SCIENTIFIC AMERICAN

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

Vol. XXV.--No. 2. [NEW SERIES.] NEW YORK, JULY 8, 1871. $3 per Annum [IN ADVANCE.]

PROFESSOR MORSE AFFIXING HIS SIGNATURE TO THE GREETING TELEGRAPHED BY MISS S. E. CORNWELL AT THE MORSE CELEBRATION.

Our engraving illustrates one of the most interesting ceremonies that has ever taken place in this city—the father of the telegraph greeting his children. The sharp click of the instrument having responded to the expert manipulation of the lady whose name is intimately connected with the early history of the most remarkable invention of the century, the message only awaits the signature of the venerable Professor to be complete. The audience with difficulty suppress their enthusiasm as he seats himself before the magic tongue whose utterances cleave space, in defiance of time and distance. The name is recorded, and the deafening cheers of the audience make the roof of the Academy of Music ring again and again with glad echoes.

The name is written not only in telegraphic characters upon sundry slips of paper, but in letters of light upon the scroll of fame,

> " One of the few immortal names
> That are not born to die."

Truly the whole nation has a right to rejoice at the appropriate memorial erected to this great man, and to share in the delight of this memorable occasion. For upon the whole nation is reflected the glory of his invention, the effect of which upon the welfare of the human race is absolutely beyond estimate.

And though we would not rob others who prepared the way before him, of their meed of glory, we hesitate not to avow that the honors paid to Professor Morse have been well earned and justly paid, and that they alike reflect credit upon the telegraphic fraternity by whom they were originated, and upon their esteemed recipient who so gracefully accepted the ovation.

In response to the greeting of Professor Morse, numerous telegrams were received. Among these were messages from the Chambers of Commerce at Hong Kong, Bombay, and Singapore. A poetical one from Chicago we append·

> " A thousand flashing wires tonight
> Meet in one circuit—grand, complete—
> And o'er them, with the lightning's pen
> We write our father Morse to greet.
>
> " But we, dear chief, a circuit form
> Which far excels th' electrician's art.
> Affection's battery warms the line,
> Each " cup" a telegrapher's heart.
>
> Repeating stations there are none;
> Unbroken flows the electric stream
> That bears you this eventful night
> Our love, our reverence, our esteem."

THE APPLICATION OF STEAM TO CANALS.—NO. 4.

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

This paper would be incomplete without mention of the experiments of Fairbairn, in 1830 and 1831, as instanced in his "Remarks on Canal Navigation, illustrating the advantages of steam, as a moving power, on canals." The preliminary experiments of light single and double gig boats on the Forth and Clyde canal, moved at a high rate of speed, and variously loaded, as well as the partial success of the steamer *Cyclops*, built under the direction of Mr. Grahame, of Glasgow, with a single stern paddle-wheel, induced Mr. Fairbairn to suggest the construction of a small steamer named the *Lord Dundas*, 68 feet in length by 11 feet 6 inches in depth, provided with a wheel thorough 3 feet 10 inches wide, and a paddle 9 feet in diameter, driven by a ten horse power steam engine; but he also recommends, as an after improvement, a steamer with two narrow paddles, close to the stern, one on each side of the rudder, urging that this plan would remove every impediment to the free access of water to the paddles, and allow an open outlet for the discharge, the paddles to be protected by fenders, sliding down on the outside of the wheels.

Mr. Fairbairn figures the cost of conveyance of a passenger by steamer, between Edinburgh and Glasgow, fifty-six miles, at two pence, or less than a fifteenth of the least possible expense by horses. Though the results given by these boats were not, in practice, so satisfactory as expected, yet Mr. Fairbairn never despaired of a future when steam should be as universal in inland navigation as it at present is in all other of the arts.

Following up the interest which about this period seems to have been excited on canal behalf, we have an influx of applications of machinery to inland water propulsion, many of which are but modified forms of the less elaborate devices we have already mentioned, in which the paramount idea of their authors would seem to be that of advancing the boat without creating a wash damaging to the canal banks, and with arrangements for discharging the water directly aft, or directly down, while some have curved platforms, or "wave quellers," to moderate the swell produced by the propeling machinery.

For actuating vessels on canals, one Henry Pinkus submits a railway constructed alongside, with one rail, on which a suitable carriage traverses. A tube conveys gas along the rail from a stationary engine and reservoir. The gas is brought through a longitudinal valve on the rail tube to a flexible tube from the carriage to a reservoir on board the vessel, and from the pressure here derived machinery is set in motion, which again, by an endless band, turns two horizontal wheels (one on each side of the rail) on shore, and supported on the carriage before mentioned. Finally, these wheels, by revolving, draw the carriage forward, and the carriage, in its turn, tows the vessel. We can imagine that this plan would never depend upon its simplicity for success.

The same inventor offers the plan of a steam engine on a vessel, driving a horizontal wheel, which, by an endless band, turns on shore a pair of horizontal wheels, similar to those described, and these, by revolving, tow along the vessel. The carriage holding these wheels has a curved guard arched over it, formed like the rail on which the carriage runs. This is to enable another carriage meeting it to pass over the first, thus providing for the use of the same rail by boats traveling in opposite directions. In place of the steam engine, the machinery on board may be turned by an electromagnetic engine, actuated by electric currents from on shore. Whether this "leap-frog" arrangement for passing boats could be extended to skipping playfully over the locks is not stated.

A claim, in 1841, proposes a locomotive steam engine on the towing path, to drag itself along a chain fixed at one end, and the boat by a towing line to the engine; while another alternately expands and contracts an elastic sack in a water channel along the bottom of the vessel, by the smoke from a furnace, and thus ejects sufficient water to propel the boat. Later on, there are variations of this. Still another drives an upright shaft in a vessel, which carries a horizontal grooved wheel, on which is an endless rope, moving a drum on a carriage on shore, by which its wheels are turned, so as to advance the carriage, which tows the craft along. The carriage is guided by a wheel in front, directed by a man. Steam is made to issue from a pipe against the air in one, and cogwheels, working into a rack rail on the banks, in another, while a third places an exhausted atmospheric tube at the bottom of the canal, and moves the boat above by a traveling piston. A fourth inventor makes his tubes of wood, and places them upon the banks, or on piles driven along the canal. In fact, "about this time," as the almanacs say, the numbers that considered themselves each the sole possessor of the idea of working canals by atmospheric pressure is amusing.

In 1847, we have flexible tubes placed under water on each side of a boat. They are alternately filled with steam and allowed to collapse. The boat is supposed to advance by the action on the water of the protuberant parts of each tube. There is certainly no needless complication of details about this. In this year we find proposed the towing of canal boats by compressed air contained in portable reservoirs, and an arrangement added to heat the air, in order to restore the caloric lost by its expansion.

The next year, a patent is granted for a tube laid along a canal, and water forced through it under pressure enters nozzle pipes fixed at certain intervals along the tube. Connected to the boat to be propeled is a receiver, with a series of open cells, and as these pass under the end of a nozzle pipe, a valve is opened, which allows the water to impinge on the cells successively, and thus force on the boat and receiver, until they set the next nozzle pipe in action, and close the valve of that which is passed. Still, notwithstanding the ingenuity of this scheme, one would desire much solicitation to invest in its success. Next, we have a shaft extending the entire length of the vessel, with propellers on its projections, working one at the bow and one at the stern. The advantages of this novel feature are not mentioned.

The last of 1851, a patent for fastening iron rails upon walings, supported on piles, and extending the entire length of the canal, on both sides, was issued. Wheels on each side of the boat, and driven by a steam engine, are rotated on these rails, and pull the boat. Instead of locks, the boat moves up inclined planes, gear wheels engaging in racks on the walings, while rollers at the bottom support part of the weight. Unless compensated for all variations of water level, we might expect to find occasional lines "high and dry."

In 1856, a provisional is filed for propelling boats by discharging a stream of fire from an inflammable composition in a tube into the water at the stern; but, from want of faith, or of means, the scheme was abandoned. At a later date, John Bourne patents an arrangement of propellers at the bow, or paddle wheels at the side, to work on the bottom in shallow water, "and thus clear it away," and propel the vessel.

With their usual ingenuity and perseverance, American inventors have explored this branch of engineering practice; but, like their trans-Atlantic brethren, have taken the question of more propulsion as the desired end, attaching thereto some device to still the agitation of the water; and very similar schemes in this field to those already touched upon, have been the result of their labors. The question is not that of a motive power alone, but simple application of the motor that will prevent waves at the bow, suction and settling at the stern, and afford a mean speed of from three to four miles per hour, when fully loaded, with a minimum quantity of fuel. The propeling machinery must be simple and compact, that it may be managed by men not especially educated for the purpose, and to economize both space and expense. These are the requisites, and a boat fulfilling the conditions will be sure of success.

Some twenty-five years ago, Captain Ericsson launched a boat with a screw propeller at each side of the bow, for the Champlain canal. There was no difficulty in the propeling force, but it did not carry sufficient cargo to be profitable. Henry R. Worthington, five years later, ran a steam canal boat from New York to Oswego, during one season. This vessel had a skew paddle wheel on each side of the bow, and a fighting crew, to overcome any prejudices which the opposition boatmen should venture to express. Notwithstanding the extreme force of the arguments employed, the enterprise was abandoned with the season, there not being sufficient capacity for a paying freight.

A boat was fitted with feathering side paddles, some sixteen years ago, by John Baird, for the purpose of towing barges on the Erie canal; but, not carrying cargo itself, and depending on the tunnage fees from the old boats, failed to be a pecuniary success.

In 1860, there was a line of sharp propellers built in Buffalo, N.Y., which, with an expenditure of from three to four tuns of coal per day, averaged six and seven miles per hour. The annoyances caused by the opposition of the horse boats, and the heavy expenses of fuel and engineers, caused their removal to a lake route. Wire rope traction and submerged chains have been frequently tried as well, and found wanting, the canal locks and numerous bends having so far proved insurmountable obstacles.

As late as last year, the duck foot, or expanding propeller, so many times tried in England, was attempted in Albany, N.Y., by Mr. Cornelius T. Smith, and also at Cumberland, Ind., by Mr. Marshall, without satisfactory results; while a Cincinnati doctor, abandoning his pills, conceived that he had hit upon the correct thing by the similar device of a reciprocating hinged shutter. The result made more noise and waves for the canal than greenbacks for his pocket, and our worthy disciple of Esculapius returned to his surgery.

At Lockport, N. Y., a wheel with spokes on the surface, made so as to rise and fall in a recess in the boat, and rolling along the bottom of the canal, was lately tried. It was driven by a chain, and so propelled the vessel. No provision for deep water or soft mud being made, the enterprise came to grief. A scheme now being tried consists of a canal tugboat provided with an endless band or chain on each side of the boat, carrying paddles, which, dipping in the water to propel the vessel, return through the air in a manner akin to similar plans which have been tried here and abandoned. There has been a large sum of money expended, and a frightful noise is produced, still, otherwise it is not considered a success.

PROFESSOR TYNDALL ON "SOUND."

In his fourth lecture on "Sound," at the Royal Institution, London, Professor Tyndall began by calling attention to the experiments of Saveur, in which musical vibrations were communicated from one body to another, when both bodies had the power of emitting the same note. The lecturer exhibited two wires of the same length and thickness, stretched to the same tension by means of screws, so that the two wires when made to vibrate by means of a violin bow, emitted the same note. He then placed a V-shaped rider of cardboard astride one of the wires, and on causing the other wire to emit a musical note, the second wire took up the vibrations and unhorsed the rider. He recommended the listeners to make similar experiments for themselves, and said that if they would sing into a piano, they would find that the wire which emitted the particular note sang by the voice, would be thrown into a state of vibration, and if a little rider were placed upon the wire, it would be violently agitated.

He next exhibited Savart's experiment, wherein a musical sound is produced by means of a descending jet of water issuing from a circular orifice in a brass plate fixed at the end of a glass tube; the sound vibrations consist of the intermittent flow of the water through the orifice. He pointed out that a jet of water issuing through a small orifice, forms a vein for a short distance from the place of exit, and then breaks into drops, caused by the rhythmic action of the water through the orifice. In his next experiment Professor Tyndall permitted a vein of water to fall vertically from an orifice; then he darkened the theatre, and illuminated the vein by means of a thin beam of light sent down through it from the electric lamp. The vein of water then looked like a luminous spear, about twelve inches long, and below this the water broke into drops, and speedily lost its luminosity. These drops could be made visible by illuminating the falling jet of water from without, by means of a series of electric flashes. The lecturer sounded a syren, and when the musical note reached a sufficiently high pitch, the luminous vein of water began to respond to the sound, and the spear shortened itself to four or five inches, resuming its original length when the sound ceased. Musical beats, produced by means of two organ pipes, caused the luminous spear to lengthen and shorten itself. The lecturer then passed from a vertical to a horizontal jet of water, and made the latter plainly visible by illuminating it with the electric light, so that its shadow was thrown upon a white screen. At a certain distance from the orifice the stream of water broke into drops as before; the syren was then sounded, and when it reached the proper pitch the drops weredrawn together, and the jet of water appeared as an unbroken cylinder of liquid from end to end.

Professor Tyndall next exhibited the action of sound upon jets of air, and mentioned the exceeding delicacy required in the manipulations, in consequence of the extreme sensibility of air jets. He was obliged to protect the jet from air currents by surrounding it with a tall glass jar, and he supported the apparatus on layers of flannel to protect it from vibratory motions connected with the building, as a passing cab would otherwise have caused much disturbance. He then, by means of pressure, urged some air, from a bag, through two bottles, one of which contained ammonia, and the other hydrochloric acid; a white smoke, consisting of chloride of ammonium was thus formed, and the jet of air was made visible to the whole audience, in consequence of its being charged with smoke. The jet of smoke laden air thus formed issued into the glass jar in a long, slender stream. An organ was then sounded, and the jet shortened itself at once from about fourteen to about four inches, and at the same became curiously forked, and did not lose this form all the time the sound continued, but resumed its original shape when the sound ceased. This jet responded at once to a slight tap upon the floor.

Next, the lecturer exhibited the action of sound upon naked gas flame. This action of sound upon flame was first noticed by Professor Lecomte, and was brought to its present state of experimental perfection in the laboratory of the Royal Institution. In the first experiment the lecturer caused a straight bushy flame to spread out, by whistling to it with his mouth, and pointed out that a smaller flame of the same kind would do the same thing, but required a higher note. A fish tail flame was also shown to be sensitive to sound, but required a higher note, and greater pressure of gas; in fact, in all these experiments the pressure of the gas must be very carefully regulated, and so adjusted that each flame is very nearly, but not quite, on the point of flaring instead of burning steadily. The most sensitive burner yet obtained by Professor Tyndall is one made of stealite; it requires a very heavy pressure of gas to bring the flame to the sensitive point, and it then gives a flame two feet long. The orifice is circular, and the jet a vertical one. A slight hiss from any part of the theatre of the Institution, made this flame shorten itself to seven inches, and the jingling noise made by shaking a bunch of keys threw the flame into wild commotion. A small bell sounded thirty feet off, in the gallery of the theater, knocked down the flame by the noise of every stroke, and a chirrup always brought it to its lowest point. Speaking irritated it especially words containing many S's, for it was especially sensitive to hissing sounds. The rustling of paper, the rubbing of hands, or the brushing of clothes, all made it shorter.

Notes of high pitch acted most powerfully on the flame. When a tuning fork was gently sounded, so as to give its fundamental note, no effect was produced; but when the fork was violently rubbed with the fiddle bow, so that it gave off overtones, the flame shortened itself, and began to flare. This tuning fork was one with a fundamental note of rather a high pitch. Finally, a musical box, playing an air from the opera of "Faust," was set to work; the high notes caused the flame to fall, while those of low pitch had no influence of the same kind.

The lecture was concluded with a few experiments on resonance, and the introduction of organ pipes. The lecturer observed that when a tuning fork was held over the open mouth of a glass cylinder containing air, when the column of air was of the right length to vibrate in unison with the fork it did so, and then, as the column of air and the fork both sang or vibrated together, a great increase in the volume of the sound produced was the result. When the column of air was made too long or too short for any particular fork, by pouring a certain quantity of water into the cylinder, or taking a certain quantity out, the sound was considerably enfeebled. In one of his experiments Professor Tyndall lengthened and the column of air by admitting hydrogen gas into an inverted cylinder, and then showed some experiments with it by means of a tuning fork. He also showed that with different forks, columns of air of different lengths are required to produce perfect resonance. In further illustration of this principle, he selected three organ pipes, and by sounding tuning forks and placing them over the mouths of the pipes, he showed that the columns of air in the pipes resounded to three particular tuning forks, each column singing to its own fork and no other. Afterwards, on causing the organ pipes to sound, they were found to emit the same musical notes as the three forks, each pipe being in harmony with its own fork, and no other. The music of an organ pipe is caused by the vibration of the column of air in its interior, and this column of air is thrown into musical motion by means of a vibrating tongue set in motion by the bellows.

(From the Albany Argus.)

FOWLER'S PROPELLER.

Our citizens have been much interested during the past two or three days in the performances of a steam yacth which came here from Bridgeport, Conn. The boat has been playing about the harbor, turning round as if upon a pivot, and moving backwards or forwards with equal facility without the aid of a rudder. Recently the vessel was visited by Canal Commissioner Wright, Canal Commissioner Chapman, Deputy State Engineer Sweet, Mayor Thacher, Captain Sanford C. Van Benthuysen, and other prominent parties, all of whom expressed themselves very much pleased with the movements of the craft. The party having the boat in charge is composed of Ex-Governor Joseph R. Hawley, of Hartford, Colonel William H. Mallory, Charles R. Bement, and Jacob Kiefer, of Bridgeport. These gentlemen are of the opinion that the new principle involved in the construction of the wheel by which the boat is propelled can be successfully applied to canal navigation.

In accordance with this view, an excursion was made by way of the canal from this city to Troy. Among the invited guests were Canal Commissioner Chapman, Assistant Commissioner George L. Ames, Deputy State Engineer Sweet, Oscar L. Hascy, S. B. Towner, S. P. Corlies, C. E. Davis, B. W. Wooster, John C. Ward, G. Hunter, Robert Walker, E. Brainard, S. S. Carslake, Warren F. Leland, and several others interested in the commerce of the city. The boat is handled so readily, that there was no difficulty in approaching the locks, or passing other craft in the channel. In a clear course, she made five miles per hour without producing a swell along the banks to exceed six inches. Arriving at Troy, David M. Greene, an engineer of great experience in connection with steam navigation, was invited to examine the vessel. All the tests made were of the most satisfactory character, and it was agreed upon all hands that the experiment was a success in itself, independent of its application to canal navigation.

The invention is known as the "Fowler wheel." The ingenious inventor is Mr. Frank G. Fowler, formerly of Illinois, now of Bridgeport, Conn. Originally his device was intended for use as a windmill, and it was found to save a good percentage over any previous contrivance. It occurred to Mr. Fowler that if he profited in obtaining power from the wind, he might profitably send force through the wheel into the water. He had the fortune, less common now than of old, to be unable for a long time to find appreciative listeners and co-operators. He made one or two experiments upon canal boats, but his wheel was then in a comparatively crude condition. In Connecticut he met Colonel William H. Mallory, of Bridgeport, a gentleman who had been a successful inventor himself. The Colonel and Mr. Fowler have been working together for two or three years. The wheel has been materially improved and fully secured by patents in this country and abroad.

A yacht called the "Pioneer" (the one now in Albany) was built two years ago expressly for this purpose. She is seventy feet long, fourteen feet wide, and schooner rigged. Without her masts and unloaded, she draws four feet. It is not pretended that she is built for speed, for it was intended, if the new wheel did not prove valuable, to convert her into an ordinary tug, with an Ericsson screw. The boiler is an ordinary tubular horizontal, with return flues. The engine has one cylinder only, fourteen inches square; that is, the cylinder is fourteen inches in diameter, and the piston has a stroke of fourteen inches. An experimental condenser now in the boat has temporarily reduced the power of the boiler, and it is difficult to raise more than thirty or forty pounds of steam; and with only one fourteen inch square cylinder, no great speed can be obtained from any wheel whatever. But when the boiler carried seventy or eighty pounds, the boat made at the rate of eleven miles an hour on a mile measured by the Coast Survey, which will do very well for a boat of seventy feet.

