a plumb rule to a spirit plumb level, particularly when great exactness is required. The best way to prove a plumb rule is to see that the edge is straight, and the center line parallel to it; and it will then prove itself most effectually. "That's practical." —J. H., of N. J.

Drilling Glass.—I have used a tin tube for drilling glass, arming it with spirits of turpentine and emery, and manipulating as your correspondents describe for brass tubes. The tin tubes work excellently in this way.—L. H. B., of N. H.

N. E. Y., of Mass.—While it is necessary for canal boats running in the same direction to pass each other occasionally, this is comparatively not of frequent occurrence. The loading or unloading of boats is not confined to either bank of the canal. Your other query has been already answered.

E. G. H., of Texas.—A life boat with air compartments would, by exhausting the air from the compartments, be rendered more buoyant, according to the weight of the air removed.

F. C., of Mass.—Your plan for propelling canal boats is essentially that of the Belgian system, prohibited in the prize competition.

Recent American and Foreign Patents.

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

BEDSTEAD.—The side rails have metallic plates attached at the ends, upon which are formed hooks, which enter mortises in the posts and engage metallic pins, in such a manner as to draw the parts tightly together. A flange formed on each plate also rests against the post, and makes the connection firmer. Sockets are also formed upon the plates to sustain crossbars placed respectively at the head and foot of the bed. These cross bars sustain the longitudinal slats, held together in sections by cross bars, so that each section sustains the weight of the person resting upon it, independently of the other. Invented by Ira Deyo, of Pa.

ELEVATOR.—This improvement, made by Valentine C. Blair, of Wheatland, Pa., consists of pairs of lever clamps or catches, so pivoted that the action of a spring causes them to gripe with great firmness the slides, upon which the frame of the platform or cage slides up and down, in case the rope should break. The outer ends or levers are connected by links at the ends of a four armed bow, which bow is attached to the rope in such a manner that it keeps the ends of the clutching levers raised against the action of the springs, so that the latter cannot cause the clamps to take hold except in case of breakage.

COUGH CANDY.—Louis Violet, of New Lebanon, N. Y.—One pound extract of horehound and one pound extract of liquorice are dissolved in alcohol and boiled down to the consistency of paste, then mixed with four pounds of sugar, which were previously dissolved in water. The medicine is, as a gum filling, put up in candies of suitable shape and style, and is harmless to the stomach, but effective in curing inflammatory diseases and affections of the throat.

TIDY PINS.—The inventor claims to have discovered a principle of construction or new way of shaping the pin, so combining a lateral or branched head with a pair of opposite and short corrugations that a narrow recess is formed between them, in which the fabric will lie and prevent the pin from working loose or slipping out. Invented by Hial H. Newton, Cleveland, Ohio.

COMBINATION TOOL.—This is a new implement for use with sewing machines, which embraces in one tool a hook, a spring nippers, and a shears the hook being to take out or put in the shuttle and adjust the thread; the nippers being to take the end of the thread projecting through the eye in threading the needle to pull it through, also to hold and adjust the needle in setting; and the shears being to cut threads, cloth, etc. B. S. Burch, of Petersburg, Va., assignor to himself and William H. Baxter, of the same place.

RAILWAY RAIL JOINT.—This consists in a long flat plate having vertical slots, one on each side, near the center, two clips with upper ends catching on the base of the rail, and lower parts projecting down through the slots in the plate, the latter being placed under the rails; a gib for holding the ends of the clips below the plate from being forced together; and a key for clamping the clips and the plate together, said key passing under the plate transversely and through holes in the clips, and the plate resting at the ends on the ties. The inventors propose to employ a split key, having the ends so shaped that it will be prevented from working out. The plate may have notches on the edges of the part resting on the ties, coinciding with the notches in the edges of the bases of the rails, for reception of the spikes used to hold the rails down and to prevent end movement. The several parts forming this apparatus for joining the ends of the rails are all very simple in form, and may be made in wrought metal, either by rolling or stamping, making, it is claimed, a very cheap, simple, and efficient joint. Invented by George E. Morris ahd Charles W. Gregory, of Danville, Ill.

HYDRANT.—This invention is intended to provide hydrants having double discharge nozzles with a convenient valve, whereby either one of the nozzles can be closed, and it consists in the application to the hydrant of a swiveled lever carrying a disk or valve, whereby either one of the nozzles can be easily closed. Equidistant from the axes of both nozzles is swiveled in the head a stem, which is packed by a stuffing box, and can be turned on the outside of the hydrant by means of a key or handle. The inner end of the stem carries the lever, to which the valve or disk is secured. This valve or disk can, by turning the stem, be brought opposite the inner end of either nozzle, thereby closing it, or can be turned so the valve will not close either. When, in the ordinary double hydrants, one hose is secured, the second can only be applied by stopping the entire supply of water by the main cock, as otherwise the force of the water would prevent the attaching of the second hose. By the use of this invention the second nozzle could be closed by the valve when the hose is to be attached, while the stream through the other hose will not be interrupted. In case a hose bursts, which is frequently the case, the valve is immediately moved to prevent more water from flowing to it, while the other hose can be used without hindrance. The interruptions often fatal to the success of stopping a fire are thus made unnecessary. Joseph L. Pillsbury, of Columbus, Ohio, is the inventor.

PIPE WRENCH.—This invention consists in forming the serrated jaws of the wrench at particular angles to each other and their handles, which adapts them for seizing and holding objects, with, it is claimed, a facility and security unequaled by others hitherto used. The claim is a wrench, ormed of a fixed jaw and a movable jaw, both serrated, having the particular shape and angle shown, and provided, respectively with handles, as shown and described. William Henry Barwick, of Montreal, Canada, is the inventor.

BUILDING BLOCKS.—Nicholas Boch, assignor to himself and W. J. Maidhof, all of New York city.—In the middle of the rabbetted block or thereabouts is formed an oblong aperture to serve as a ventilating flue. These blocks are more particularly adapted for use in constructing buildings with stone fronts and brick backing: but the inventor thinks they will be found perhaps equally serviceable under other circumstances.

BOLT HEADING MACHINE.—In this machine, the clamping dies have two simultaneous movements at right angles to each other, while the header has but one; and the same screw pressure effects the whole, while it, at the same time, furnishes to the spring the stored-up power to retract the clamps. Invented by George Chapman, of Rockford, Ill.

ROCK-DRILLING MACHINE.—This invention relates to improvements in machines for drilling rock for tunneling and other purposes. It consists in an arrangement of adjusting supports on a vertical frame, upon one end of a truck, for shifting the drills and operating gears vertically and horizontally, the machine having four sets of drill supports and four drills. It also consists in certain novel swivel heads, in which the drills work, and by which they are mounted on the said adjusting supports, and by which also the drills may be pointed and held in any direction, each independent of the other. Norman W. Robinson, Burlington, Vt., is the inventor.

CURRIERS' SLICKER.—George T. Collins, of North Eastham, Mass., has invented a currier's slicker, which consists in an arrangement of the blade and handle and adjusting apparatus for moving the blade as it wears away, to have it project from the handle the same distance at all times, and also in the application to the handle of a strengthening band of iron, to prevent it from working. By this arrangement the blade may be moved forward as fast as it wears, and held firmly in position; also, the warping of the slotted part of the handle, by which the blade is often loosened in the common slickers, is avoided.

TOY GUN AND PISTOL.—A new combined spring and air gun, to be used as a toy and for target practice, consists in the use of a sliding barrel, which actuates an annular piston. The stock or handle of it holds a rigid cylindrical case, and a trigger, whose point enters the case through an aperture. A spiral spring is fitted into the case, so as to surround the barrel and be in contact with the front end of the case. An annular piston is placed loose around the barrel, within the case, so as to be interposed between a shoulder and a spring. The barrel can slide within the case, and, when pulled forward, draws the piston along and compresses the spring, until the piston has passed and is locked by the trigger. The barrel can then be pushed back into the case, without affecting the position of the piston. Its backward motion is arrested by an elastic ring, placed upon the headed front part of the barrel. The breech end of the case is open, but can be closed by a pivoted breech plate. When the barrel has been pushed back, after having locked the annular piston to the trigger, a dart, or light projectile of a suitable kind, can be placed in the back end of the barrel. When the trigger is next touched to release the piston, the spring will expand and force the piston back, whereby the air contained in the back of the case will be expelled through the barrel, causing it to expel the dart. Invented by H. M. Quackenbush, of Herkimer, N. Y.