Let us attempt to convey an idea of the invention, if it can be done without a drawing. The stern of the boat is cut away underneath about as much as for the ordinary screw. The latter has a screw nearly horizontal. The shaft of the Fowler wheel is perpendicular in the stern, and the wheel works on a horizontal plane. This one has three arms, each with its adjustable blade. Experiments were made with four and two, but three were found to be the most economical. The wheel is four and a half feet in diameter. The extremity of each arm is inserted, by a movable joint, in the center of a thin strong steel blade standing perpendicularly. The blades are twenty-eight inches in depth, twelve inches at the top and ten at the bottom, and slightly rounded at the counters. The blades stand with their sides toward the center shaft. Above the arms there is an eccentric on the shaft, which is held fast as the wheel revolves. From the ring or strap around the eccentric, strong rods extend to the outer edges of the blades. Now as the shaft revolves, the blades, as they pass around the circle, change their set, so to speak; that is, the edge of a blade to which the eccentric rod is attached moves from and toward the shaft. As a blade moves forward, it acts upon the water much as a man's hand does when he is swimming. It may be said to hook or pull upon the water, and pull the boat forward. As the blade goes to the rear, its angle upon the arm or radius is changed, and in passing around the rear of the shaft, the blade drives the water to the rear, pushing the boat forward. In the revolution there are two points at which the blade is parallel with the keel and exerts no power.

We have described the boat as moving straight forward upon the line of her keel. The eccentric is governed by a wheel on deck, just like the ordinary steering wheel. If it be desired to change the course of the vessel, the eccentric is shifted. This shifts the set of the blades, and the line of force exerted is put at any desired angle with the keel. In an instant, with a whirl of the wheel, the power is exerted at right angles with the keel, and the boat whirls around. Or without a word or signal to the engineer, the power is completely reversed and the wheel is pulling straight astern. In a few seconds the boat is going astern.

There is no reversing gear on the engine.

The power can be exerted in any direction, that is, at any angle with the keel, with an easy turn of the wheel, which two fingers can govern.

There is no rudder on the boat; the steering is done by shifting the direction of the power.

The Ericsson screw works in a plane vertical to and at right angles with the keel. The Fowler wheel works in a horizontal plane. The latter can adjust the breadth and depth of its blades so as to exert the same power with half the draft. It can place the blades below the ice, and at the same time farther from the bottom than the screw works.

The proprietors claim greater economy in construction, unequaled facility of turning, less draft than the Ericsson with the same power, and equal if not greater speed.

They are making several applications of the wheel, and they are very hopeful that they have the invention which is to settle the future of the Erie canal. The simplicity of the engine, quickness of turning, and light draft, with great power, are adapted to this end.

In Buffalo, at the shipyard of David Bell, two revenue cutters are building, for the revenue service. They are of 250 tons burden and of the same model, as nearly as possible. One is to have the Ericsson screw, and the other the Fowler wheel. They will be completed before the first of August, and they are to be taken down the St. Lawrence and delivered in New York. The test will be exceedingly interesting.

The Fowler steering propeller company have two tugs building at Philadelphia, 73 by 16, with each an 18 in. square cylinder. Also a small vessel in Maine designed for seine fishing for menhaden or "bony fish." The navy department has in preparation plans for two monitors of peculiar construction, with this wheel, which has, for fighting, wonderful advantages over any other. The company has also built a steel launch, 33 by 8, on the precise model of the largest launch of the navy, and, they claim, to have made with it speed greater than that of any steam launch in this or any other navy.

Animal Mechanics.

Rev. Samuel Houghton, M. D., Dublin, D. C. L., Oxon, F. R. S., recently gave the first of three lectures at the Royal Institution, on "The Principle of Least Action in Nature, illustrated by Animal Mechanics."

Dr. Houghton said that he would give a few examples to show what he meant by "The Principle of Least Action in Nature." If we suppose the earth to be a lazy, intelligent, living animal, swimming round the sun, we only require to know three points to mathematically calculate its whole orbit, on the assumption that it is a living animal swimming round the sun in such a way as to get through its journey with the least trouble to itself. On the same principle his hypothesis was that in every arrangment of joints, muscles, bones, and parts, the arrangement must be such that the muscle will occupy exactly the position it would take if it were a living intelligent animal, which had sought the place where it could do its work with the least trouble to itself. By means of the hypothesis it is possible to calculate the position of the bones, sockets, and muscles, and it is one which he believed would prove to be a valuable key to unlock the secrets of animal mechanics.

He would give another illustration. One day he watched some oyster women in the Mumbles harbor, near Swansea. They filled their baskets with oysters, and then the ground they had to traverse consisted of two parts. The first part consisted of slippery shingle, and the second of plain common.

What surprised him was that they did not walk straight to the common as he would have done, but went off in a slanting direction, and made a "tack." After seeing this he measured the angles made by their path, and by the one he would have taken; then he mathematically determined the relative roughness of the two roads, and found they had chosen the best they could possibly take to save unnecessary waste of power. He did not suppose they had any more consciousness that they were doing so than a planet or a ray of light; they were not, however, lazy animals, but good industrious women, doing the maximum of work with the minimum of effort, their path being determined by Him who made them.

As another illustration he would call attention to the hexagonal cells made by the bee, whereby the largest quantity of cell space is made with the minimum amount of wax. Nature, or the intelligence which underlies nature, has to produce a certain amount of muscle to do a certain amount of work, so it is obviously to the interest of the creatures, formed by nature, to do their work with the least possible quantity of muscle.

Before it is possible to advance one step in the scientific investigation of animal mechanics, it is necessary to ascertain the coefficient of muscular force. In the case of a rope, its coefficient would be the number of pounds weight necessary to break it across. Suppose a rope, 1in. square in cross section, made of muscular fibre, were hanging from the roof of the theater of the Institution, what weight would it lift from the ground by its contraction? That weight would be its coefficient. It cost him twelve years of hard work to determine this point, and to obtain the following figures for human muscle:

Arm	94·7	pounds to the square inch.
Leg	110·4	" " "
Abdomen	107·0	" " "
	104·03	pounds, the real coefficient of muscular force.

Until the foregoing coefficient was obtained he could take no steps in the application of geometry to anatomy. He was obliged to make his experiments with human beings only, because none of the hairy animals with long tails had intelligence enough to aid him by doing what he required of them. As regards men, he had to measure the power of their muscles during life and the size of their muscles after death. In walking across the room a vast number of muscles are brought into play, so the difficulty is to ascertain the power of each particular muscle; and from such movements the inquirer cannot work back to know the force per unit of cross section of each muscle.

By work in hospitals, where some of the patients suffered from diseases in which muscular contractions were a leading feature, he gained some of his data, and in other directions he sought for more. He learned how to work the treadmill so as to get through the task with the least trouble to him self, and he could now do it in a lazy manner as well as the cleverest burglar in London. He also knew the easiest part of the wheel to work at. The key by which he first obtained a clue to these secrets was an ounce of tobacco, which key he found competent to unlock the heart of the surliest of burglars.

He not only had to determine the power of the muscles of young healthy men during life, but to measure their dimensions after death. Many of his examinations after death were necessarily made upon elderly persons, wasted by long sickness, and this tended to give false results. Therefore he, to get accurate results, had to watch for chances of examining subjects who died suddenly by violent deaths, or who were executed by the hands of the law, but in Ireland he found many impediments to this line of action. In the case of violent deaths by accident, the cause of death was usually so obvious that the coroner could not order an examination of the remains, and the friends of the deceased were usually so anxious to "wake" him that they would not permit scientific dissection of the body. Then as to those who suffered by the hands of the law, in Ireland murders of a social or private nature incurring the penalty of death are almost unknown, and men are usually only executed for agrarian crimes; in such cases the criminal has with him the sympathy of such large masses of people that it would be very dangerous for a scientific man to dissect the body of any patriot who had shot his landlord. While beset with these difficulties a clever but rather wild scheme entered his head, of taking a farm in Westmeath, refusing to pay his rent, shooting his landlord, and then dissecting the body at his leisure. But he saw that certain inconveniences might attend this plan; in short, he believed, upon his honor, that public opinion in Ireland would not tolerate the shooting of a landlord in order to obtain the coefficient of muscular force.

However, he had at last succeeded in obtaining the coefficient; and the use which could be made of it, he would explain in his next lecture.

Guillois' Dental Cement.

Professor Charles James Fox, in the *British Journel of Dental Science* says:

It is of the same nature as that commonly called osteoplastic, but it differs from it in this particular, that it can be mixed to a consistence much resembling putty, and in that state can be manipulated for some minutes without setting irretrievably. If you mix the other osteoplastics as thick as this, they set rapidly or crumble; if you use them in a thinner condition, they run about on the gums and teeth. When once set it is so hard, if it has been properly manipulated, as to turn the edge of the instrument, should it be deemed requisite to remove it. As to its durability, it is of course impossible to say much, seeing that it has only been introduced into England for a few months; but this much may be said, that, taking four months' experience with other cements, and four months, with this, I have found it so superior that I have entirely discarded all other osteoplastics, amalgams, etc. In small cavities in the incisors, or in shallow cavities where osteoplastics would wash out in a short time and dissolve away, Guillois' cement remains at the end of four months as good as when it was put in. I cannot tell what further experience may prove, but so far—and only for four months' experience do I speak—I have not had one failure, which is more than I can say of any other."

This cement has also been successfully used in this country for some time past. A writer in *Dental Cosmos* says that it is susceptible of a polish, and that it can be colored to imitate the natural teeth, so that a filling composed of it can hardly be detected. It is believed to be a good substitute, in very many cases, for gold fillings.

Charles Reade's Rational Roof.

The following, from the pen of the above named novelist, has rather a "Reade-y" tone, as musicians and perhaps architects will say, but it contains some good suggestions:

It is a sure sign that a man is not an artist, if, instead of repairing his defects, he calls an intellectual superior to counteract them. The fire escape is creditable to its inventor, but disgraceful to the builders. They construct a fire trap without an escape; and so their fellow citizens are to cudgel their brains, and supply the builder's want of intelligence and humanity by an invention working from the street. The fire escape can after all, save but a few of the builder's victims. The only universal fire escape is—the rational roof.

To be constructed thus: Light iron stair cases from the third floor to top floor and rational roof. Flat roof, or roofs, metal covered, with scarcely perceptible fall from the center. Open joists and iron girders, the latter sufficiently numerous to keep the roof from falling in, even though fire should gut the edifice. An iron lined door, surmounted by a skylight; iron staircase up to the door, which opens rationally on to the rational roof. Large cistern or tank on roof, with a force pump to irrigate the roof in fire or summer heats. Round the roof iron rails set firm in balcony, made too hard for bairns to climb, and surmounted by spikes. Between every two houses a partition gate, with two locks and keys complete. Bell under cover to call neighbors in fire or other emergency.

Advantages offered by "the rational roof:"

1. High chimney stacks not needed.

2. Nine smoking chimneys cured out of ten. There are always people at hand to make the householder believe his chimney smokes by some fault of construction, and so they gull him into expenses, and his chimney smokes on—because it is not thoroughly swept. Send a faithful servant on to the rational roof, let him see the chimney sweep's brush at the top of every chimney before you pay a shilling, and good-bye smoking chimneys. Sweeps are rogues, and the irrational roof is their shield and buckler.

3. The rails painted chocolate and the spikes gilt, would mightily improve our gloomy streets.

4. Stretch clothes' lines from spike to spike, and there is a drying ground for the poor, or for such substantial people as are sick of the washerwomen and their villainy. These heartless knaves are now rotting fine cambric and lace with soda and chloride of lime, though borax is nearly as detergent and injures nothing.

5. A playground in a purer air for children that cannot get to the parks. There is no ceiling to crack below.

6. In summer heats a blest retreat. Irrigate and cool from the cistern; then set four converging poles, stretch over these from spike to spike a few breadths of awning; and there is a delightful tent and perhaps a country view. If the Star and Garter, at Richmond, had possessed such a roof, they would have made at least two thousand a year upon it, and perhaps have saved their manager from a terrible death.

7. On each roof a little flag staff and streamer to light the gloom with sparks of color, and tell the world is the master at home or not. This would be of little use now; but when once the rational roof becomes common, many a friend could learn from his own roof whether a friend was at home, and so men's eyes might save their legs.

8. In case of fire the young and old would walk out by a rational door to a rational roof, and ring at a rational gate. Then their neighbor lets them on to his rational roof and they are safe. Meantime, the adult males, if any, have time to throw wet blankets on the skylight, and turn the water on to the roof. The rational roof, after saving the family which its predecessor would have destroyed, now proceeds to combat the fire. It operates as an obstinate cowl over the fire; and, if there are engines on the spot the victory is certain. Compare this with the whole conduct of the irrational roof. First it murdered the inmates; then it fed the fire; then it collapsed and fell on the ground floor, destroying more property, and endangering the firemen.

Foreign Bodies within the Eyeball.

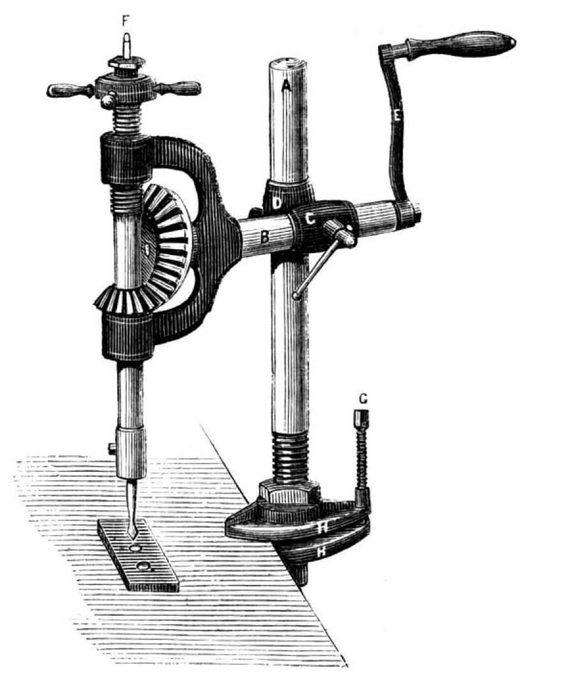
The most dangerous thing which can happen to the eye, is the lodgment of some foreign body within it. Amongst all classes of mechanics, such injuries are constantly occurring, from chips of metal flying off from the instruments they are using, or the work on which they are employed. So also in the stone workers, metal grinders, polishers, engineers, etc.; all of whom are thrown out of employment by the loss of an eye, and reduced from comparatively affluent circumstances to almost beggary. Amongst children, pieces of percussion caps, pins from the ends of darts, small stones or shot from bow guns, etc., only too often strike the eye with sufficient force to penetrate and destroy the globe. It is impossible for a person himself or those about him to decide whether a piece of iron or other foreign body has entered the eyeball and remains there. This the ophthalmic surgeon alone can do by looking into the eye, through the pupil, by means of a peculiar mirror, called the ophthalmoscope. He can then see the foreign body, and perhaps make a drawing of it, which the patient may recognize as corresponding to the portion which has flown off from the instrument or tool he was using at the time he met with the injury. Now this deciding whether or not the foreign body is in the eyeball is all important. If it has merely cut a hole in the eyeball, and dropped out back of the eye, the patient may escape with perfect vision; but if it, no matter how small, has entered the eyeball, there is not one chance in a million of the eye's being saved, and an even chance whether the other eye is not also lost, from what is called sympathetic inflammation attacking it.

In many parts of the system a foreign body, like a needle, splinter, bullet, etc., may remain perfectly quiet and do no harm. Not so, however, in the eye; here it is fatal to sight in the injured, and perhaps the other eye also. Its presence may at once destroy the eye by exciting acute and active inflammation. After such destruction, and when only a stump of the eye is left with the foreign substance in it, this remaining portion of the globe is liable, at any time, to repeated attacks of inflammation. Even if the sound eye has not been previously attacked, in some one of these outbursts of inflammation in the stump, this insidious and dangerous sympathetic trouble comes on, taking at first the form of weakness, inability to bear the light, slight pain and discomfort. These symptoms increase in severity, and a gradual change takes place, the eye degenerating and sight being lost. The only remedy for such sympathetic inflammation is the removal of the cause, namely, the eye or the stump, with the foreign body in it. This, if done too late, may not save the second eye. An eye with a foreign substance within the eyeball never should be allowed to remain. The present operation for its removal is so simple and effective, and the subsequent wearing of an artificial eye so facilitated, that there need be, in these days of ether, no fear or dread of the operation. It is only in the rarest instances that a foreign body has been removed from within the eyeball.

A glass eye can be worn generally within a fortnight of the removal of an useless or painful stump or globe. Cold water and the solution of atropine are all that can be recommended, besides quiet and protection from light, before proper surgical assistance is obtained.—*From Dr. Jeffries' work, "The Eye in Health and Disease."*

IMPROVED HAND AND LIGHT POWER DRILL.

Our engraving illustrates an improved drilling machine, adapted to hand or light power drilling. It can be clamped to almost any part of a machine, or to a bench, and may be made to drill holes at any angle from its point of support.



A is an upright which, by means of clamping jaws, H, and the set screw, G, may be fixed to the framework of a machine, bench, etc.

Sliding collars, D and C, are pivoted together with set screws to hold them in position when set as desired. This part of the apparatus forms a universal joint by which the drill may be pointed in any direction.

The spindle is carried by a head on the hollow shaft, B. The crank, E, or a pulley in its place, if desired, drives a shaft passing through the hollow shaft, B, and keyed to a miter gear, meshing into a pinion on the spindle.

The feed is applied in the usual manner by a hand wheel. In drilling small holes, the crank is used on the shaft, B, as shown. When large holes are to be drilled, the crank is placed directly upon the spindle at F, with a ratchet attachment, by which greater power with less speed is secured.

We are informed that a large number of these drills are in use in machine shops in and about this city, and are giving excellent satisfaction. The sliding collars, C and D are now made as a split sleeve. They are manufactured by Messrs. Holland, Cody & Co., No. 8 Gold street, New York.

An Important Invention.

A recent issue of James R. Osgood & Co.'s popular illustrated periodical, *Every Saturday*, says the *Record*, brought to its many readers an agreeable surprise. They found that in order to get at its diversified contents, instead of opening its mammoth folds, with much trouble and impatience, they had only to turn the leaves like those of a book, and find its treasures displayed to their gaze. This change makes a revolution in the business of publishing huge illustrated papers, and the means by which it was effected must rank among the most important recent improvements in newspaper publishing. We give the following interesting account of the invention:

The machine which produces this result is the invention of Messrs. Chambers & Co., of Philadelphia, and was made by them under arrangement with Messrs. Osgood & Co., especially for *Every Saturday*. It is the only machine of this kind in the world, and is really a wonder in its working, accomplishing various processes of folding, pasting and trimming at one operation. The two sheets of which *Every Saturday* is composed are fed in at opposite ends, are taken up by the machine and carried toward each other, while by a series of automatic movements they are folded, trimmed and pasted, *in transitu*; and arriving simultaneously at the centre of the machine, the smaller sheet is placed accurately inside the larger one, and both receive their final fold and are deposited carefully in the box placed for them, a perfect paper.

This operation is repeated, when the machine is at its highest speed, thirty times a minute, producing 1800 copies an hour, without mistake or variation.

Extract from the Diary of a South African Diamond Hunter.

A writer has been contributing to *All the Year Round* an account of a brief experience in the South African Diamond Fields, in the form of a diary of events, toward and untoward, the most of his adventures coming under the latter category. He says this diary gives a good notion of a digger's daily routine. If English convicts had to keep such hours, from five A. M. to 7 P. M., what a groan would run through philanthropic England! Of one thing he is certain, that sorting pebbles is harder work than picking oakum.