CULINARY VESSEL.—This invention has for its object to improve the construction of culinary vessels, such as kettles, pots, boilers, etc., in such a way that the said vessels may be easily tipped or inclined to pour out their entire contents without danger of scalding the hands of the operator with the steam from the said vessel; and it consists in a jointed bail and catches, in combination with the body of the vessel, so that the handle being placed a little below the edge of the vessel, the hand, when grasping said handle, is entirely protected from the steam arising from said vessel. Samuel W. M. Chattaway, of Middletown, Conn.

SHUTTER WORKER.—This invention consists in an open skeleton bracket attached to the blind, and a toothed sector on the end of a spindle, the spindle passing through the window casing, with a handle on its other end, so that the sector can be turned, and the blind opened and closed by a person on the inside. By this improvement the trouble and annoyance of opening the window for opening or closing the blinds are avoided. When closed, the blind is securely locked by a tooth and bar, and when open, it is fastened by a catch. James W. Jedkins, of Monmouth, Me.

CARRIAGE SEAT.—Simon P. Graham, London, Canada.—This invention relates to sundry improvements in the rails, bottoms, spindles, and pillars of carriage seats, all tending toward increased simplicity, and cheapness of construction.

NAIL CUTTING MACHINE.—A. W. Paull and J. Morgan, Jr., Wheeling, West Va.—The invention consists in a novel means of holding the end of the nail plate firmly and immovably, whereby any pattern of nail blank and any exact number of nails to the pound may be always obtained with absolute uniformity.

POWER FOR SMALL MACHINERY.—Charles L. Johnson, Omaha, Neb.—This invention consists in an arrangement of parts, whereby a weight hung outside of the building, may be made use of for the purpose of operating a mechanism placed within the building, by which mechanism, when thus operated, any small machinery may be driven through suitable connections.

KILN FOR THE TREATMENT AND PRESERVATION OF WOOD BY THE ROBBINS' PROCESS.—John W. Fielder, Princeton, N. J.—This invention relates to an apparatus for preserving wood by what is known as the Robbins' process, that is to say, by placing wood in an air-tight kiln, and introducing thereinto the vapor of creosote oil, which vapor drives moisture and air out of the pores of the wood, coagulates the albumen of the sap, thus preventing its putrefaction, and fills the pores with oil, thus rendering it secure from decay.

WATER METER.—Joseph W. Cremin, New York city.—This invention relates to the application of the device, known as Barker's Centrifugal Mill, to a water meter, the revolving hollow arms being placed within a case, and mounted on a hollow shaft, extending crosswise thereof, said shaft connecting at one side of the chamber with the supply pipe, and at the other side with the registering clock work, which is worked by the turning of the shaft through the agency of water rushing into the arms and out at holes in, or near, the ends of the latter, in the ordinary way of operation of the centrifugal mill.

CAR COUPLING.—James B. Harper, St. John, Mo.—This invention relates to an automatic car coupling, in which the drawheads are pivoted to the cars so as to be horizontally rotatory, and in which the link is pivoted at one end to one of the drawheads, and has at its other end a pointed head, with spirally cut sides, which head, when two cars are coupled, enters the other drawhead, the lips of which, acting on the spiral sides of the head, turn the same vertically until it enters the cavity of the drawhead, after which the said head turns horizontally so far as to present its rear side to the inner sides of the lips of the drawhead, and thus be held within the latter.

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.—APERIENTS.—I would like to ask some physician, whether the habitual use of aperients is injurious?—F. C.

2.—TURBINES.—I would like to learn through the SCIENTIFIC AMERICAN, if turbine water wheels, having gates placed beneath the wheel in draft tubes, to regulate the amount of water used, obtain any more useful effect from the water, or are any better, than the same wheel whose gates are placed so as to regulate the water as it enters the chute, or as it passes from the chutes to the bucket of the wheel? Does a wheel having its gate below it become any more of a reaction wheel than the same would if its gates were before, so as to regulate the water as it entered the shaft? and does it derive as much power from the direction of the water? And how is it when using partial gates?—J. C. W.

3.—BLEACHING WOOD.—Can any of your readers inform me of any good process for bleaching wood that has been stained or colored? I want to prepare it for use.—D. L. F.

4.—LIQUEFACTION OF NITROUS OXIDE.—Can any of your readers inform me what is the obstacle met with in the liquefaction of nitrous oxide gas on a large scale, by mechanical pressure or otherwise?—W. W.

5.—PREVENTING RUST.—I have a piece of machinery composed principally of tinned iron, or ordinary tin, and which, from the nature of the machine, it is necessary to keep in the cellar. It is covered with several coats of ordinary oil paint, which becomes sticky and soft, and the tin is beginning to oxidize or rust in spots. Can you inform me what paint I can use as a covering, that will resist the rust attacking it? Also what is the best thing to prevent the rusting of bright machinery that works in a cylinder, and is not easily accessible? Some parts of it are composed of bright steel, others of sections of clock springs, etc.—G. R.

NEW BOOKS AND PUBLICATIONS.

A MANUAL OF THE PRINCIPLES OF ROAD MAKING. Comprising the Location, Construction, and Improvement of Roads; Common, McAdam, Paved, Plank, etc., and Railroads. By W. M. Gillespie, LL.D., C.E. Tenth Edition, with large Addenda. Edited by Captain Cady Staley, A.M., C.E. A. S. Barnes & Co., New York and Chicago.

As a happy combination of practical information and scientific elucidation of an important subject, this work might well be taken as a model, so far as it goes. Were the facts here presented more generally diffused, there would soon be a marked improvement in American roads. That the work has reached its tenth edition is evidence of its practical value. We think the editor might, however, have profitably substituted for much of the matter relating to plank roads, a discussion of the more modern roads made of wood as well as a notice of various kinds, roads in which stones, coal tar, etc., are the materials employed. It is a little too late in the day to waste much time in the discussion of plank roads. In short, the book is scarcely up to the age on the subjects of which it treats, and so far as railroads are concerned, is not complete enough to be of great use to engineers. The information given as to earth roads, McAdam, and other well known kinds of roads, is sound and practical, and this we regard as giving the book its chief value.

SCRIBNER'S MONTHLY.

The July number of this popular illustrated magazine, under the editorial management of J. G. Holland, formerly of the Springfield (Mass.) *Republican*, is just out, and may be had at any of the periodical stores, or of the publishers, Scribner & Co., 651 Broadway, New York.

THE AIR WE BREATHE.

This is an interesting essay, read before the Western Social Science Association, at its annual meeting for 1870, by W. H. Churchman, A.M. Published by the Indianapolis Printing and Publishing House.

SPECIAL REPORT ON IMMIGRATION.

Mr. Edward Young, Chief of the Bureau of Statistics, will please receive our thanks for a copy of the above named report.

Practical Hints to Inventors.

MUNN & CO., Publishers of the SCIENTIFIC AMERICAN, have devoted the past twenty-five years to the procuring of Letters Patent in this and foreign countries. More than 50,000 inventors have availed themselves of their services in procuring patents, and many millions of dollars have accrued to the patentees, whose specifications and claims they have prepared. No discrimination against foreigners; subjects of all countries obtain patents on the same terms as citizens.

How Can I Obtain a Patent?

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

How Can I Best Secure My Invention?

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

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

Preliminary Examination.

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

Caveats.