We give an extract in his own language—a bit of very graphic description:

"Let me describe the diamond fields in detail. The land I am now looking at on the other side of the Vaal is a long, low hill, sloping gradually down to the water, and covered with low, prickly shrubs. The spot is by no means beautiful or inviting to cattle or man. It is neither picturesque nor promising, yet it contains the very essence of wealth, the choicest treasures of royalty, power, and beauty. There, since the beginning of the world, trodden under foot by savages and wild beasts, unheeded, while Europe has suffered its storms and convulsions, these diamonds have slumbered. The upper part of the sloping hill is composed of orange colored gravel, with here and there boulder stones, detritus of old water courses, cropping out. This gravel is very attractive to the eye, and consists for the most part, of agates, cornelians, clear yellow stones, and bits of jasper. For the first day or two, you feel inclined to make a collection of the best of these; but this avarice wears off when you begin to find the good and sound stones are few and far between, and are nearly as scarce as the diamonds, which, like all good things, are shyest of all. Whenever a spot of this gravel is selected, either by new comers, or from a diamond having been found, the people make a rush, and the whole of the ground is at once divided into lots twenty-one feet square. The new and hopeful hands begin at once to pick and loose up the virgin ground, and after throwing by the big stones, they sift the smaller gravel through a large screen, and get rid of all pebbles bigger than a pigeon's egg. Of course, the man lucky enough to find a diamond bigger than this, is sure to see it in the sieve. All that goes through the sieve is the small gravel or wash stuff. This residuum is carted down to the river early in the morning and washed in a cradle, which consists in a couple of sieves, the upper one coarse in the mesh, the lower one fine. These sieves are placed on a frame set on rockers. The gravel is placed in the upper sieve, and one man rocks the cradle, while his companion pours water on all the gravel and fine dust which has washed through the two sieves. The upper sieve is looked over, and the contents thrown aside, while the gravel from the under one, containing pebbles from the size of a hazel nut to that of a big pin's head, is reviewed on the table, at which we will suppose I and my comrade Ash are itting. We are in a bower made of branches and an old sail. We each grasp a flat piece of zinc, and commence by drawing a small portion of the gravel towards us, like children playing with shells. With one motion of the hand we spread out our store carefully on the table, and with another, like disappointed gamblers that we are, we sweep it contemptuously off; so the diggers here go on hour after hour, day after day, month after month, and perhaps never, after all, see the welcome gleam of the long sought diamond. The manual labor is not so great, but oh! the monotony and weary watching of the stones. It is dreadfully tiring; one's back aches, all one's limbs feel benumbed, and the shoulder blades have soon their own special grievances.

"January 1st.—Hurrah! At last, after washing and washing, and scraping and scraping over some tuns of gravel and pebbles, we have found—not a Koh-i-noor, oh, dear no!—quite the reverse, only a small diamond about as big as a mustard seed. Still it is a diamond, and it is a good omen. There are more where that came from. Hurrah! we shall rock the cradle now with renewed hope. We may make our fortunes yet. I am afraid we have got the gambling spirit of the true digger upon us now. The fever has seized us at last, and the chill and ague of the first reaction of disappointment has gone forever. Another month we may be laughing and dancing with hats full of diamonds, or be driving back our oxen to Natal in rueful rags, footsore and half starved Never mind, my boys, rock away. We don't care now, even if there is a rock ahead. Heaven helps those who help themselves."

MR. ALEX. S. MACRAE, of Liverpool, England, writes us as follows:—"A very practical and a most useful adaptation of common salt (chloride of sodium) in partial substitution for alkali in the manufacture of soap, is now being most economically and advantageously used in this country. A soap can be produced in the bar, or molded into pattern, cheaper than by any other known process; and plain and fancy soaps of every odor, color, and design, are being freely circulated, at a figure costing the public no more, when boxed, than $2·88 or $3·36 per cwt. of 112 pounds. This, too, where the manufacturers have to pay 30 cents per cwt. for carriage on the salt!"

Improved Stovepipe Cleaner.

To be able to avoid the dust and filth caused by taking stovepipes down, in order to clean them, is a desideratum for which all good and tidy housekeepers will devoutly thank the inventor of this simple device. By its employment, a pipe may be thoroughly cleaned, and kept clean, both in the horizontal and vertical part, so that the inconvenience of taking down and putting up—the latter operation being one that tries both patience and good temper—may be avoided.

A curved disk of the same diameter as the pipe, having a short stem which passes through a hole in the elbow, occupies when not in use the position shown at the right in Fig. 3, where a portion of the pipe is shown broken away. Its curvature corresponds to that of the pipe, so that in this position it does not, in the least, interfere with the draft.

The stem has an internal thread into which a rod, with a handle formed thereon, being screwed, the disk may be forced along the horizontal part of the pipe, carrying along with it the soot, into the chimney flue.

The end of the pipe which enters the chimney is cut off as a quill is cut in forming a toothpick; this forms a chute which carries the soot well into the flue, while, at the same time, it allows a free upward motion of the gases of combustion when they pass into the flue.

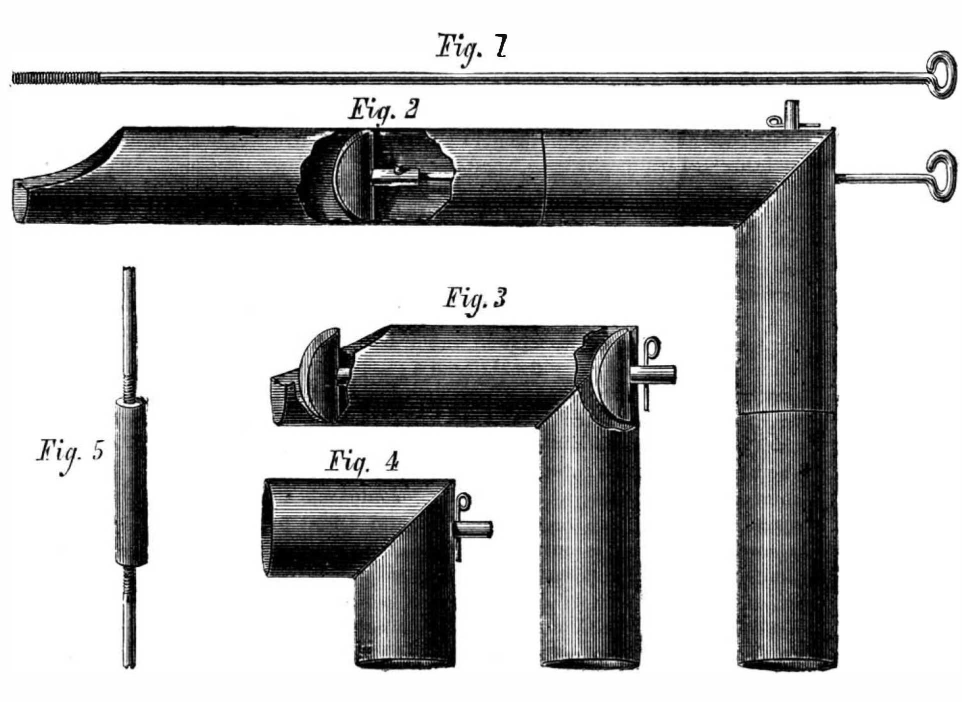
If one rod be too short, others are joined to it by means of the coupling sleeve, shown in Fig. 5.

If, instead of pushing the soot into the chimney flue, it be desired to draw it back, so that it will fall through the vertical part of the pipe into the stove, whence it can be easily removed, the disk, with the proper length of rod attached, is left in the position shown at the left of Fig. 3. When so left, the soot accumulates behind it; and when drawn back, the pipe is cleaned as desired.

The same principle is applied to the vertical part of the pipe. Pins placed in holes through the stems of the disks hold them in place when not in use.

A wire guard stretched across the chimney end of the pipe, prevents the disk from being forced entirely out of the pipe.

This improvement was patented by Daniel Murphy, of Richmond, Va., April 25, 1871. Address him for rights or further information.



MURPHY'S STOVEPIPE CLEANER.

Vulcanized Rubber.

About thirty years ago, says the *English Mechanic*, Mr. Thomas Hancock was shown some pieces of india-rubber, for which it was claimed that, while their elasticity was unimpaired, they were unaffected by heat and cold, and were rendered able to resist, in a great measure, the action of the ordinary solvents of caoutchouc. In order to discover the means whereby this change had been effected, his spare time was devoted, night after night, to labors in his laboratory at Stoke Newington. His first attempts consisted in dissolving caoutchouc and sulphur in oil of turpentine; but after making some hundreds of experiments in this direction without success, it occurred to him that as the india-rubber was not injured by the heat of the boiling turpentine, it would not be injured if dipped into a bath of melted sulphur at 240° Fah., about 76° less than that of the above named solvent. He accordingly placed some pieces of sheet rubber in an iron vessel containing sulphur at a temperature of 240°, and found that after a time they had absorbed the sulphur throughout their whole substance, but that there was no change in the natural qualities and characteristics of the rubber. He replaced the pieces, however, and raising the temperature considerably, left them exposed to the action of the sulphur for some hours, and had the satisfaction of finding them perfectly changed, the ends nearest the fire of those remaining in the bath longest having turned black and acquired the consistency of horn. Thus a discovery made accidentally by Mr. Goodyear, in America, was worked out in this country by the persevering efforts of Mr. Hancock, and from that time to the present, the applications of vulcanized india-rubber have rapidly increased in number, and its manufacture has attained an importance which, in all probability, will be still further augmented.

Such was the process by which the first specimens of vulcanized rubber were produced, but several other methods of imparting similar properties to caoutchouc were soon afterwards discovered; notably, that by Mr. Parkes, discovered about two years after Mr. Hancock obtained his patent. In this similar results were obtained by steeping raw rubber in a solution of sulphur in bisulphuret of carbon, or in coal naphtha—a process which had the further advantage of dispensing with heat.

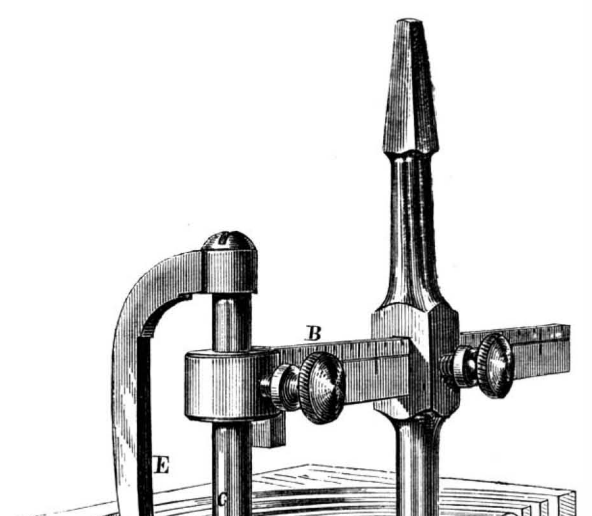
Since the date of the first patent (1843), the method of preparing the rubber has been greatly improved, but, as it is not our purpose to explain the manufacture itself, we proceed to describe some of the applications of vulcanized rubber in mechanics.

The principal rubbers imported are Para, Java, and African, of which Para is the finest and most expensive, being chiefly used for waterproofing purposes, and for the con- termed), *i. e.*, those used for mechanical purposes, it ranges from 1·013 to 1·520 after vulcanization. So that while Para has a specific gravity, per cubic foot, four ounces less when vulcanized than in the sulphured but uncured state, A or No. 1 quality of the ordinary rubber has a specific gravity eleven ounces less per cubic foot when vulcanized, its bulk being consequently increased to a larger extent than that of the Para. On the other hand, those rubbers known as "mixed mechanicals" (*i. e.*, containing pigments or ingredients other than sulphur), increase in density during vulcanization, and it is necessary in molding them to patterns to allow for shrinkage. As a rule, the amount of this can generally be ascertained from the manufacturers sufficiently accurately for those who wish to construct their own molds, though it is better in practice, we believe, to allow the rubber curers to make the molds themselves, especially as they charge only cost price for them.

DORN'S CIRCULAR CUTTER FOR WOOD WORK.

Our engraving illustrates a very handy bench tool for wood workers, by the use of which a great variety of ornamental circular work may be performed.

It consists in the adaptation of variously shaped tools to an arm, projecting from the shank of a bit, as shown.



A is the bit, having a rectangular enlargement on the shank, mortised for the reception of the graduated arm, B. This arm carries various cutting tools, C, whereby circular grooves of semi-circular, semi-ovoid, rectangular, and other sections may be cut as desired, of any radius within the capacity of the tool; or plain disks may be cut out, as heretofore with this class of tools.

The shank of the bit above the [illegible] tools in various combinations, the ornamental patterns may be multiplied at will.

Samples of the work done by this tool show that it is an important addition to the present stock of wood worker's tools. This improvement was patented through the Scientific American Patent Agency, June 6th, 1871, to R. H. Dorn, who is also the owner of the Broadbent patent on a similar tool, which was also patented through this office, August 8, 1865. For further information address R. H. Dorn, Port Henry, N. Y.

EXPERIENCES OF A BUREAU OFFICER.

[Extract from a speech of Hon. S. S. Fisher, late Commissioner of Patents.

In the spring of 1869, at the suggestion of the then Secretary of the Interior, I was appointed by the President to the office of Commissioner of Patents. When the position was first tendered to me I visited Washington to confer with the Secretary. The rush of office seekers at that time was something fearful. Crowds thronged his ante-chamber and the halls leading to his room. Eager faces were to be seen on every side, and the messenger at the doors was beset with petitions to secure immediate admission.

As I did not enter upon the discharge of the duties of my office until the first of May, and after the new administration had been two months in power, I had some hope that I should escape the importunities to which others had been subjected. In this I was mistaken. The crowd that had surrounded the door of the Secretary, had, in a measure, apparently disappeared, but it had only divided into four smaller streams, that daily beset the portals of the Commissioner of Pensions, of the Land Office, of Indian Affairs, and of Patents. Not that we were fortunate enough to be waited upon by one fourth only of those who had besieged our official chief. He was but a poor office seeker that staked his chances upon a single bureau. The approved plan was to have several sets of recommendations, to apply to all the Commissioners, and to draw a bow which prudent forethought provided, not with one or two strings only, but with four. The modesty of the gentlemen was remarkable. There are four grades of examiners in the Patent Office. Of these the lowest is that of second assistant examiner, to which belongs a salary of $1,600. The next that of first assistant examiner, with a salary of $1,800. The next, principal examiner, at a salary of $2,500; and the highest that of examiner-in-chief, at a salary of $3,000. The applications on file were legion, and it so happened that by far a greater portion of them were for the post of examiner-in-chief, an officer who, in the language of the law, must be a person "of competent legal knowledge and scientific ability." Scientific ability and competent legal knowledge seem to have been entirely compatible with ignorance of English grammar and Webster's spelling book, for some of the letters were wofully deficient in the former, while, as a specimen of contempt for the latter, it appeared that more than one of the applicants was unable to spell correctly the name of the office for which he applied. One asked to be appointed an "examener" of patents, and this specimen of orthography was unfortunately thrice repeated in his communication. The attempt to tabulate these bundles of applications in an intelligent form, was an almost hopeless task. It was impossible to accept the applicants' own estimate of themselves. On paper they were brimful of scientific ability and competent legal knowledge, but a very short oral cross-examination was sufficient to cast a doubt at least upon the mind of the Commissioner. Of one I asked, "Have you had any practical mechanical scientific experience?" "None." "Have you made mechanics a subject of theoretical study?" "No." "Have you had any experience in procuring patents or in the practice of the Patent Office?" "None whatever." "Have you studied or practiced law?" "No." "Well, sir, will you tell me what reason you have to suppose yourself competent to discharge the arduous duties of an examiner in charge of a class in this office?" "Well, I suppose I could learn!" What would have become of the class of inventions of which he proposed to take charge, and of the public interests, while this gentleman was pursuing his studies at their expense, was a question that it was unnecessary to press. One of these gentlemen put the matter upon the right ground. He made no secret of the fact that it was salary and not the public service that had attraction for him. He wrote; "I understand that there are clerkships in the Patent Office, called examiners, with a salary of $2,500. I desire to apply for one of these positions." But if the applicant's description of his own qualification was not to be wholly relied upon, still less were the recommendations which he tendered in support of his claims. An examiner already in the Patent Office, fearing that his place might not be secure, had sought to fortify himself with a few more endorsements. Among others, his member of Congress wrote in his behalf. He said that it gave him great pleasure to recommend his young friend, Dr. Blank; that he hoped he might be allowed to retain his place, as he was "a young gentleman of great promise." Now, as it happened that the examiner so warmly recommended was a white haired and spectacled gentleman of sons for the same place. The attention of some of these gentlemen was called to the circumstance, when they stoutly denied any knowledge whatever of the applicants, although there could be no doubt but that their letters and signatures were genuine. It might be supposed that, although these gentlemen might have incautiously put their names to paper, that in their oral interviews they would be more sincere. Unfortunately it was found that even less dependence could be placed upon their verbal statements. A member called with his constituent, whom he urged with vehemence and with some temper, as a person eminently fit to hold any position in the bureau. He was assured that no vacancy existed, and that there was no opening for his friend. They left, but scarcely had the door closed upon them when the member returned alone, to say, confidentially, "You needn't give yourself any trouble about appointing Jones. If you have a vacancy that you can give to my district, I can name a better man. You know we have to do these things," and a few moments afterwards he was crossing the street arm in arm with Jones, to whom he was no doubt explaining how obstinate the head of a bureau was in these matters of appointments, and how great were his own labors on behalf of his deluded constituent.

I spent several nights in reading the batch of recommendations on file and in abstracting them for reference. When the task was completed I found myself no nearer the desired information than at first, and practically without any real information as to the capacity or character of the men from whose number selections were to be made.

Correspondence.

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

STEAM ON THE CANALS.

We are in receipt of communications from various inventors, stating that they have *good* plans for canal boat propulsion, which they lack means to patent, and asking us to appeal in their behalf to the public. Now the public is an incredulous, unsympathizing source to appeal to. It refuses to be convinced on such matters without evidence. The best way, for such inventors to get their inventions along, is to make as good drawings and explanations of their devices as possible, and get copies of them, with dates affixed, witnessed by persons upon whose integrity they can rely; and then bring their plans to the notice of practical men with capital, making the best arrangements they can to obtain the necessary funds to perfect and patent their machines. A share in a really good invention will nearly always secure the needful money to proceed with it.

To the Editor of the Scientific American:

As a practical engineer and machinist of thirty years' experience, an inventor and patentee of several useful machines, I feel interested in the solution of this old but very knotty question. I consider steam as the only motor which can be used advantageously at the present moment, although I believe science will, at no very distant period, develop some other source of power, cheaper and more portable. Therefore, from whatever source the power may be derived, the manner of applying it for the propulsion of canal boats is the only thing that needs to occupy the attention of inventors. I have seen, in Belgium, a boat propelled by water forced out of its sides by pumps. The boat seemed to go well, but as I had other matters in hand I did not interest myself in obtaining any information on the economy of the system. I know this system is very old; but it seems to me to be very natural and very simple to take the water out of the canal at the bottom of a boat and force it out at either end of the boat with just sufficient force to obtain the desired speed. I have never heard any good reason why successive attempts in this particular direction have failed; but many reasons present themselves to inventors of experience. How difficult it is to enlist the capitalist or the public! In fact, the originator of an invention is generally neglected and forgotten; and years after he has passed away, the time arrives: a necessity is felt for self-preservation, and the capitalist is alive; and the whole public is alive with inventors. It is simply necessary for a man to go through some old books, put a few old notions together, take out a patent, and he is an inventor. So, at the present time, we have boys and girls, men and women, dreaming of the one hundred thousand dollars, and every one has some scheme to win the prize.

I read, in "Answers to Correspondents," lately, "Your proposition for the propulsion of boats by forcing water through a longitudinal channel by a pump or screw, is an old device." This is very true; but is that any reason why it should be discarded as useless? I think not. Surely mechanics have advanced somewhat since the time those experiments were tried.

I believe that the system is good; and it is only the mechanical arrangements for forcing out the water in a proper manner which are at fault. And after studying all the varieties of propositions, wheels, screws, poles, floats, chains, etc., I feel obliged to return to the simple directing force pump, steam at one end of the piston and water at the other, without a single lever or joint; and I believe the jets of water may be so directed, after a few experiments, as to counteract each other, to prevent damage to the banks of the canal.

I will give a rough sketch of my ideas on this system; it is old enough, and I do not think a valid patent could be sustained for propelling boats by water, forced out behind, before, at the sides, or any other parts of the boats. But I am sure there is plenty of room for a good pump, specially designed for this purpose; that would be a good patent. Now I intend to try my skill in this direction, and I shall, in a short time, illustrate my design in your valuable journal.

The following is a rough sketch of the principle. I propose to make small, compact, double cylinder steam pumps, and to place a number of them in the center of the boat. Each set of pumps will be complete in itself, with separate inlet and outlet pipes for steam and water, so that they may be worked separately or collectively. It is possible that one or more of the pumps may become useless from some substance getting into the valves; they can then be stopped and arranged without impeding the progress of the vessel. Each set of pumps has its own jet, and the jet of water may be directed slightly inclined towards the bottom of the canal, and the currents might be made to meet each other, so as to prevent flushing the sides or banks of the canal. Experiment only can decide the size, form, and direction of the several jets, to produce the least possible commotion in the water. A suitable valve must be placed to each set of pumps, so as to reverse the direction of the water without reversing or stopping the pumps; some may go one way and some the other, and the jets may be made to turn round to assist in steering or turning the boat when necessary.