Persons desiring to file a caveat can have the papers prepared in the shortest time, by sending a sketch and description of the invention. The Government fee for a caveat is $10. A pamphlet of advice regarding applications for patents and caveats is furnished gratis, on application by mail. Address MUNN & Co., 37 Park Row, New York.

To Make an Application for a Patent.

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116,001.—Ligature, etc.—S. P. Gilbert, Racine, Wis.

REISSUES.

4,419.—Tape Measure.—L. P. Bradley, New Haven, Conn. Patent No. 92,573, dated July 13, 1869.
4,420.—Harvester.—J. Butter, Buffalo, N. Y.—Patent No. 25,034, dated Feb. 7, 1860.
4,421.—Stove.—A. C. Corse, Troy, N. Y.—Patent No. 107,597, dated Sept. 20, 1870.
4,422.—Boot.—C. S. Dunbrack, Swampscott, Mass.—Patent No. 95,210, dated Sept. 28, 1869.
4,423.—Horse Power.—M. B. Erskine, Racine, Wis.—Patent No. 107,237, dated Sept. 13, 1870.
4,424.—Diaper.—J. C. Hempel, Baltimore, Md.—Patent No. 91,334, dated June 15, 1869.
4,425.—Stock Car.—Amos Rank, Salem, Ohio.—Patent No. 111,872, dated Feb. 14, 1871.
4,426.—Stove.—A. White, Rock Island, Ill.—Patent No. 101,688, dated April 5, 1870.

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4,985.—Billiard Marker.—H. W. Collender, New York city.
4,986.—Clock Case.—Paschal Converse, New Haven, Conn
4,987 to 4,989.—Carpet Pattern.—J. Fisher, Enfield, Conn.
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EXTENSIONS.

Sewing Machine.—J. E. A. Gibbs, Steele's Tavern, Va.—Letters Patent No. 17,427, dated June 2, 1857; reissue No. 373, dated July 13, 1858.
Invalid Chair.—J. G. Holmes, Charleston, S. C.—Letters Patent No. 17,537 dated June 16, 1857.
Steam Pumping Apparatus.—G. H. Corliss, Providence, R. I.—Letters Patent No. 17,423, dated June 2, 1857.
Steam Pressure Gage.—C. A. Eastman, Boston, Mass.—Letters Patent No. 17,550, dated June 16, 1857.
Hydrant.—G. P. Perrine, Richmond, Va., J. E. Boyle, New York city.—Letters Patent No. 17,632, dated June 23, 1857.

DISCLAIMERS.

Sawing Machine.—Jacob Lagowitz, Newark, N. J.—Letters Patent No. 10,963, dated May 23, 1854.
Sawing Machine.—E. Peck and G. J. Bogert, New York city.—Letters Patent No. 10,965, dated May 23, 1854.
Steam Pumping Apparatus.—G. H. Corliss, Providence, R. I.—Letters Patent No. 17,423, dated June 2, 1857.

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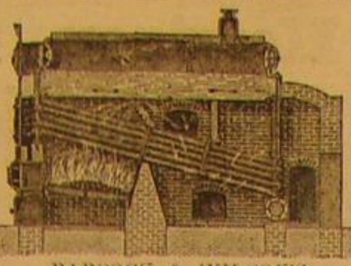

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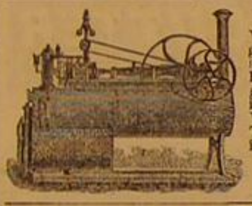

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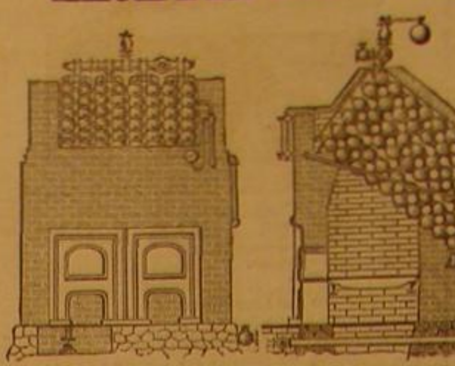

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