Such is a brief sketch of my idea, and I shall feel greatly obliged if you or any of your correspondents can show any radical defect why this system of propulsion should not be encouraged, and the necessary machinery for the purpose perfected.

I perfectly agree with the remarks of your correspondent, Mr. John Bamber, of Rochester; and I would suggest that all aspirants for the prize should send a good working model (say a boat three feet long) of their invention, and that each inventor send a detailed description, with his model, so that the Commissioners would understand it and be able to select the best, second, and third, and advance the money necessary to make the experiments. I, for one, could not afford to spend $10,000 in experiments, but I could afford to make a model sufficient to give a clear notion of my invention, and this would be sufficient expense to put an inventor to; and as no scheme would be attended to without a model, it would prevent the Commissioners from being flooded with crude notions, and no end of correspondence.

Lake View, Chicago. JOSEPH LAURIE.

To the Editor of the Scientific American:

Your articles in the SCIENTIFIC AMERICAN, relating to the Erie canal, brought to my recollection a trial made upon the Western Pennsylvania canal, about twenty years since, by a Mr. Adams, its simplicity attracting attention. Nothing but the ordinary boat could be seen, excepting that, at a short distance from the sides, what the spectators called a "fence," made of sheet iron, was placed near the bow, in a straight line parallel to the sides, to prevent the motion of the water (caused by the passage of the boat) from striking the banks. This simple arrangement had the desired effect. The propeller, from what I could learn, was something of the nature of the bicycle. I cannot say whether it had two or three wheels. I understood that they were arranged to carry no more weight than would cause them to bite and give motion to the boat when the power was applied. It appeared to be only a matter of power to get the desired speed, the fence cutting through the water like a knife.

Columbus, Ohio. WILLIAM HENRY.

[The plan described would undoubtedly prevent injurious side swells, but we think it would require greater power for propulsion.—EDS.

To the Editor of the Scientific American:

I noticed in your valuable paper of June 24, "Forwarder's" article on canal (steam) navigation, wherein he ("Forwarder") says that it is the "bow of the boat" that makes the swell or wave, and not "the screw" used for propelling the boat. He is correct, as I can testify from my own observation. I have observed different tugs plying on the Chicago river, and found that it was the bow and not the stern that made the wave.

Now I, for one, have not been trying to invent a new screw or paddle wheel. But what I have invented is a device to destroy the waves after they are made.

I hope "Forwarder," will discontinue calling Chicago naughty names, as it will be Chicago who will produce the Moses who will lead the New Yorkers out of (canal) bondage, and who will also walk off with the $100,000, that is, if any one does. H. W., Jr.

Chicago, Ill.

Fallacies of Building---Drying Lumber.

To the Editor of the Scientific American:

In your issue of June 3, I notice an article from a Mr. James, of Paterson, N. J., on the "Fallacies of Building," and particularly on the seasoning of timber. He seems to have serious doubts of our ability to cut timber in the forest and place the lumber in a building the next week, and have it keep its place. A book was once written to show that a steam vessel could never be used to cross the ocean. It is difficult to make an egg stand on the small end until you know how. Great difficulties in theory vanish, when we can witness the facts.

Having expended more than twenty years' time and a large amount of money, to investigate and establish the science of properly seasoning, shrinking, and drying of lumber and timber, I will state some facts, that have come under my observation, which run somewhat counter to the views of Mr. Henry.

There are few subjects in which the community at large have a deeper interest than in the proper preparation of wood for our dwellings, furniture, etc., whether we consider it in the light of durability, elegance, comfort, or health. It is one, however, on which a great diversity of opinion exists. It is passing strange that a subject of such universal importance has not been more agitated, and settled on a sure basis. Each man has his own theory. Who is right? If we examine the doors, windows, furniture, etc., of our dwellings and public buildings, we ought to be ready to affirm that nobody is right, providing they practise as well as they know how. I noticed in one of the most expensively built palaces in New York, that the panels of the doors had nearly shrunk out of the matching, before the building was sufficiently dry for occupation. Who believes that this is necessary?

My own experience prompts me to say: That the drying of lumber does not season it, and seasoning lumber is not drying it. That any amount of common air drying does not necessarily (if ever) produce a thorough shrinkage, even though the time be a hundred years. That time has nothing to do with either seasoning, shrinking, or drying, but is alone the result of condition and heat. That lumber may be thoroughly seasoned without being either dried or shrunk. That lumber may be made as dry as desired, and yet not be seasoned at all, and with only a partial or very slight shrinkage. That common air never seasons lumber (though it dries it), and can never more than partially shrink the wood. That seasoning, shrinking, and drying, are each separate and distinct operations, and in most cases do not depend at all upon each other. That they are all necessary, though not in the same degree. That the order of their value to the wood, is in the order named; the seasoning being of the greatest, and the drying of the least value.

To season wood, is to coagulate or chemically change its albumen from a fermentable and destructive agent to an insoluble and preserving substance, which should always be left in the pores of the wood. When thus treated, its tendency is to prevent the future shrinking and swelling of the wood, and it greatly adds to its beauty of finish. It is also a protection against eremacausis, or dry rot, where timbers exposed to its influence, such as car beds, railroad ties, bridge timbers, etc., and is the cheapest mode of preserving timber known. Creosote can also be added in the same preparation, and at an almost nominal cost. If this albumen be removed from the wood by steaming, boiling, or soaking in water, it greatly injures the value of the wood, and it can never afterwards have the same strength or beauty of finish.

Common air, therefore, can never season lumber, for want of a sufficient degree of heat, since albumen in wood cannot be properly coagulated at a heat less than 160°.

The shrinking of wood, which is the next in the order of value, can never be thoroughly performed if the outside of the wood be dried first, which is always the case in common air drying.

When the outside is dried first, it forms an enamel or band of dried wood, which will not yield to a thorough shrinkage when the inside becomes dry. This enamel also prevents a rapid drying of the wood, as it closes the outside pores, and permits the free passage of moisture from the inside. If lumber could be dried in the air, with a person to sprinkle water on it frequently, to prevent the forming of the enamel, it would secure a more perfect shrinkage in the end, though the water thus used would greatly damage the wood in color, strength, and durability. But under no circumstances can common air be depended upon, to properly prepare lumber for buildings, or any other good work, no matter how many years of time are allowed.

I was furnished by the Rogers Locomotive Manufacturing Company, at Paterson, N. J., with a sample of their best air dried lumber, to see if I could shrink it in dry steam. As strange as it may appear, it shrank $\frac{7}{16}$ of an inch to the foot in two days, as a part of 30,000 feet of lumber in the same room. A sample of black walnut timber from the car shops of the Hudson River Railroad shrank $\frac{5}{16}$ of an inch to the foot in one day. Some staves from a pail and tub factory, that had been dried both in the air and in a hot air kiln, shrank more than an inch to a pail in one day; and entirely green staves were equally well shrunk and dried in the same room and in the same length of time. Some gunstocks at the United States Armory at Springfield were more thoroughly shrunk in 2½ days in dry steam than others that had been dried in the air under cover for 8 years. Those sticks that were prepared from the green in 2½ days could be selected in the dark, from the 8 years air dried, by their superior finish. Some timber at Pittsburgh, known to have been air dried for more than 60 years, and used for building gun carriages, was tested by baking, with some of the same size that had been prepared from the green in 48 hours in dry steam, and to the surprise of many, the 60 years' air dried wood shrank nearly double that of the steam dried. Thousands of such cases can be furnished to those who are skeptical, or new tests can be made for their especial benefit. One person who was skeptical dried a piece of lumber 3 years in a yard and one whole year in a hot air kiln, and yet the dry steam shrank it $\frac{3}{16}$ of an inch to the foot, and diminished its weight.

But the drying of lumber has very little importance, in comparison with its being seasoned and shrunk. Six green gun stocks, as a part of 9,000 in the same inclosure (16×20 feet), at the Springfield Armory, shrank in weight the first day, 12 lbs. 13 ozs.; the second day, 5 lbs. 5 ozs.; the third day, 2 lbs. 13 ozs. The same stocks shrank in size, the first day, $\frac{23}{64}$ of an inch; the second day, $\frac{9}{64}$; the third day, none, thus showing that the shrinking in size stops before the timber is quite dry. There is therefore no advantage in drying timber after the shrinking in size stops, under a seasoning heat of dry steam.

One of the great advantages of seasoning and shrinking of lumber by dry steam, is, that the lumber can never afterwards be exposed to a higher degree of heat or a more thoroughly shrinking atmosphere, unless it is actually burned to charcoal. Another advantage is, that a day in dry steam has produced better shrinkage, on an average, than a year in the air. Practical men can readily sum up the interest on capital, storage, checks, splits, warps, and decay, and see if that do not amount to more than $1 per thousand feet, which is about the average cost of thoroughly seasoning, shrinking, and drying of lumber by dry steam.

We live in a fast age. We do not depend upon canals now for rapid traveling. Lightning speed suits us much better. Improvements are constantly being made. We should not discourage but rather aid their introduction. We can hardly afford to go back or cling to the old and expensive process of air drying lumber, when we can have far better seasoned and shrunk timber, in days, than by the common air in years; while after the air has done its best, the dry steam will add more to its value than the entire cost of preparing the wood from the green, and yet with all the advantages of the dry steam, it is the cheapest, most rapid, and thorough process known to science.

If these views shall be found to conflict with those of Mr. Henry or any other person who may read your valuable paper, I shall be pleased to discuss with them any of the points I have made, through the SCIENTIFIC AMERICAN or otherwise. H. G. BULKLEY.

Chicago, Ill.

Paine's Electro-magnetic Engine.

To the Editor of the Scientific American:

Having noticed several articles in your paper with reference to Paine's electro-magnetic machine, I believe I cannot do better than describe a visit which I paid it about three months ago.

Entering the office in company with a friend, at about twelve o'clock one day, I was told that the machine was not running then, but would be in operation at one. Proceeding there alone, at about that time, I was, after the formality of sending up my name, conducted by a small boy, through numerous by-ways and passages, to the second story of a back building, where I was met by the illustrious inventor and a few select friends. Mr. Paine began by showing the small model machines, which he set in motion by a battery of four cups, of about a gallon capacity each. These models revolved very well, but apparently with no power, for they could be stopped easily. I then began to reason with him on the absurdity of his position, and adduced in my support the experiments of Joule, Mayer, Faraday, and others. He, evidently, had no very high opinion of these, and pronounced the conservation of force an old fashioned idea, which had been overthrown in these enlightened days by his "experiments," though what the latter were I have never determined.

After conversing some time, to no purpose, he prepared to overthrow me and my authority at one blow, by an exhibition of The Machine. This was standing in front of a chimney, on one side of the room, with the axis of its wheels parallel to the wall. The wheel to which the magnets were attached was, unlike the models, inclosed in a cast iron case, which enveloped it closely above, but spread out into a rectangular base below. The latter rested directly on the floor. The axis of the wheel projected on each side, and, to one end, a pulley was attached, and to the other, the brake for operating the magnets. The machine had the general appearance of a fan blower with an enlarged pulley. The battery was attached to two binding screws, fixed to a standard on the chimney, and the current was supposed to pass from these, along wires, to the break piece, and thence to the magnets. A belt on the pulley connected with a shaft overhead, whence another belt proceeded to the pulley of a small circular saw.

As soon as the connection was made with the battery, the whole apparatus began to move, and soon the saw attained great velocity, shaking the building with violence. The latter effect was caused by a heavy fly wheel on the saw arbor, which probably was not well balanced. When well in motion, boards were applied and sawed with the greatest ease. To show the excess of power, they were sometimes placed on edge and passed over the saw, so as wholly to envelop it, and the cut made from end to end, without the velocity being at all diminished. On throwing off the belt from the saw, the machine still proceeded at the same velocity, with entire indifference to external resistance. On mentioning this to Mr. Paine, he informed me that when the saw was attached, and the resistance greater, the increased pull on the magnets brought them nearer together, by bending the heavy iron frame; and, as magnetic attraction varies inversely as the square of the distance, it only required a small change of distance to account for the increased power. I clearly indicated that I was skeptical on this point, and suggested that it would also work without variation if the power proceeded from some well governed steam engine in the neighborhood. On this he intimated that, if I were not careful, a force might proceed from his body which would act in conjunction with gravitation in causing me to be projected through the window, and strike with violence on the ground below.

The exhibition being over, on going down stairs in company with the rest, I tried the door of the room below, but found it locked, and the windows covered with papers. I desired to get in, but was met with the assurance that the room was rented by a man who was then absent.

This, I believe, is the last visit paid by an outsider to this wonderful invention. I have been there several times since, but there has been no admittance to me, or to any one else. I have since been to the owner of the building, and find that Mr. Paine rents the room to which I sought admittance, and also rents power in that same room, which is directly below that containing his machine. The engine from which the power comes generally stops work at twelve, and starts again at one, but sometimes works all day.

My visits there have established the following facts: First. That my friend and I were denied admittance at twelve o'clock, but were invited to come at one. Second. That the shaft in the room below does not revolve between the hours of twelve and one. Third. That the room below, containing power, was rented by Mr. Paine, but that he kept it carefully locked, and misguided me as to the tenant. Fourth. That the working parts are concealed in an unnecessarily strong case, well adapted to the concealment of another source of power. Fifth. That part of the apparatus is attached to the wall, so that the machine must always occupy the same position on the floor. Sixth. That the models have not a power proportionate to their size. Seventh. That the machine runs at the same velocity, whether producing one horse power or a fraction of a horse power, and this without a governor.

These are the facts of the case. Where the power of the machine comes from I am unable to say. Is there some secret connection between this machine and the shaft below, and does the battery serve only to make this connection? Or does the battery, when applied, connect the apparatus with a larger battery? I leave these questions to others; but, unless the reasoning and experiments of a host of our greatest men be false, and unless the greatest development of modern science be overthrown, this machine cannot but derive its power from some extraneous source.

In a late communication to your paper, Mr. Paine sets himself up as the peer of Faraday, Tyndall, and others, and gives as the reason, his long devotion to science. He evidently does not consider that to be ranked with such men requires something more than devotion; it requires brains; brains to discriminate between true science and quackish nonsense; brains to discover and originate. And pray what fact, among the thousands of science, does Mr. Paine pretend to have proved beyond doubt? Let him answer. As to Mr. Paine's "science," I assert that it is a tissue of error and ignorance, from beginning to end. Even his vaunted invention of metallic foil, wherewith to envelop his magnets or wire, can operate in no other manner than to the detriment of his machine, as any such metallic coating lengthens the demagnetization, which is the very thing to be guarded against. This is due to an induced current, which forms in the coating, and, being in the same direction as the primary current, operates in the same manner to keep up the magnetism. His reason for the machine's keeping at the same velocity also shows great ignorance of the subject. In the first place, the law of magnetic force, under these circumstances, is stated entirely wrong. For this case, the true law is complex, but most nearly approaches to that of inversely as the distance, instead of as the square of the distance. (See Joule, and also Tyndall, in the *London, Edinburgh and Dublin Philosophical Magazine* for 1850.) And, in the second place, approach of the poles would not necessarily increase the efficiency; in this kind of machine there is a distance of maximum efficiency; and if the magnets revolve at a distance greater than this, the attraction becomes too small; and if at a less distance, the times of magnetizing and demagnetizing the magnets become too great, and the machine goes too slowly. The distance in this machine is, undoubtedly, within the limit, for Mr. Paine prides himself upon its smallness, and so further reduction, could it take place, can act in no other manner than the opposite of that claimed. But it is my opinion that all the force brought to bear on the magnets could not move them one two-hundredth of an inch, when attached to such a frame.

As to Mr. Paine's disregard for the conservation of force, I have little to say. His assertions are made directly in the face of this principle, and yet he has never adduced one experiment, or even a plausible reason, to prove what he says. He takes you into a building where shafts are revolving by the vulgar power of steam, and directs you to look while he evokes power from nothing. You must not touch anything; you must not enter the room below; you must not be there while the engine next door is at rest; but you must simply look, and by that renowned maxim of fools, that "seeing is believing," you must believe that the whole structure of science has fallen, and that above its ruins nothing remains but Mr. Paine and his wonderful electro-magnetic machine.

Newark, N. J. HENRY A. ROWLAND, C. E.

Social Science versus Mental Emaciation.

To the Editor of the Scientific American:

In a recent number of the SCIENTIFIC AMERICAN, an article appeared under the title of "Social Science," the drift of which, if rightly understood, was, beyond doubt, in the right direction.

Again, in the number for June 10, another appears under the title of "Mental Emaciation." If it be the work of the same mind as that on social science, that mind has clearly lost its way in passing from one topic to the other, both, by the way, being very closely related.

The conclusions of that on social science were, if properly comprehended, that the criminal, because of certain changes in the structure of the brain, ought to be regarded rather as a diseased person, than as one sinning against light and knowledge; or, in other words, as a criminal *de facto*.

Mental emaciation pre-supposes the possession of mental endowments at one period of life, in a state of decadence at another; and, in the judgment of the writer, at a date too early to be included in, or accounted for, by the inevitable decline due to advancing life.

The business of the mechanics, artisans, and laborers of the world, if properly understood by the writer of this note, is to give form to materials to subserve some useful, ornamental, or æsthetic end to their fellow men, or inferior animals in their service. All the inventions and contrivances figured or described in the past issues of the SCIENTIFIC AMERICAN, are in fact, variations of forms of a few materials, to attain some desirable end or result to mankind.

Now, the human brain at birth is like these few materials—formless—for most purposes of utility, except the perpetuation of the race. And the business of educators, from the primary school to the university, workshop, factory, or farm, is simply to give forms to the material structure of the brain, to the end that it may be competent to evolve certain results in after life. And education does not often, or always, stop with leaving school, university, farm or shop. Each individual occupation followed in after life by any one, is but a school to make its follower more proficient all the time he or she is engaged in it. And that is the basis of "specialisms" in human occupations. And the specialist attains success precisely as his attention is turned to narrow single purposes or objects.

It would be manifestly unjust to charge the conductors of the SCIENTIFIC AMERICAN with being political emaciates, for the very satisfactory reason that politics have not probably been objects to which they have devoted special attention. In other words, they have not been political specialists. And the censure cast by them on business men at fifty years of age, as being "mentally emaciated," is not, in a large majority of cases, merited.

Mental phenomena depend on forms (molecular) given by educational influences to brain matter; as insanity and crime, in most cases, are either shown, or inferred, to depend on changes in the structure of brain material.

Believing that the SCIENTIFIC AMERICAN does not seek to do any class of men, however large or small, injustice, I certainly think it due to the large class whom it charges with mental emaciation that it should know and acknowledge its mistake, and make the *amende honorable.*

Zanesville, Ohio. Z. C. MCELROY.

Patent Knot and String Envelope.

To the Editor of the Scientific American:

In glancing over your excellent paper, I noticed two diagrams of a letter opener, the vast improvement of the latter attracting my attention immediately. Now if I (taking my idea from the inventor of 1871, as I have no doubt he took his from the inventor of 1858), should add a short stick to the knot so conspicuous in the patent of 1871, could I also obtain a patent? W. H. S.

New Haven, Conn.

[We presume you could, if the same liberal minded examiner that passed the knot patent still retains his office.—EDS.

The Viaduct Railroad.

The last meeting of the directors of the Viaduct Railway Company was a secret one, but it has since been ascertained that the proceedings were as follows: A majority of the members were present; the president, Judge Hilton, stated that several corps of surveyors were actively engaged in making the necessary surveys of the proposed route, though nothing had been sufficiently matured to be presented to the Board for action, and that he had been under the impression that the committee from the Chamber of Commerce, appointed at their meeting last week, would have been present on the occasion to lay their views before the Board respecting the extension of the road to the Battery or some other point at the lower end of the island, but he had not heard from the committee in any way.

It is understood that 150 engineers are engaged upon the surveys. Considerable misunderstanding seems to prevail outside the city as to the precise nature of the Viaduct road. It will run, on an average, about twenty-five feet above the surface of the ground, on brick arches, between transverse iron ribs, supported by heavy iron lateral columns, of elegant design, themselves supported on inverted arches of solid masonry built into the ground. The space under the arches it is intended to convert into stores and markets, having entrances on both sides of the line. The stock subscription books are now open, as will be seen from an advertisement in another column.

Effect of Cold on Iron.

An esteemed correspondent, Mr. John Towle, of Bristol, Vt., sends us the following: "When I have broken iron for the foundery, such as old stoves, plows, and the like, it breaks with lighter blows in the winter, when full of frost, than in the summer, when it has been heated in the sun. And in straightening horseshoes in winter, I have had them break with one blow of the hammer, while in the summer they will straighten easily, and not even crack. These facts are evidently proofs that iron and steel are more brittle in frosty than in warm weather." Mr. Towle's facts show the behavior of iron, under percussive force, to be widely different in extreme temperatures. But its tensile strength, under steady pressure, has recently been shown, by experiment, to increase when the iron is cold.

Compressed Leather.

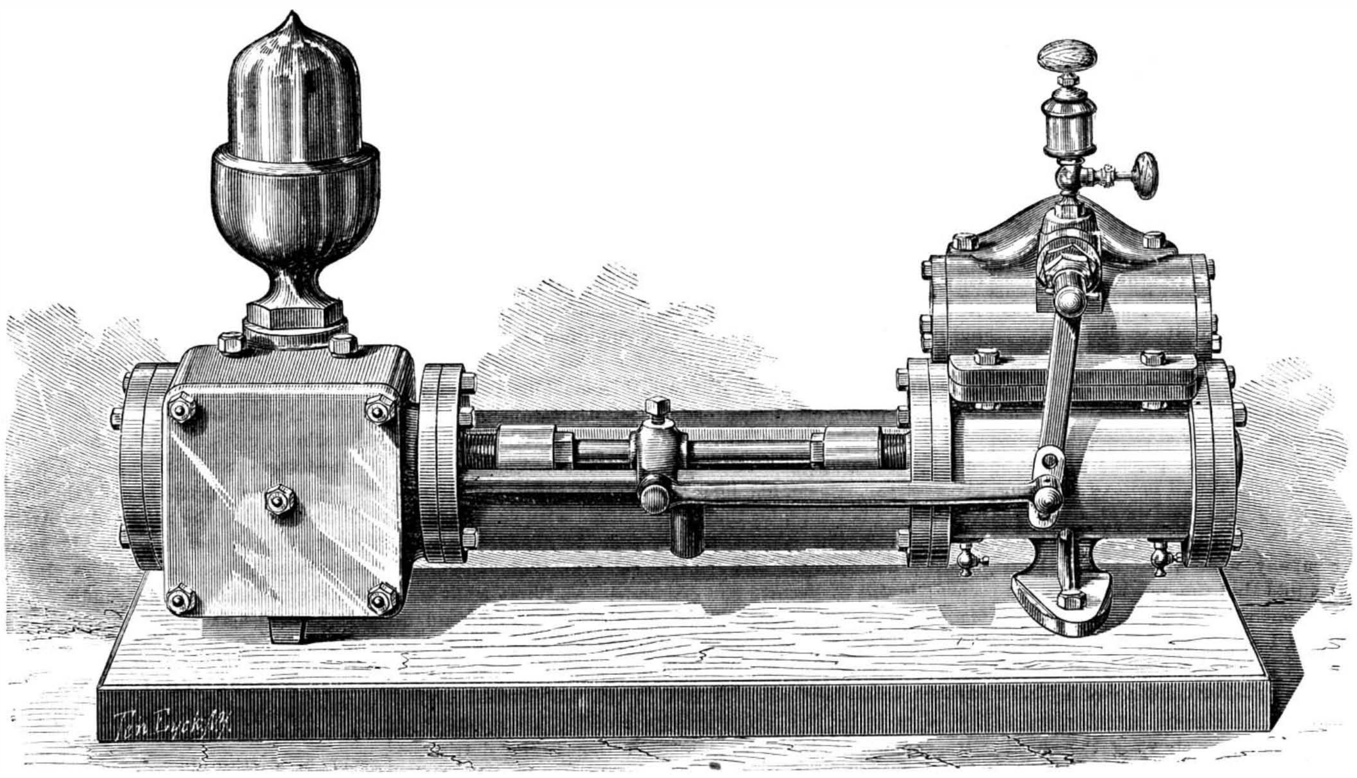
A new process for using the clippings and refuse from saddlers' and shoemakers' shops, is manipulated as follows:

The leather shavings are washed clean, cut up fine, and soaked in water and sulphuric acid, one per cent of the acid being sufficient. The immersion must continue till the shavings become plastic, and the leather then can be pressed into molds, with only a moderate amount of pressure. It can be rolled into thin sheets, and will be useful for many purposes; it will not, however, resist moisture. A little glycerin rubbed in will prevent its cracking.

Cameron's Steam Pump.

The independent steam pump—or donkey pump, as European engineers are pleased to term it—although a comparatively recent invention, is now so well known and so extensively used as to be considered an almost indispensable adjunct to a steam boiler. Its relations vary, however. In some cases, the donkey draws its nourishment from the boiler; while in others, the boiler draws its nourishment from the donkey.

The great range of applicability of steam pumps, for moving fluids in almost every possible condition, is increasing daily. For instance, it is now the practice in the oil producing regions to lay pipes (two inch is the size generally employed)from the wells to a point intersecting the nearest railroad, for the conveyance of the crude oil. In some cases oil is conveyed in this way a distance of fourteen miles, forced by a single pump placed at the end of the line, the pipes lying on the surface of the ground and following its undulations. The pressure is, of course, very great, and depends upon the quantity delivered in a given time, but the plan works so successfully that the question is being seriously considered, of connecting the oil districts with the great commercial centers in this way.



CAMERON'S PATENT STEAM PUMP.

The steam pump shown in the annexed engraving is int nded chiefly for feeding boilers—a duty that requires a safe and reliable instrument. It is constructed with a view to the fact that we are making steam machinery faster than we are educating men to take care of it properly; and consists, therefore, of the fewest possible parts, and these of the simplest character.

The steam cylinder is shown on the right hand, and the pump cylinder on the left. The piston rod is an unbroken piece, extending from one cylinder into the other, and carrying between the two cylinders an arm, which performs the office of the eccentric in a rotative engine. The steam chest is bored out in the ends, and is fitted with a piston or plunger, which carries the main slide valve back and forth with it. This plunger is operated by a small slide valve seated in the steam chest casting, on the further side, which receives its motion from the arm on the piston rod, through the horizontal and pendant links which vibrate a shaft that extends through the steam chest and carries a toe that engages with the small valve. The horizontal link is connected to the arm on the piston rod, by an eccentric hook than can be lifted when it is desired to stop the machine instantaneously.

The only parts of the steam engine inclosed are the main steam piston, the main slide valve, the plunger, and the auxiliary slide valves. The pump cylinder is equally simple; it is fitted with a piston and four valves. By removing the bonnet shown in the cut, the whole interior of the cylinder is not only exposed, but is rendered accessible for the removal of any foreign substance.

The pump valves, four in number, may be removed by un screwing the two plugs shown on the top of the cylinder, and lifting out the spindles on which the valves play. The valves and valve seats are made of solid composition.

There is not a screw or little piece of any kind, inside the machine, that can get adrift to disarrange it or give trouble.

These pumps are double acting, and the duty being the same in each direction, their operation is smooth and regular. Their parts are manufactured on the principle of gunwork, each piece being interchangeable.

They are sometimes arranged to feed boilers, in situations where the throttle valve is operated by a float or similar contrivance that varies with the water level, where they are relied upon to stop and start under care of the attachment with the utmost confidence.

This excellent steam pump bears testimony to the restless ingenuity of our American mechanics, which is never satisfied until the whole field is exhausted. It is the latest addition to the already large variety manufactured by the well known firm of A. S. Cameron & Co., whose works are situated at the foot of East Twenty third street, New York, and cover more than an acre of ground. The whole establishment is devoted exclusively to the manufacture of steam pumps, under six distinct patents, granted at different times to Mr. A. S. Cameron; and it is managed on the co-operative plan, each workman being interested in the profits.

COATES AND LASCELL'S WATER ENGINE.

The utilization of the power of small streams with great heads has long been a subject of interest and importance. In many of the mining districts of California, there are streams which fall abruptly from great hights, but the flow of which is so small that, to apply it to work through the medium of overshot wheels or turbines, would involve very great expense, while a large portion of the fall would necessarily be sacrificed. Endless chains, carrying buckets, pressure wheels with buckets worked by cams, and many other devices have been employed with greater or less success, to render the power of such streams available; but there is no doubt that the cylinder and piston is essentially the best thing ever invented for the purpose.

The limited elasticity of water, however, introduces difficulties in working cylinder engines not met with in the employment of steam; and it is only in comparatively recent times that these difficulties have been so far surmounted as to give smoothly working water engines.

The engine illustrated herewith works without shock or jar, and can, undoubtedly, be made to economize a very large percentage of the power of any stream, falling from a hight not too great to admit of its being safely conducted to the cylinder in pipes.

The principal merit of the design of the engine is its simplicity and compactness. We need not dwell upon this point, as it is sufficiently shown in the annexed engraving.

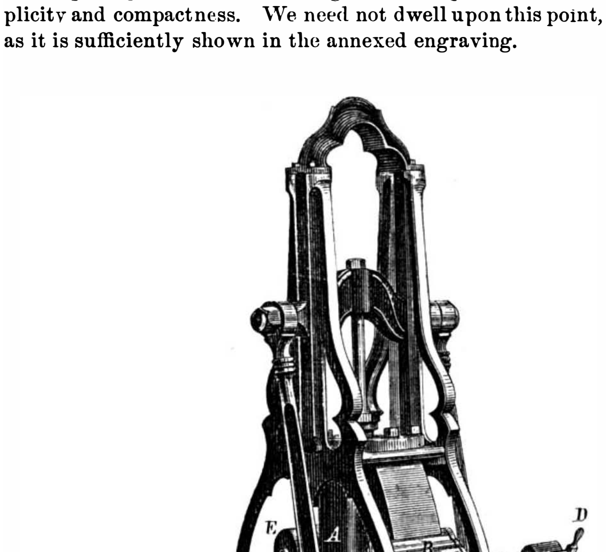


Fig. 2 shows the construction of the valve of the Coates and Lascell engine, which the inventors claim meets all the requirements of the case, claims which, upon personal inspection of the machine, we think, are well sustained.

The valve is balanced and self-packing. It therefore runs lightly and without leakage. The engraving comprises a longitudinal and a cross section, by which the construction is clearly shown.

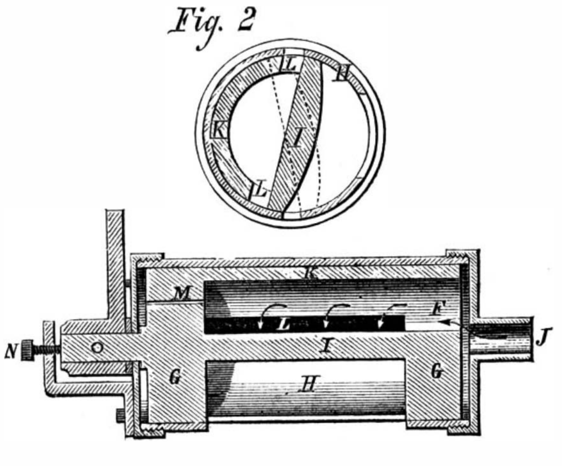
The induction port, F, is located at one end, in one of two transverse disks, G, at the end of the valve, which disks fit closely the interior of valve chest, H. The disks are connected by a flat plate, I. A hollow trunnion, J, admits the water which flows in the direction of the arrows into the valve chest. A plate, K, curved in cross section, as shown, and flush with the perimeters of the disks, G, which it connects, is convex on the outside and concave on the inside, and parallel with the plate, I. In the plate, K, openings, L, are left between the plates, I, and K, and are the eduction ports of the valve.

The plate, K, diffusing the pressure, increases the strength and resisting capacity of the valve. An orifice M, is made through the disk opposite the hollow trunnion, by which water passes through to the back of the disk, and thus balances the end pressure of the valve very nearly, only enough being allowed to act against the washer or packing placed around the stem to keep the joint from leaking. By the aid of the set screw, N, this packing may be relieved of pressure if necessary. Occasion for using this screw, however, occurs rarely, it being found that the packing is regulated by the adjustment of hydrostatic pressure above described.

At the beginning and end of the stroke, the crank travels much faster than the piston, while through the middle of the cylinder the travels of both are nearly equal; and when a governor is used, or the water throttled so as to give the engine any given rate of speed, the crank must necessarily travel much the slowest, as it must wait for the cylinder to fill the otherwise rapidly increasing area, caused by the rapid travel of the piston through the center of the cylinder. Now, to obviate this difficulty, Mr. Lassell has introduced an auxiliary pipe and valve, D, Fig. 1, which is opened by means of a separate eccentric, so adjusted that when the piston has traveled one fourth the distance from the end of the cylinder, this valve gives the additional supply of water necessary to equalize the crank's motion. The defect thus overcome is analogous to that which occurs when what is called wire drawing takes place, the piston traveling faster than the steam.

The advantages of water pressure engines over steam are that: They are always ready to run, no waiting to get up steam; no engineer is required to attend them, as opening and shutting the stop cocks is all that is required to start and stop them; there is no waste of power or fuel, where power is used intermittently—when a job is finished, the en gine is stopped, and started when another is ready; there is no danger of accidents from explosions, no dirt, dust, or ashes, to annoy; no room required for storage of fuel, etc.; they can be used where steam would be inadmissable; the reduction of the rates of insurance would, in many places, pay the running expenses of a water engine; they are much cheaper than steam engines.

Fig. 2



A modification of this engine has been made to adapt it to blowing church organs. The crank has been dispensed with, and the parts are so arranged that the organist can start and stop it from his seat as easily as he can pull a stop of the organ. It has a governor valve also, which is connected with the organ bellows in such a manner that the speed of the engine is governed by the bellows of the organ, resulting in perfect adaptation of supply to demand.

These engines have a counting machine attached, to register the number of revolutions, by which the engine acts as a meter, measuring its own consumption of water.

For further particulars, address the Cold Water Engine Co., Watertown, N. Y.

Scientific American.

MUNN & CO., Editors and Proprietors.

PUBLISHED WEEKLY AT
NO. 37 PARK ROW (PARK BUILDING) NEW YORK.

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

☞ "The American News Co.," Agents, 121 Nassau street, New York.
☞ "The New York News Co.," 8 Spruce street, New York.
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VOL. XXV., NO. 2 . . . . [NEW SERIES.] *Twenty-sixth Year.*

NEW YORK, SATURDAY, JULY 8, 1871.

Contents:

(Illustrated articles are marked with an asterisk.)

MECHANICAL POWER AND SPECIFIC WORK.

Upon no other point are men so constantly making mistakes as upon the subject of mechanical power applied to a specific purpose. A man having to put a barrel of pork in his wagon, and finding himself unable to lift it, makes an inclined plane of a plank, rolls up the barrel, and thinks he has gained mechanical power thereby. If visionary, he may, perhaps, go further, and argue that as there has been a clear gain of power, there can be no impossibility in constantly repeating the gain, and so, by the aid of suitable mechanism, solving the problem of perpetual motion.

The plank may serve as the type of all mechanism, and if it can be clearly explained what is really gained by its application, we shall have the clue to the general use of all machinery.

In the first place, the barrel is to be raised to a given hight; which, without the aid of the plank, the man finds himself unable to do, no matter how long or how arduously he may labor. If we can now comprehend the reason why he cannot raise it without the plank, we shall be better prepared to comprehend what is the peculiar office of the inclined plane, and shall be able to place it in the same category with those of all the (inappropriately so called) mechanical powers, of which machines are composed.

We must, however, first comprehend the fundamental fact, that the mere exertion of force (bearing in mind that force is not mechanical power) never does any work whatever. A ball may rest upon a table forever, constantly exerting a pressure or force towords the earth's center, but never doing any work. Work is the movement of masses, and the word movement implies distance through which bodies are moved. It is only, then, when force is applied through distance that work is done; and as to traverse space or distance requires time, we only arrive at a standard of measurement of mechanical power, expended in the performance of work, by taking for the unit a body moved against a given constant resistance (1 lb.), through a given distance (1 ft.) in a given time (1 m.); or the foot pound in common use, equivalent to a pound of matter raised one foot in hight in one minute of time.

When we say simply that force performs work, we do not express the whole truth. When we say force, exerted through distance, *in time*, performs work, then we cover the whole ground.

But while any force, operating through any distance, in any length of time, great or small, will perform *some* work, we find that the amount accomplished depends primarily upon the magnitude of the force, and the length of time through which it can be exerted. In mechanics, we increase the time a force acts by increasing the distance through which it acts, and *vice versâ*.

But force (static) and resistance (static) are correlative terms, and if by any means we lessen the action of one, we also lessen the action of the other, since there cannot be any exertion of force unless it is opposed by an equal exertion of force.

Therefore, a force applied to the elevation of a weight, or the overcoming of a resistance, must be a little more than the resistance; that is, the force in pounds, multiplied into the distance in feet it must act to perform the work, must be more than the resistance in pounds, multiplied into the distance through which it is to be overcome. If these products are equal, the body will not move, but will be in a condition to move with the application of the slightest degree of force, the velocity with which it will move depending upon the difference between the opposing forces. The reason why the weight cannot be raised by the unaided strength of the man, in the above illustration, is that his muscular force, multiplied by the distance the barrel is to be raised, is less than the weight of the barrel multiplied by the same distance.

Now, when the barrel rests on the plank while being rolled up, the resistance is divided into two components, one of which acts in the direction of the earth's center, and the other against the muscular energy employed in rolling the body along the inclined plane. The muscles only are called upon to overcome a fraction of the resistance required to be surmounted in directly lifting the body from the ground; but this fraction of the weight, multiplied by the distance through which the barrel is rolled, is precisely equal to the entire weight, multiplied by the hight to which it is raised; and as work is force overcome through distance, the expenditure of mechanical power, measured in foot pounds, is precisely the same in both cases. All the plank has done has been to render possible the application of the limited power of the man to the specific purpose of raising the barrel.

And this is all the lever, the screw, the wheel and axle, or any combination of these elements into a complex machine, can do. They are instruments for the application, not the generation of power. They are "mechanical powers" only in the specific sense that they enable us to apply power to definite purposes. They transmit only; they create nothing. When, then, a man speaks of dynamic power being multiplied through leverage, he is talking utter nonsense. Static pressure may, however, be so increased.

We have never yet met a man who permanently believed in the possibility of a self-moving machine, who could comprehend the distinction between static force, or pressure, and pressure acting in time and through distance, or mechanical power.

Many of those who can make the distinction fail to do so in their reasoning, and thus err in conclusions. Our correspondence reveals to us the fact that many inventors of ingenuity, and well versed in mechanical resources, are wrecking their hopes upon this rock. The law of virtual velocities lies at the very bottom of the science of dynamics, and mechanics cannot comprehend too early that, in the words of Grove, "Mere pressure never does work."

EXTINGUISHING FIRES BY CARBONIC ACID.

It is well known that fires in coal mines have been extinguished by pumping in vast volumes of carbonic acid and afterwards cooling down the adits by water. How far such a method would succeed in the open air and with burning houses is a question that can only be determined by actual experiment. One of the best ways of driving carbonic acid out of caves and wells is to let down a red hot cannon ball. The rarification and expansion produced by the heat soon displaces the carbonic acid, and renders a descent into such a place possible. This experiment, frequently shown in the chemical lecture room, would seem to throw some doubt upon the probable success of any attempt to play a stream of carbonic acid upon a burning building. Another question to be considered is the one of heat of the combustible material. If it were possible to stop the combustion by a stream of gas, the great heat would re-ignite everything the moment the air was allowed free access, unless as, in the case of the coal mine, great volumes of water were poured on to cool everything down below the point of ignition. If this be true, it would be easier to put out the fire by water in the first place than to be at the expense of double engines for gas and water. Another difficulty may arise in the transportation of carbonic acid through iron tubes. It is well known that this gas can be easily split up or dissociated by passing through a system of heated tubes, and although it is not probable that the same thing would take place with cold iron mains, it might be well to institute an experiment or two before laying down a few hundred miles of pipe. When a fire is put out by water, the intrepid firemen are often deluged with water to cool them and to protect them from danger. In the case of carbonic acid, every living being would have to keep at a safe distance, and a bad leakage or an unfortunate aiming of the pipe might produce disastrous consequences.

We understand that at the last session of the Legislature, a law was passed authorizing a company to lay pipes, three feet beneath the level of the streets of New York, for the purpose of extinguishing fires by carbonic acid. It is intended to convey the gas in the same way as illuminating gas is furnished to consumers, from large reservoirs or gasometers, and to have—we cannot call them hydrants—but something on the same plan, for attaching hose all over the city, ready to put out any fires that may occur.

Whether private houses are to be furnished with double pipes so as enable the gas men to deluge them if occasion should require, we are not informed. Nor is anything said in the act of incorporation about furnishing free soda water by saturating the Croton reservoir with the gas. The whole scheme looks suspicious, and we should really like to know if the project has ever been seriously entertained.

HOW BODIES MAY BE FROZEN BY HEAT.

The fact that there now exist several machines which through the consumption of coal produce ice, is one quite inexplicable to many; and perhaps while we are enjoying our iced drinks, so grateful in the hot weather suddenly come upon us, an explanation of this apparent paradox may not be unacceptable. That heat should directly or indirectly produce cold seems, at first thought, an impossibility; nevertheless, in the laboratory of nature this is an operation constantly going on; and it is in this wise:

Whenever a body changes from a solid to a liquid state, or from a liquid to a vaporous condition, large amounts of sensible heat disappear. Either the temperature (sensible heat) of the body itself falls very much lower than it was before its change of state, or sensible heat is abstracted from surrounding bodies to maintain the expanding substance of its former temperature. The heat abstracted and stored up in the body, so that it no longer produces the effects popularly included in the term "heating," has been called latent heat. Its amount varies greatly in different solids, liquids, and vapors.

Now there are two ways in which bodies may be expanded, namely: by adding to their heat—sensible or latent, or both —or by removing the pressure their surfaces sustain. Or we may, if we choose, both impart heat and remove pressure simultaneously.

Thus the gas chlorine, when submitted to a pressure of about four atmospheres, becomes a liquid, and will remain so as long as the pressure is continued. During the act of compression, it gives off a certain amount of heat, which is the exact equivalent of the mechanical power employed in reducing its volume. When the pressure is removed, it expands to its original bulk as a gas, and in so doing takes the same amount of heat, from other bodies, as it lost when compressed. Air, when compressed, gives off heat, and absorbs the same amount again when it expands. In reducing the volume of bodies, we may not only use compression, but we may also abstract heat by bringing them into contact with colder bodies, thus powerfully aiding the mechanical power in bringing about the desired result.

But mechanical power is only another name for heat, the source of all terrestrial power. If we employ a water wheel to generate our power, we find this possible only because heat has raised the water for us. If we use wind as a motor, it is heat that puts the air in motion; and if we employ steam, we must do the same thing. If we use an electromotor we find our materials prepared for us through the same agency.

The various ice machines employ volatile materials such as expand into gas at ordinary temperatures, or at least do so when atmospheric pressure is removed from their surfaces. In thus expanding they abstract heat from water placed in suitable vessels, brought in contact with the absorbing bodies. The expanded gases are next compressed, the heat given off during the compression being absorbed by some other body—most generally water. The condensed and cooled materials are then allowed to expand in contact with the vessels containing the water to be frozen again, and so on repeatedly until ice is produced.

Thus we see that heat indirectly produces cold, and this is only an expression of a general law. Nothing can gain heat without loss of heat in something else, and though the gain or loss may be latent and not appear in the temperature, yet we may be sure that the sum total is always the same.

CO-OPERATIVE COLONIES.

It seems to us that coöperative colonies might be made the means of improving the condition of a very large proportion of those who crowd our commercial centers, and who have nothing to rely upon for support but their physical toil. There are large areas in this country where a very small amount of labor will supply ample food and clothing for a large family. In many of the Southern States, there are lands where an industrious laboring man could, with the produce of a very few acres, and the wages of such work as he might get to do, live in a measure of comfort which, with constant toil, early and late, he never could attain in any large city.

Some three years since we visited the State of Delaware, and noticed particularly the results of the intelligent cultivation of the worn-out lands of the section through which we passed. A judicious rotation of crops, together with a supply of fertilizers derived from the bodies of king crabs, and other materials of which the shores of Delaware Bay afford an almost unlimited supply, will, it has been demonstrated, render the lands adjacent to the bay extremely productive.

We saw clover, corn, wheat, peanuts, and sweet potatoes growing in great luxuriance; while peaches, grapes, pears, and berries, find there an unequalled climate and soil, the entire country teeming with these fruits.

In addition, the salt marshes abound with game birds; the tidal rivers swarm with fish, so easily taken that large quantities are caught with a small expenditure of time. The shores of the bay furnish such supplies of oysters that we saw them sold at twenty-five cents a bushel. The climate is so mild that cheaper houses, less clothing, and less fuel suffice. Truly, thought we, for men who get their living by their muscles, this is a veritable Canaan.

The coöperative colonies, which have been formed lately in this city, designing to avail themselves of the natural advantages of productive sections of our vast territory will, we hope, some of them prove so successful that they will demonstrate the value of such coöperation.

To be successful these associations should, as much as possible, embrace a variety of the mechanical trades of the most general utility. They should have their own tailors, shoemakers, carpenters, blacksmiths, cabinet makers, and wagon makers. They should admit only those of sober and industrious habits, fully impressed with the value of coöperative effort and really understanding what coöperation means. They should be particularly careful to exclude all that is liable to breed discord, and should adopt such codes of regulations as can be practically adhered to by all well disposed members.

We are inclined to believe that many of these associations are organized in too hasty and crude a manner to be successful, and that they do not sufficiently scrutinize the character of their members.

In the selection of localities, those which afford the best opportunities for diversity of industry will, in the end, always prove the best.

We are the more inclined to favor these organizations from the fact that they are making an intelligent effort to better the condition of the laboring classes, and that they are composed of select and peace loving workingmen, who see that in the strikes and other means employed by trades unions to force higher wages, the true interests of labor are not really advanced.

STEAM ON THE ERIE CANAL.

We find it necessary to repeat what we have already said in regard to the propulsion of boats, under the conditions specified in the New York State law offering the $100,000 prize.

Many of our correspondents apparently think it is sufficient to confine their thoughts to the invention of a means of propulsion, without regard to speed. We have already shown that the minimum velocity required by the act (three miles per hour) involves a modification of the form of the square box boats now in use. The advance of such a boat at the required speed would create injurious side swells, no matter what means of propulsion were adopted.

Some of our correspondents appreciate this difficulty and regulate their plans accordingly. One suggests the employment of side wheels, with outriggers carrying longitudinal shields running parallel to the sides of the boat and outside of the wheels, the shields to be as long as the boat. This would undoubtedly prevent side swells to a very great extent, but it would make the width of the boat so great in proportion to its tunnage that it could not carry the stipulated load and get through the locks.

Another correspondent proposes a wheel with radial flukes, which shall engage the bottom of the canal and thus propel the boat. This device is old, and besides does not provide for the obviation of side swells.

As we understand the law, the speed may exceed three miles per hour, provided the inventor can so construct his boat that greater velocity can be safely attained.

Inventors will see that the conditions under which success can be attained are few, and those of failure numerous. It would be wise for many of them to give the law more careful scrutiny than they appear to have done.

BUILDINGS FOR MANUFACTURING PURPOSES.

Some two or three years since we called attention to the necessity of a special profession of "Architectural Engineering." Our interest in the subject has now been revived by a failure of an expensive building, designed by a supposed competent architect, for a special manufacturing business, to answer the purpose for which it was built. The proprietors have, we are informed, been compelled to expend considerable money and lose valuable time to rectify its defects, besides having to change machinery from floors upon which it was originally placed to others less convenient.

The fact is that men who can build graceful and handsome churches are not therefore necessarily competent to design a factory, esp cially one intended for new branches of industry. To imitate is not to design. But every new building intended to be occupied by machinery long used and well understood, must, although the same ground plan is observed, be more or less varied in detail to adapt it to the peculiar circumstances of its location, the soil upon which it stands, etc. It requires more than artistic talent and knowledge of the properties of materials to do this. Knowledge of the nature of the operations to be carried on in the building, judgment matured by experience, and inventive skill, combined with skill in the art of building, are necessary.

Some of the finest manufacturing buildings in the country were in their internal arrangements entirely designed by men familiar with the peculiar industry for which they were constructed, but who were quite unfamiliar with architecture as an art.

Utility rather than beauty must be the controlling idea in erecting such buildings. Yet whenever without sacrificing convenience and strength to appearances, beauty of design can be secured, it is of course very desirable. To combine these elements requires no mean skill, and it is evident that to greatly excel in this class of work a man must have made it a special study.

EX-COMMISSIONER FISHER'S EXPERIENCE IN THE PATENT OFFICE.

We commence this week the publication of extracts from a speech recently delivered before the Young Men's Christian Association, Cincinnati, by Hon. S. S. Fisher.

The incidents he relates occurred while holding the office of Commissioner of Patents, and his amusing experience is not unlike that of the chiefs of other bureaux under the Federal Government. We have withheld the publication a week or two, undecided if we could afford the space the lecture would occupy. But his description is so graphic and racy, and portrays such a good insight into the peculiarities of office seekers generally, that we decide to make copious extracts, which will be continued through several numbers.

INSPECTION OF THE BOTTOMS OF WELLS.—Sufficient light to enable any one to see the water or earth at the bottom of a well, can be directed down the shaft by means of an ordinary looking glass. If the well be under cover, two glasses will be required, and our own ingenious readers will, by a little experimenting, soon be able to arrange them in the right positions.

[Special Correspondence of the Scientific American.]

BURDEN HORSESHOE PATENT EXTENDED---VALUE OF THE INVENTION.

Washington, D. C., June 26, 1871.

On the 14th of June the famous patent of Henry Burden, of Troy, N. Y., for a Horse and Mule Shoe Machine, was extended by Commissioner Leggett. No contestant appeared in opposition to the extension. The patent was issued June 30, 1857, and reissued in 1865.

Mr. Burden died in January last, and the applicants are his two sons, Mr. James A. Burden and Mr. I. Townsend Burden. He was a man of strong intellect, great energy, and untiring perseverance. To perfect the machine referred to was the ambition and success of his life, and no efforts or sacrifices seemed to him too great for its accomplishment. Others had labored in the same direction, but had failed of success, and abandoned their undertakings. It required the inventive talent and extraordinary persistence of such a man, together with his unusual pecuniary resources and mechanical facilities, to work out the difficult problem. Mr. Burden's first efforts to this end were made prior to 1835, in which year he was granted a patent for a machine, which however proved a failure, and involved a heavy expenditure. In 1843, he received a second patent on another device, but this also failed when put to practical use. In 1853, his determined efforts suffering no abatement in the intervening time, he decided to abandon the particular line of devices he had hitherto chosen in his experiments, and to adopt certain others involving different mechanical principles. The happy result appeared in his patent of 1857. He subsequently devised important improvements, which were embodied in another patent issued in 1862. As an automatic feeding, bending, and molding machine, the patent of 1857, just extended, was all that could be desired, but in the process of creasing and punching the nail holes some difficulties arose, which were overcome in the patent of 1862.

When first entering on his experiments, and this was as early as the year 1835, Mr. Burden carried on extensive iron works, of the highest grade, at Troy: but during the years, from 1853 to 1857, his general business was in many ways sacrificed to the one great object he had so long and sanguinely had in view. Many stories are told of his intense and enthusiastic application at that time; how for days and weeks his meals were brought to his place of business; how he often worked, sometimes in company with his favorite mechanics, 24, and even 30, hours without intermission; and how he many times called up all his workmen at midnight to open the mills and manufacture some new device or modification. His rolling mills were often idle for weeks, that all his hands and shops might be devoted to the horseshoe machine, in its embryo, but surely developing, condition. His machine and pattern shops were at that time fully equal to any, if not the best, in the country; and were provided with the most approved implements.

The present machine turns out, with unerring certainty and perfection, one shoe in a second of time. The average weight of a shoe is one pound, and it is not uncommon for one machine, in the ordinary running of the shop, to transform 10½ tuns of bar iron into perfect shoes in 12 hours, which is equal to the hand work of at least 600 men for the same time.

To estimate the saving to the country from a general adoption of this important article, it must be borne in mind that the prevailing prejudice against its use compelled the inventor to place it in market at a price returning him no profit whatever, and not even covering the cost of manufacture. In other words, he offered it at the price of the material, looking for his returns exclusively to the regular profit on the manufacture of the iron, the machine materially increasing the business of his extensive puddling and rolling mills.

With some modifications, this plan has been adhered to up to the present time, and it is contended by the firm that the public, in proportion to its adoption of the machine horseshoe, is saved the entire cost of the manufacture by hand, the profits to the manufacturer being derived from the invention only so far as the iron is thereby put in a more saleable form.

The average charge for making a horseshoe by hand is estimated by some at sixteen cents, by others as high as twenty cents (the material of course not included); the average price of the Burden shoe has been 8½ cents, so that the latter brings to the consumer a saving of at least two thirds on the entire cost. During the last year, the machine shoe has been sold at still lower rates, averaging less than five cents.

Since the introduction of the invention, 82,000 tuns of iron have been used in the manufacture, and the sales have amounted to $9,000,000, showing a saving to the public of $18,000,000.

It would be difficult to estimate the expenditures and losses during the many years of experiments. In the four years previous to the issue of the patent, the losses caused by the interruptions of the general business of the establishment amounted to at least $100,000. A famous litigation suit, in protection of the invention from an infringement, cost the inventor the sum of $25,000.

The prejudice, already referred to, against the article, both among the blacksmiths and the consumers, was general, and often bitter and violent. In New York city the excitement at one time rose to such a pitch that a blacksmith who had resolved to make trial of the shoe, was killed by his fellow workmen. This opposition was caused in part, and not unreasonably so, by the defective quality of the shoes put on the market by other parties, and even by Mr. Burden himself, on his first attempts to introduce them; and to overcome this, when the manufacturing process had become perfected, was a difficult task, and involved great labor and heavy expenditures. Mr. Burden's sons and other responsible agents visited all sections of the country, and personally conferred with the leading master workmen. Charging the machine with the expenses of inventing and perfecting it, of making and selling the product, and the market price of the iron, and crediting it with all the proceeds of the sales, it is pretty clearly shown that the inventor and his heirs have sustained a heavy loss.

The value of this invention in its relation to the military operations of the late civil war may not be generally known. Many thousand men were spared for active field service whose services would otherwise have been required in the shops. Quartermaster-General M. C. Meigs says: "The army depended, to a very great degree, upon shoes made by this machine, and they gave satisfaction wherever used. It is not possible to state its value to a government. It is one of those inventions which add to the military strength of a nation, not to so great a degree, but in the same manner as the steam engine, the steamboat, and the locomotive."

Assistant Quartermaster-General J. A. Donaldson writes: "During our civil war, as Chief Quartermaster of the Military Division of the Tennessee, and afterwards of the Missouri, I had ample opportunity of testing these shoes, and found them superior in every particular to those made by hand. In the great operations of our armies—when it would have been impossible to manufacture a sufficient number by hand—such, for example, as Sherman's Atlanta campaign, and his March to the Sea—the Burden horse and mule shoes were an essential element of success, and I cannot speak too highly of them."

During the war, about 14,000 tuns of shoes were used in the Government service, the price paid being even less than market price to private individuals, and the saving, as compared with the cost of the same if made by hand, was about $4,000,000.

The history of this invention, if fully written, would finely illustrate the workings of a strong inventive intellect, impelled by an energy well nigh heroic and borne over obstacles and through labyrinthine delays by the presence of a never failing hope. Mr. Burden knew no misgivings, and failures only stimulated to greater exertions. But what we know of the inventor's life is sufficient to excite our admiration and quicken our appreciation of the measure of human vital force that may be embodied in one important invention.

Mr. Burden was born in Scotland in 1791, and came to this country in 1819. He received a thorough education in mathematics and engineering, and in boyhood displayed much inventive genius. In 1820, he invented the first cultivator in the country; in 1840, the railroad spike machine, which became widely known, not only from its intrinsic value, but also from an extended litigation to which it gave rise. Other valuable inventions might be referred to. A thorough mechanician and mathematician, he wasted nothing in blind and random labors.

During the war, Mr. Burden took much interest in furnishing to the various Sanitary Commission fairs, held in the leading cities, miniature horseshoe machines, and the suitable white metal for manufacturing diminutive shoes, which were sold in great numbers as ornaments or mementoes. It has been stated that the sum of $20,000 accrued to the Sanitary Commission from these sales; and many will remember that, at the New York city fair, they were conducted with great success by Mrs. General McDowell.

STEAM FIRE ENGINES.

The boiler and works of a steam fire engine with a running gear are so constructed as to dispense with a reach or perch pole, and to allow the forward wheels to be turned completely under the frame in such a manner as to place the weight of the parts upon the axles, and relieve the frame of all strain except what is necessary to preserve the proper relative position of the axles. This construction of steam fire engines renders them less liable to be injured or disabled by the giving way of parts, and adapts them also to be turned or managed with greater facility, accuracy, and safety, while the engineer and firemen have such access to the engine and boiler, respectively, as greatly facilitates the performance of their duties. The parts composing the engine are arranged directly over the front axle, and the boiler on the rear axle, the axle being connected by curved reaches or braces. Thus the front wheels may be turned completely round the engine, which facilitates turning in narrow limits, and enables the tongue and connected parts to be placed out of the way of the engineer. This construction also allows the engineer and fireman to work entirely separate or without one being in the way of another, and removes the weight of both engine and boiler entirely from the reaches, enabling them to be made light so as to reduce the aggregate weight and cost of the machine. The saving effected in repairs, and the increased speed with which this engine may be driven, alone, are claimed to equal or exceed in a brief period its entire cost.

Invented by Lysander Button and Theo. E. Button, of Waterford, N. Y.

Brick Kiln.

This invention consists in improving the construction of brick kilns, so that the over burning of some and insufficient burning of other bricks can thereby be prevented, as well as the unnecessary waste of fuel. It consists in the application to the top of the kiln of a series of horizontal intersecting flues, and of registers above the crossings of the flues, whereby the products of combustion can be directed in their course. Upon a brick kiln of suitable size and shape, and built up of raw brick in the well known manner, with furnaces, eyes, and crevices for the proper distribution of heat, is placed a course of bricks, in such manner as to leave horizontal, longitudinal, and transverse flues, which intersect each other. The outermost flues are quite close to the verge of the kiln. All the flues are in proper connection with the smoke crevices, so that all the products of combustion enter the same. Upon this course is laid another course, set on edge and close together, so as to cover the flues made in the first course. The brick of the top course are preferably fire brick, so as not to be injured by rain water. Cement may by used, to securely close the joints in the top course and prevent the escape of heat through crevices. Samuel C. Brewer, of Water Valley, Miss., is the patentee of this improvement.

Preparing and Bleaching Paper Pulp.

John Campbell, of Chatham Village, N. Y., has invented an improvement in preparing and bleaching paper pulp and other fibrous materials. His invention has for its object to improve an apparatus for preparing and bleaching such substances, patented in 1869, so as to make it simpler in construction, cheaper, and more effective in operation; and it consists in a combination of a receiver and supply tube, with an induction air pipe.

The paper pulp or other material to be bleached is placed in a suitable vessel, and agitated and thoroughly mixed by a paddle wheel, working in a compartment with an inclined or curved floor, in the ordinary manner. An air pump or blower may be used, or anything that will force the atmospheric air through the mass. The inventor prefers to use two, one at each end of the engine or vessel holding the material to be bleached.

The pipes from the blower are led into the engine in such a direction that the currents of air, in addition to hastening the bleaching of the material by rapidly combining with said materials the chemicals used, will also drive the mass in the same direction in which it is driven by the paddle wheel. With one or both the air pipes is connected a tube, provided with a stop cock, near its intersection with the said air pipe. To the upper end of the tube is connected a cup or receiver, to receive the chemicals to be introduced into the engine or vessel holding the material to be bleached. With this construction of the apparatus, a chlorine solution, of one third less strength than is used in any other process, is placed in the engine, and the chemicals to be introduced into the solution are placed in the receiver. The paper pulp or other material to be bleached is placed in the engine, and the paddle wheel and fans are set in motion. Then, by adjusting a stop cock, the chemicals in the receiver are introduced with more or less rapidity, as may be desired, into the air pipe, and are carried by the blast of air into the engine, and thoroughly and rapidly intermingled with the material, thus producing ozone oxygen with great rapidity, without the use of a chlorine gas generator, and, it is claimed, bleaching the mass of pulp in fifteen minutes.

When the bleaching is completed, the stop cock admitting the chemicals is closed, and the stirring and air blast are continued for a sufficient length of time to drive off all the remaining gases before they have had time to injure the material.

The Progress of Discovery.

Science has long been known to have a romantic aspect, and her wonders are becoming daily more numerous. Poetry and the exercise of the imagination, are exhibited by many of her most enthusiastic votaries; and a glance at our letter files will show her comic side, although humor must be considered as her last attribute. We condense a letter from a correspondent, address unknown, into the following statements, remarkable for their originality, and the courage with which they are advanced:

Fat in the body is stored up during sleep. Nature makes us sleep more (if we let her) before a rain storm than at any other time, to give us an extra supply of fat for heating and *waterproofing* purposes. When we feel unusually drowsy (not having fatigued ourselves, or taken a narcotic), we may feel perfectly certain that rain, hail, or snow, will fall in our district within twenty-four hours.

Our correspondent rightly claims these discoveries as his own, and says, with obvious truth, that he "never met, or heard of, any one who could foretell the approach of rain, etc., by the above method." Neither did we. He is sound in the last assertion, without doubt.

The Rights of Labor.

"In this land of liberty," writes a correspondent of the Haverhill *Gazette*, "a man should have a right to sell his labor—the work of his hands—at any price he pleases; he should be the sole judge—no one else has a right to interfere. It is the old oligarchy of slavery. What is the difference whether you are a slave to an individual or to a society? The result is the same. Every man has a right to fix the price at which he will work, the number of hours he will work, and all the conditions relating thereto. It is a matter which concerns himself alone, and the capitalist has the same right; he is the sole judge how much he can afford to pay. No society or combination has a right to interfere. The whole question of wages is and should be a personal matter between the employer and the employé. What right has an outside—a third person—to say at what price or how many hours per day, one man shall work for another? None at all.

"If I can get three dollars for working ten hours per day, and am strong, robust and hearty, and believe it for my interest and the interest of my family,—if I can better educate them, impart to them more culture and refinement, and give them a higher social position, by *working fourteen hours for four dollars and twenty-five cents*, who has a right to say I shall not work the fourteen hours per day? How or where does any one—the legislature or a society—find the right to step between me and the man who wants my labor, and say how much he shall pay or how much I shall receive? It is time this question was settled. The sooner it is settled, the better it will be for laboring men. Capital can stand it better than labor, because it does not require daily food, meat, and drink to live upon."

Can Filling and Soldering Apparatus.

Leopold Charly Straub, of Pittsburgh, Pa., has invented a new and improved can filling and soldering apparatus, which is an important improvement if, as claimed, it will economize time and material during the operation, and produce satisfactory workmanship.

The invention consists, first, in the arrangement, on a rotary frame, of a series of swivel disks, on which three or more cans can at once be supported, one to be filled, one closed, and the third soldered. It also consists in the application to the said rotary frame of certain gearing and spring catches, whereby the can which is being soldered can be rotated under the soldering apparatus to receive the binding material around the cover. A hinged hopper for filling, and a new arrangement of soldering apparatus is also employed. These cans are simultaneously operated upon. One can under the hopper is filled, the next receives the cover, and the third is soldered. When one has been soldered it is released, another empty can is brought into position, and so on continuously.

Steam Sewing Machines.

Steam power for driving sewing machines is extensively used, especially in the larger establishments. An example is seen at the great dry goods concern of A. T. Stewart & Co., in this city. On the fourth floor are about 500 females and a small number of male assistants, engaged in various branches of cutting and fitting female apparel. The majority of these employés are operators on sewing machines. The machines are ranged in rows, and are moved by steam. An operator can start or stop the running of a machine by the use of her foot on a pedal, which connects with a friction roller attached to a shaft which is worked by steam. The employés are enabled to make very good wages by means of this ingenious invention.

THE returns to the department of agriculture indicate an increase in the acreage of wheat, compared with that of last year, of four per cent, nearly three-fourths of a million acres, nearly all of which are west of Mississippi. In New England there has been a small decrease, while in Massachusetts the condition of the crop is 14 per cent below the average; in Connecticut 6; in Georgia 25, and in California 42. None of the principal wheat-growing States indicate a poor yield, and unless subsequent disasters occur, the crop will be fully equal to that of last year.

No plant yields anything like as much nutriment from the same extent of soil as the banana. Alexander von Humboldt estimated that it returns twenty times as much as the potato, and a hundred and thirteen times as much as wheat.

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.—SETTING BOILER.—I wish to set a boiler, and should be pleased to have your opinion upon the following: My boiler is fourteen feet long, thirty-two inches in diameter, having no flues at all. To save fuel, I thought of having it arched over with a fifteen or seventeen inch arch perpendicular, to return the heat over the top. Will it injure the top sheets of the boiler to wall it up in this way? I don't intend to carry more than twenty to twenty-five pounds of steam.—A. M.

2.—LEAKY BOILER.—I am using a large upright boiler, which leaks badly at the ends of the tubes. Calking does it no good. I am under the impression that I saw something advertised in your paper for stopping leaks in boilers. I have looked over my back numbers, but cannot find it. If you can inform me of anything that will do any good you will much oblige—R. C. P.

3.—RECOVERING MERCURY FROM OLD BATTERY PLATES.—Can any of your readers give me a cheap method of recovering the mercury from old battery plates?—G. E.

4.—STRAIGHTENING SHADE TREES.—I have been informed that there is a process for straightening shade trees by slitting the bark. Will some one tell me on which side of the bend the slits are to be made, at what time of the year, etc.?—L. P. O.

5.—DRESSING MILLSTONES.—What is the best method of laying off and dressing millstones thirty-six inches in diameter, so as to secure the highest production of corn meal, ground very fine, in a given time?—C. W. D.

6.—SOLUTION OF OZONE.—Will some chemist inform me, through your columns, how to prepare ozone (on a small scale) and retain it in solution in a solvent, or in any fluid—for instance, in a solution of chlorinated soda? What is the simplest process for preparing the ozone, and then impregnating the above solution with it? Any other particulars will oblige—B. F. R.

7.—CASE HARDENING.—What is the process of case hardening, and is there any way of hardening a large body or mass of steel or iron by a bath, solution, or other mode available in such a case?—L. H. M.

8.—CHEAP HORSE POWER.—I would like practical directions for constructing, at the least possible expense, one or two horse power for farm use, to cut feed, saw wood, churn, etc. Farmers cannot go to the expense of an iron wheeled concern, costing a hundred dollars or more, but want something that an amateur mechanic can make.—E. G. A.

9.—GALVANIZING COPPER PLATES.—Please to inform me of the simplest and best method to galvanize copper plates for amalgamating.—J. H. H.

10.—AN IMPORTANT WANT.—A metal or alloy for culinary utensils, such as pots or kettles for stewing acid fruits, is a great desideratum. Neither iron, brass, nor copper will answer. Porcelain lined kettles would meet the conditions of the case if they were durable; but the porcelain soon cracks and flakes off, then galvanic action sets in, and a hole is soon eaten through the kettle. Many cooks stew fruits in tin pans, but the tin soon wears off and the pan is ruined. Some metal not affected by fruit acids is needed.—J. H. P.

11.—IRON SLAG.—I am desirous of utilizing our iron slag As it runs from the furnaces it is too brittle. I wish to find an amalgam that will hold it together and toughen it, if such a thing be possible.—H. N. M.

12.—BURSTING OF CASTINGS.—I am making cast iron wheels six feet in diameter. The bodies of the wheels are light, but the hubs are pretty heavy; and they all burst apart after being taken out of the sand for cleaning. They always break in the rim, although the wheels are quite cold when taken out. We use No. 1 pig iron.—L. A. P.

13.—COAL.—Which coal is the best and most economical (the price being the same), anthracite or bituminous? And does bituminous coal burn out or destroy a boiler faster than anthracite coal? Since the high price of anthracite coal, many have used the Cumberland coal in this section of the country. Some like it and some do not. I went the other day to buy some Cumberland, and the dealer did not talk very favorably regarding it, saying that "there was sulphur in it that destroyed the plates of the boiler," etc. I have used both, and cannot tell which is the cheapest. But I like the bituminous for making steam, as I have a small boiler, and have to make steam fast, and think there is not blaze enough to anthracite coal to heat the tubes of the boiler. If any of your correspondents, having tested the two coals, would furnish some facts, they would be of great value to many in this part of the country besides myself.—G. H. W.

14.—HARDENING CEMENT.—Is there any artificial means by which hydraulic cements can be made hard in a few days?—B. & D.

15.—WASHING FLANNELS.—I am fairly annoyed in the washing of my flannels. They will shrink, no matter what I do to prevent it. I have tried various remedies to no purpose. Now, I would respectfully ask, Can flannels be washed without shrinking them? If so, how?—H.

16.—CHEAP BATTERY.—Will some kind reader oblige me by telling me how I can construct a cheap battery and instruments to learn telegraphy? I would like to learn it, but I have not the time nor the money to do so. I think I could make the apparatus if some one would tell me how.—T. G. B.

17.—COATING GLASS.—Is there any process by which to deposit a metallic coating on the interior surface of a glass demijohn, the neck of which is too small to admit one's hand? Silver will do, if nothing cheaper can be used, for the purpose. All that is required is a metallic film of some kind that can be deposited from solution.—C. E. G.

18.—CEMENT FOR AQUARIUM.—What will make a good cement for an aquarium?—C. E. G.

19.—QUARTER TWIST BELT HOLE.—Will some one tell me how to draft a quarter twist belt hole in a floor?—J. E. D.

20.—COAL SMOKE INJURIOUS TO GRAIN CROPS.—Are the gases contained in coal smoke injurious to wheat or other grain on which it settles? A piece of ground lying at the end of the switch of our railroad where there is a good deal of coal smoke from engines every day, had on it a crop of wheat, sown in the very best condition, and looking well until harvest; but it is almost altogether a failure, as the grains are not more than half filled. Wheat of the same kind, but grown in different fields, is very good, the soil in this field being of the richest quality. Some think the gases from the smoke (of which there is a great deal over this field), at a certain period in the growth of the grain, will injure it.—D. C. R.

21.—MARBLEIZED SLATE.—Will some correspondent tell me what is the paint and glazing used in marbleizing or polishing slate or iron mantels? What do they coat iron beams with to keep them from rusting under ground?—A. D. L.

22.—CIRCULAR SAW.—LONG STEAM PIPE.—I am operating a circular saw mill at this place. The mill is run by a 12 by 20 engine, and is located 180 feet from our boilers. The steam is supplied through a three inch wrought pipe, placed out of the ground, on posts from eight to twelve feet high. The pipe as yet has never been cased in, and in consequence we work a great deal of water through the cylinder. We intend casing the pipe in a wooden trough ten or twelve inches square, and packing ashes around the pipe. Will this prove to be of much advantage, and will it prevent the steam condensing so much? We are now compelled to work with our cylinder cocks open to get rid of the water. Is there no method of superheating the steam, should our casing not prove sufficient to prevent condensing, or is there no method of separating the steam from the water before it reaches the cylinder? What is the probable loss by transmission of steam that distance? I have a saw that is cupped or dished, which makes it heat in the center in sawing. Is there any way of remedying it?—B. L. C.

23.—HARDENING BRASS.—How can I harden brass after it has been annealed, without hammering or rolling it?—W. R. P.

24.—OILING BELTS.—Will some of your numerous readers, experienced in the use of leather belts, give information as to the best, that is, the quickest and cheapest method of oiling belting? Also, is there danger of putting too much oil on the leather?—C. H. C.

25.—ELECTRIC MACHINE.—How can I make an electric machine that I can turn by hand, and create electricity sufficient to run a diminutive electric engine? I am a gunsmith, with good facilities for such work. I wish to get or make a nice machine for experimental purposes.—H. L. C.

26.—WELDING STEEL.—Can I weld two pieces of sheet steel, eighteen inches wide and one eighth of an inch in thickness, burr joint (?), so as to have a durable joint?—M. L.

Inventions Patented in England by Americans.

June 6 to June 10, 1871, inclusive.

[Compiled from the Commissioners of Patents' Journal.

BRETELLES.—R. H. Eddy, Boston, Mass.
DINING CARRIAGE.—G. M. Pullman, Chicago, Ill.
HOISTING MACHINE.—J. Scott, Pontiac, Mich.
JOURNAL BOX.—B. C. Baker, Toledo, Ohio.
LUBRICATOR.—H. A. Clark, Boston, Mass.
PAPER BINDER.—E. Dyer, Providence, R. I.
PINCERS.—A. Clarke, Philadelphia, Pa.
PNEUMATIC SIGNAL.—A. G. Myers, New York city.
SLEEPING CARRIAGE.—G. M. Pullman, Chicago, Ill.
STAMPING MACHINE.—E. Dyer, Providence, R. I.
TRUSS.—T. A. McFarland, Erie, Pa.
WATER INDICATOR.—F. Millward, Cincinnati, Ohio.

Foreign Patents.

Examples for the Ladies.

Mrs. Mary B. Hamlin, of Troy, N. Y., earned with a Wheeler & Wilson Machine, in 1870, $1,113.49, stitching shirts.

The List of Local Newspapers

Published by Geo. P. Rowell & Co., Advertising Agents, No. 40 Park Row, New York, offer great advantages to those advertisers who wish to attract custom from the rural population among which the papers circulate. They are furnished free, to any address, on receipt of stamp.

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.

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

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

Boilers.—Allen's patent will prevent scale from forming, and not injure the iron. In 3 gallon cans, price $6. J. J. Allen, Philadelphia.

Wanted.—Assistance to get out Canal Propeller. Address Jos. Hough, Norristown, Pa., who has a double acting one now planned out.

Wanted.—Partner to build the Revolving Cylinder Steam Engine. Had a test of five years. W. H. Morton, Hamilton, Ohio.

The RAILROAD GAZETTE is read and preserved, and therefore it pays to advertise in its columns.

The "Ball & Fitts" Water Meter, warranted accurate and reliable, and acknowledged by those who have examined and tested them the best water meter ever used. Manufactured by Union Water Meter Co., Worcester, Mass.

Power Punching and Shearing Machines. For car builders, smith shops, rail mills, boiler makers, etc. Greenleaf Machine Works, Indianapolis, Ind.

J. A. Whitman's Water Wheel Governor beats them all for bis. and price. Auburn, Me.

I have received, through the agency of Munn & Co., a patent on the best Summer Cook Stove in the market. The exclusive right, except for this State, for sale cheap. J. D. Kellogg, Jr., Northampton, Mass.

Electrical Instruments, Models, etc., made to order, and Gear Wheels and Pinions cut, by W. Hochhausen, 113 Nassau st., Room 10, N. Y.

Bliss & Williams, successors to Mays & Bliss, 118 to 122 Plymouth st., Brooklyn, manufacture Presses and Dies. Send for Catalogue.

Bright and industrious American, Scotch, English, German, or French boys, of 16 years or older, who desire to learn the machinist trade, in a first class establishment, will please address, for terms, P. O. Box 685, Hartford, Conn.

The Bucket-Plunger Steam Pump discharges at both strokes, with only two water valves. Valley Machine Co., Easthampton, Mass.

Wanted.—A machine to make galvanized iron eave cornice. Address T. J. Heizmann, Altoona, Pa.

Millstone Dressing Diamond Machine—Simple, effective, durable. For description of the above see Scientific American, Nov. 27th, 1869. Also, Glazier's Diamonds. John Dickinson, 64 Nassau st., N. Y.

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

Lord's Boiler Powder is only 15 cts. per pound by the bbl., and guaranteed to remove any scale that forms in steam boilers. Our Circular, with terms and references, will satisfy all. Geo. W. Lord, 107 W. Girard ave., Philadelphia, Pa.

Improved mode of Graining Wood, pat. July 5,'70, by J. J. Callow, Cleveland, O. See illustrated S.A., Dec. 17,'70. Send stamp for circular.

Ford's Portable Tobacco Press for Planters. Will sell Virginia, Maryland, Missouri. Address Ford's Tobacco Warehouse, Evansville, Ind.

Air Cylinder Graining Machine.—A perfect tool for House Painters and Manufacturers of all kinds of Decorated Ware. Complete Machine for $50.00. Send stamp for Circular. The Heath & Smith Manufacturing Co., 44 Murray street New York.

For the most perfect Band Instruments in the world, send to Isaac Fiske, Worcester, Mass. Illustrated Catalogues free on application.

The Patent for the best Hydrant, or Fire Plug ever invented, for sale. For descriptions, terms, etc., address Lock Box 356, Lockport, N. Y.

Best Scales.—Fair Prices. Jones, Binghamton, N. Y.

Steam Watch Case Manufactory, J. C. Dueber, Cincinnati, Ohio. Every style of case on hand, and made to special order.

L. & J. W. Feuchtwanger, Chemists, 55 Cedar st., New York, manufacturers of Silicates of Soda and Potash, and Soluble Glass.

For Hydraulic Jacks, Punches, or Presses, write for circular to E. Lyon, 470 Grand st., New York.

Belting that is Belting.—Always send for the Best Philadelphia Oak-Tanned, to C. W. Arny, Manufacturer, 301 Cherry st., Phil'a.

Send your address to Howard & Co., No. 865 Broadway, New York, and by return mail you will receive their Descriptive Price List of Waltham Watches. All prices reduced since February 1st.

Ashcroft's Low Water Detector, $15; thousands in use; can be applied for less than $1. Names of corporations having thirty in use can be given. Send or circular. E. H. Ashcroft, Boston, Mass.

To Cotton Pressers, Storage Men, and Freighters.—35-horse Engine and Boiler, with two Hydraulic Cotton Presses, each capable of pressing 35 bales an hour. Machinery first class. Price extremely low. Wm. D. Andrews & Bro., 414 Water st. New York.

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

Improved Foot Lathes, Hand Planers, etc. Many a reader of this paper has one of them. Selling in all parts of the country, Canada Europe, etc. Catalogue free. N. H. Baldwin, Laconia, N. H.

Presses, Dies, and Tinners' Tools. Conor & Mays, late Mays & Bliss, 4 to 8 Water st., opposite Fulton Ferry, Brooklyn, N. Y.

Cold Rolled-Shafting, piston rods, pump rods, Collins pat. double compression couplings, manufactured by Jones & Laughlins, Pittsburgh, Pa.

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

Glynn's Anti-Incrustator for Steam Boilers—The only reliable preventive. No foaming, and does not attack metals of boilers. Price 25 cents per lb. C. D. Fredricks, 587 Broadway, New York.

To Ascertain where there will be a demand for new machinery or manufacturers' supplies read Boston Commercial Bulletin's Manufacturing News of the United States. Terms $4 00 a year.

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.

ROACHES.—On page 394, current volume, query No. 3—"Is there any sure poison for roaches, that may be used without danger to children and domestic animals?" Being somewhat of an entomologist, I may be excused for stating that the *Blatta*, vulgarly called the cockroach, belongs to a genus of nocturnal orthopterous insects; these are prolific, laying masses of eggs, carefully wrapped all around. These hatch, and when the young scamps are no larger than ants, they will penetrate into boxes, chests, etc., through the smallest apertures, and enter upon their depredations. They speedily attain their full size, split on the back, and change their skin, but not their habits. Although they become winged, they seldom fly, trusting to their legs, which they use nimbly in their half adult condition. During the day they hide away in cracks or anything that will afford them shelter; so soon as darkness comes on, they sally out in swarms. About a month ago, my attention was called to my kitchen and pantry. Going in with a light, I was astonished at the numbers scampering and swarming into the corners, up to the ceiling, and on the walls, a legion of dark imps that hate the light. I thought I would accommodate the pestiferous creatures with a feast; I accordingly mixed up a quantity of freshly burned plaster of paris (gypsum, such as is used by dentists, etc., for making molds and ornaments), with wheat flour and a little sugar. This I distributed, on shallow plates and box boards, placed it in the corners of the kitchen and pantry, and left them to their glory in darkness. In the morning I found they had eaten quite freely. I fed them for three nights in succession. The plaster and flour, somehow, interferes with their intestinal canal, and gives them a costive habit, and spoils their appetite, I fancy. The short of the matter is, the roaches disappeared; whether they died outright, or left in disgust, I will not undertake to say. One thing I know, however, they are scarce and far between on my premises just now. The remedy is perfectly safe and simple. Try it.—J.S., of Pa.

CHEAP BATTERY.—There seems to be a great difference in the opinions of those that have given directions for constructing a cheap galvanic battery. I have made a great many experiments with, I guess, nearly all the forms of batteries, but I don't think that there is any cheaper or one that will give as little trouble as Daniell's sulphate of copper battery. If the person that makes the inquiry will go to any telegraph office, he can see one and learn all he wants to know about it; and if he cannot get a porous cup, he can use a common flower crock, with the hole in the bottom stopped with melted beeswax. The connections should be made with copper wire, as any other kind is soon eaten off.—A. E. T., of Ohio.

PLATING BRITANNIA METAL.—J. F. (page 378) will succeed in plating Britannia and soft solder by first depositing a coat of copper on his soft metals, and then putting them in the cyanide solution.—D. G. P., of Ill.

REFINING GOLD.—J. E. H. can refine gold by dissolving it in aqua regia, and then pouring off the solution from the precipitate. Add to the solution a filtered solution of copperas as long as a precipitate is formed. Decant and wash thoroughly. Digest in dilute sulphuric acid, and wash again, and you have pure gold. Melt in a crucible lined with borax, under carbonate of potash.—D. G. P., of Ill.

TURNING CONE PULLEYS.—Finish on cone as desired, and then turn one pulley of the other (small) cone; take two pairs of callipers, and set them to the large pulley, on finished cone, and the small pulley (after it is turned to the desired size) on unfinished cone. Hook the jaws together, and mark their aggregate diameters on a rod with an awl or pencil. Now set one pair callipers to next smaller pulley on finished cone; hook them together as before, set the other pair to the mark, and turn the next pulley to the size of the latter.—G. L. B., of Pa.

SPEEDING PULLEYS.—Multiply the diameter of the pulley in inches by the speed that it runs, and divide by the pulley driven, and so on down. Or, if a given speed be required, multiply as above, and divide by the speed required, and the answer will be the size to give the pulley.—G. L. B., of Pa.

CISTERN.—The best answer to the question of E. E. H. is that nothing but pure water should ever be put into a cistern; and then, if properly constructed, it will remain "pure and fit to drink." If a cistern be merely an open vessel, especially of wood, and the accumulation of dirt on the roof is allowed to pass in with the water, no known substance thrown into the water will really "purify" it. This is a case where "an ounce of prevention is worth many pounds of cure."—A. B., of Mass.

CHIMNEY.—Every chimney will emit a "sooty odor," when in use, depending upon the character of the fuel: but it is aggravated if the chimney be foul. The most efficacious mode of cleaning out a flue, is to burn it out, which is always a safe operation if the chimney be properly constructed. Sweeping will help it, but is not as effective as burning, and beside costs something, while a flue can be burned out in a few minutes by putting an old newspaper or two into the bottom and applying a match. —A. B., of Mass.

PREVENTING RUST.—For the benefit of G. R., query No. 5, June 24, I would suggest a solution of carbonate of soda to prevent the rusting of polished metals. The solution can be applied with a brush, or the metal can be submerged in it. The latter is much better. As a coating for iron or tin, that will effectually resist atmospheric action, and also acids, I would recommend Pierce's "stone surfacing composition."—L. P. B., of Pa.

FIXING LEAD PENCIL MARKS.—If J. H. R. will breathe on his paper for a moment, after he has written with a lead pencil, he will find his lines will stay much longer, and be much darker.—W. E. D., of N. Y.

POWER TO DRIVE SAW.—E. A. M. will find a thin saw will run easier than a thick one. The more teeth there are in the saw, the smoother it will cut, but variations in the number will not add to nor diminish the power required.—S. H.

BLACK COPYING INK—BEST EXTANT.—Take two gallons of rain water, and put into it ¼ pound of gum arabic, ¼ pound brown sugar, ¼ pound clean copperas, ¾ pound powdered nut galls. Mix, and shake occasionally for ten days, and strain. If needed sooner, let it steep in an iron kettle until the strength is obtained.—E. G. A., of Minn.

NOISY GEARS.—I had in charge three pair of bevel gears, 30 inches diameter, running 120 revolutions per minute. The driver had wooden teeth, and at a distance of 40 feet could not be heard. I lubricated with tallow and black lead, with a little oil added, to keep it soft, twice a week, and they ran very well.—T. S., of Pa.

N. & Co.—We do not believe exhaust steam, in passing through a pipe surrounded by shavings, would be likely to ignite the shavings.

W. F. W. asks why is the bearing of a shaft or saw arbor called a journal? Because when it rotates, it is supposed to travel or go on a journey, and take notes thereof—hence journal.

B. A. J., of Wis.—If thills are pivoted to a wagon below the line of draft, the horse lifts the load to some extent, and thus does not draw quite so hard; but, as what he does not draw he carries, his work is just as hard, if not harder than it would be if the thills were pivoted higher.

J. D. N., of Ca.—A person acquainted with arithmetic can, if ordinarily intelligent, and willing to apply himself closely to study, make very fair progress in algebra without an instructor.

R. H., of Vt.—Like all other perpetual motion devices we have seen, yours has the trifling difficulty that it cannot be got to work on its own account. The reason is given in another column, in an article entitled "Mechanical Power and Specific Work."

B. G. C., of Ala.—The unpleasant odor of gas stoves, arises from the permeability of the tubing, and partly from the products of combustion. The latter does not render the food cooked unwholesome, but the air is rendered more or less unfit for breathing, and of course deleterious to health, unless good ventilation is secured.

J. G., of ——, will find directions for building a cheap ice house on page 359, Vol. XXIII, of the SCIENTIFIC AMERICAN.

W. J. B., of Dakota.—The principal objection to the Belgian system of wire cable towing is the difficulty in dealing with the slack, and keeping the cable in the center of the canal in rounding curves.

T. H., of Mo.—If, as you say, you have been a reader of the SCIENTIFIC AMERICAN for six years, you ought to have learned from it by this time that there is no such substance as you inquire for. The old "sailor man" who tells you he can discover gold or silver, by attraction of divining rods or magnets, is either self-deluded or is trying to delude you.

G. V., of Conn.—Have received a large number of letters on the canal question, for publication, where the parties desired to put their inventions against a modest amount of capital. We have not room for yours.

A., of N. Y.—The information you seek will be partly found in Box's "Treatise on Heat." To find complete data, you will need to search through many different works relating to heat.

W. B. W., of N. Y.—The U. S. gold coins are alloyed with copper.

J. E. W., of N. Y.—Brass scraps are remelted and used. They sell readily as old brass. Leather scraps are also utilized by a process you will find in another column.

NEW BOOKS AND PUBLICATIONS.

HERMES MERCURIUS TRISMEGISTUS; his Divine Pymander Also, The Asiatic Mystery, The Smaragdine Table, and the Song of Brahm. Edited by Paschal Beverly Randolph. 8vo, pp. 144. Boston: Rosicrucian Publishing Company. 1871.

We are told in the preface of this book that "the Divine Pymander, or Poemander, as it is now more commonly rendered, meaning 'shepherd of men,' comes from Egypt. It is not a child's book, nor a sectarian work, but it is a divine revelation." Further on it says: "In this book, though so very old, is contained more true knowledge of God and Nature than in all the books in the world, I except only Sacred Writ." The Rosicrucians who publish the book, say of themselves: "We claim to stand in the door of the dawn, within the cryptic portals of the luminous worlds, and that the lamp that lights us is Love Supreme! Unlike others, we do not recognize God as the Light—for this can be seen and known—but as the *Unfathomable Shadow*, the unsearchable *Center*, the impenetrable *Mystery*, the unimaginable *Majeste—utterly* past discovery—and who, as we approach, ever recedes, luring us through illimitable ages and epochs, up the steep mountain of *Achievement*—the whole end of man's being—in which opinion we of course differ from all philosophies in Christendom." Then, to show what they mean by "achievement," they express the following very high opinion o three well known modern characters—"Men, for instance, like James G. Bennett, James Fisk, Jr., and B. F. Butler, beyond all cavil the three ablest men on this continent, in their respective spheres, and whose superiors in absolute individuality of character cannot, today, be found on earth; born *kings of will*, and intensity of purpose"—in fact, we suppose they represent the *trismegistus*, or thrice great Hermes of modern times. We have not room for more extracts, and can only say that philologists have pretty much come to the conclusion that no such person as Hermes ever existed, and that the twenty thousand books attributed to him are quite as apochryphal as the author himself. The presumption also is that the Rosicrucians never had more actual existence than the Pickwick Club.

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Recent American and Foreign Patents.

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

OFFICE INDICATOR.—Lewis Burger, of Chicago, assignor of three fourths his right to W. S. Gobble, of Scottsville, Ill.—A novel combination of parts whereby the necessary routine information will be given to parties inspecting it when the office is closed or open, has a tablet for orders, a small receptacle for business cards, a letter box, a clock dial, whose hands can be set to indicate the hour at which the office is opened or closed, disks which display through appropriate apertures the day of week, month, and name of month respectively, etc.

MILKMEN'S SIGNALS.—Elisha Belcher Blake, of Tarrytown, N. Y.—This invention has for its object to furnish an improved house or receptacle for the pitcher or other vessel in which the milk is received from the milkman, to protect said vessel from dust, dogs, cats, rain, etc., and obviate the necessity, of watching for the milkman, and which shall be so constructed as to sound an alarm when the door is opened. If no other benefit should be derived from this invention than the suppression of the unearthly screech with which milkmen in New York and Brooklyn announce their arrival, the inventor must be hailed as a public benefactor.

APPARATUS FOR STEAMING AND FILTERING.—John Murdock, of South Carver, Mass.—The object of this invention is to provide convenient and simple means for performing various operations in and around the household, and it consists in a receptacle elevated on legs, with a funnel shaped bottom and flanged top, whereby it is adapted for steaming substances smoking meat, filtering water, etc. Upon this receptacle is placed a cask in steaming food for cattle or in smoking meats. Filtering material is placed in the funnel in cleansing water. One or more casks or vessels may be fitted to the stand, as seen in the drawing, and used as occasion may require. In filtering or leaching, the purified liquid or lye is discharged through a pipe at the bottom. Steam may be introduced through a pipe for cooking vegetables for feeding animals. A small stove may be connected with the funnel, in which sawdust or other combustible material may be slowly burned for smoking meat in a cask. All the operations referred to have to be performed on the farm, and great inconvenience has been experienced for the want of a suitable stand on which to support barrels or vessels for these purposes. By this stand the barrel is suitably elevated and supported and the processes named may be performed in a convenient manner.

EYE BALSAM.—William Klingbell, of Champaign City, Ill., has invented an eye balsam, composed of various substances found in the U. S. Dispensatory, which, applied externally, in such proportions and at such intervals as will appear most adapted to the nature of each case, will, he claims, cure diseases and defects of the eye, especially those leading to or arising from short-sightedness.

GRATE BAR.—William Muir, Archibald, and Pierce Butler, Carbondale, Pa.—These grate bars have a broad base and narrow top, with concave sides and oval top, and a deep longitudinal groove in the bottom; they also have numerous transverse openings from the bottom up through the sides and part of the top, calculated to extend upwards considerably in the fuel to admit the air freely to fine fuel, such as culm, sawdust, spent tan bark, and the like.

WATER FILTER.—William Linton, Baltimore, Md.—This invention relates to a filter so constructed that a large central chamber is provided for the reception of asbestos, which constitutes the filtering material used, and in which a smaller chamber is formed at each end of the cylinder or case, the same being divided by a scroll or spiral partition, so that the water takes a spiral course on entering and leaving the filter. Suitable nozzles are also provided for reversing the current of water and thus cleansing the filter.

SOLDERING FURNACE.—Andrew J. Burke, Baltimore, Md.—This invention consists in an apparatus whereby the soldering of the parts of a can together is effected, without the use of the hot iron, by causing the cans to gradually advance along a heated plate till the solder becomes melted, and then shoving the cans aside upon a cooler plate, where they remain till the solder cools, and the parts are thereby joined together.

TENONING MACHINE.—This is a machine for trimming tenons of wood, whereby, it is claimed, much time is saved and the work is more accurately performed than it has hitherto been. It consists in a knife and adjustable guides in combination with a properly constructed frame. The machine is adapted to various kinds of tenons, but is especially useful in trimming spoke tenons. An adjustable guide supports the small end of the spoke while the sides of the tenon at the other end are being trimmed. In trimming the sides of the tenon the main guide is adjusted so as to give the tenons the desired thickness. In being trimmed, the spoke is held firmly in the required position by two guides, one of which slides out and in or to and from the bed, and is varied as to hight by means of an incline. For trimming the edges of the spoke tenon, a flap or apron is adjusted or inclined to correspond with the disk of the wheel, and the knife will cut the edge of the tenon so that it will fit the mortise in the hub and give the proper or desired dish to the wheel. The machine may be used in making wooden wedges, the flap in this case being adjusted to give the wedge the desired angle. Andrew C. McQuaid, of Wenona, Ill., is the inventor.

SEATS FOR STORES.—Socket plates are affixed to the under side of the counter, in which brackets are fitted, which support the seats in such a way that both brackets and seats may be turned under the counter when not in use. Daniel Christian, of Chagrin Falls, Ohio.

PROPELLING BOATS BY OARS.—The oar is made in two parts, and the other portions of the device are so constructed that the rower may sit with his face in the direction the boat is advancing, and at the same time feather his oars. The invention of Thomas G. Pringle, of New York city.

COAL SCUTTLE.—The invention of Edgar Eltinge, of Kingston, N. Y., has for its object the improvement of a shield or cover patented by him in 1866. It consists in a construction and combination of parts, designed to make the shield cheaper and more convenient.

ATTACHMENT FOR VACUUM CUPS.—This invention supplies an electro-magnetic or galvanic attachment for Dr. Hadley's vacuum cups and receivers, patented in 1867, by the use of which an electric, galvanic, or magnetic action is exerted upon the selected nerves, and conveyed to any part of the nervous system, at the same time that an influence is exerted upon the arteries, veins and lymphatics, when a vacuum is produced in said cups or receivers. William Amer, of Janesville, Wis., is the inventor.

SILK SWIFTS.—John N. Stearns, of New York city.—The heads of the swift are made of sheet metal, of circular or other suitable form. The central axle is made also of sheet metal, tubular, and soldered to the centers of the heads. The projecting gudgeons, by which the swift is hung in the supporting frame, are rivets driven through the plates, so that their heads abut against the inner faces of said plates. They are retained in place by solder, and the central tubular axle is applied after the rivets have been secured, and covers their heads. The silk holders or rounds are of wire, and their ends are fitted through apertures in the end plates, and soldered to outer faces; or they may be laid over the edges of the plates and then soldered to their outer faces. It is claimed that by making a metallic swift in the manner specified, lightness, durability and cheapness are secured.

WRENCHES AND PIPE TONGS.—James A. Morrison, of Brady's Bend, Pa., has invented a combined pipe tongs and wrench. The device consists of two handles, curved on one side of their pivot, and two curved serrated jaws pivoted thereto, in such a manner as to adapt them to hold tubes, etc., whether true cylinders or not. The rear parts or handles of the levers or arms are made straight, and their forward parts are curved, so as to point toward each other, and upon them are formed tenons, which enter recesses in the convex sides or backs of the curved jaws, to which they are detachably pivoted by short bolts and nuts, so that the said jaws may adjust themselves to objects of different sizes and shapes.

IMPROVEMENT IN CONSTRUCTION OF CARS.—The car is made mainly in tubular form and of sheet metal, except a supporting frame or platform. The latter is composed of two long parallel beams tied together by cross-bars, and the body consists of an outer shell of sheet metal plates bent over T ribs, and an inner shelf, similarly fitted to the inner sides of the said ribs. The ribs rest at the ends on the timbers, and are firmly attached to them, and spring over from one to the other in a true circle. The ribs are arranged as far apart as the width of the sheets which are joined thereto and secured by riveting or by any other means. A level floor stretches from side to side above the beams and rests thereon, and a curved plate is suspended between the beams below the floor to form an air passage for admitting air from the ends along under the floor, to rise up into the car through holes therein, and between the outer and inner shell. The inner shell is perforated for allowing air to enter between the two walls, above the contents, and to pass down and into the contents, when of grain or other like substance, through the perforations below the grain; or air may enter the spaces from below the bottom, the latter being supported above the beams and passages provided between it and the beams.—John E. Leeper, of Godfrey, Ill., is the inventor.

PLOW ATTACHMENT.—John T. Hovis, Clintonville, Pa.—This invention relates to the combination with a plow of a vertically reciprocating cutter bar, similar to those used in mowing machines, the office of which is to sever such lodged and prostrate grass stalks, stubble, etc., as might lie in the line of the furrow, thus preventing the plow from clogging with such vegetable matter, and also enabling it to turn the same under, so that it may rot, and thereby fertilize the soil.

MAGAZINE FIREARMS.—John L. Kirk, of Mattoon, Ill.—This invention consists in the arrangement of certain devices to form one of the now numerous class of firearms which carry a magazine of ammunition in a cylinder, composed of a cluster of barrels or tubes, soldered or otherwise fastened together. The construction gives a very compact and apparently effective arm.

GRAIN CLEANER.—John H. Weaver, of Gap, Pa.—This is a new combination of familiar devices in a fanning mill, or grain cleaner, whereby the inventor claims increased efficiency in separating wheat and other grains from chaff and other foreign bodies, such as straw, sticks, seeds, etc.

ELECTRO-MAGNETIC MEDICAL APPARATUS.—This invention relates to several improvements in the arrangement of electric apparatus used for generating electrical currents, which are to be applied to invalid and sick persons, for healing diseases. It consists in an improved arrangement of the battery, binding terminals, and adjustable magnets, and in a novel general combination of parts, whereby a compact, safe, and portable apparatus is produced. Albert J. Steele, of Brooklyn, N. Y., is the inventor.

HARNESS BUCKLE.—Thomas Crakes, of Mishawaka, Ind.—This invention has for its object improvement in buckles, or fastenings, for various parts of harness for horses, etc., but more especially designed for coupling the hames. The end parts of the buckle are made with hooks, or eyes, upon the outer ends, to hook into eyes, or rings, attached to the straps or hames to be connected. The other parts of the buckle are constructed to give a convenient and secure fastening.

REVOLVING FIREARMS.—John L. Moss and Edward W. Johnson, of Columbus, Miss.—This invention has for its object to facilitate the loading and shell extracting process in revolving rifles and pistols; and consists, principally, in the use of a rotary breech plate, which is hung upon the base pin, so that it will revolve, but not slide thereon, while the cylinder can freely slide, being connected with the barrel by keys. The breech plate has grooved supports for the cartridge head, and will retain the shells when the cylinder is carried forward, extracting them from the latter.

HARVESTER DROPPER.—John N. Wallis and Theodore Wallis (assignors of one third of their right to Henry G. Wise), of Fleming, N. Y.—This invention has for its object to furnish an improved attachment for harvesters, which shall be so constructed as to drop the grain in compact gavels at the rear of the body of the machine, entirely out of the way of the machine on its next round, and which is at the same time simple in construction and convenient in operation. The dropper consists in a series of parallel bars, or slats, attached at their forward ends to a shaft, the journals of which work in bearings in the framework. The framework is extended back, with an inclination toward the rear of the body of the machine, and to its pivoted rollers, around which passes an endless apron. The endless apron is driven from the mechanism of the reaper, and is designed to receive the gavels from the dropper, transfer them to the rear of the body of the machine, and drop them. The grain is transferred from the dropper to the endless apron by a beater, which consists of a series of slightly curved fingers, attached to a shaft, the journals of which work in bearings in the frame work. The fingers of the beater pass up between the slats of the dropper, lift the grain from said dropper, and transfer it to the endless apron. The throw or movement of the beater may be regulated as desired. A foot lever, operated by the driver, serves to throw the apparatus into or out of gear. The harvester should be provided with a stop, to prevent the cut grain from falling upon the dropper while the grain upon said dropper is being transferred to the endless apron.

WATER WHEEL.—This invention has for its object to furnish an improved water wheel, which shall be so constructed as to overcome the lateral and centrifugal pressure that is wasted upon the rims and scrolls of most wheels, and thus produces no useful effect. Upon the interior surface of the outer sides of the buckets are formed curved flutes, shoulders, or offsets, the effect of which is to give the water a spiral direction, and distribute it equally over the discharge or reaction buckets, thus preventing the wheel from clogging, and relieving the scroll from the centrifugal and lateral pressure. George W. Leonard, of Middle Valley, Pa., is the inventor.

SIDE-HILL PLOW.—George W. Leonard, of Middle Valley, Pa., has invented a swivel, or side-hill plow, so constructed as to raise the top of the working mold board to prevent it from clogging, and to enable it to turn a better furrow. It consists in the combination, with the double mold board, of an adjustable plate. Each edge of the forward part of the double mold board serves alternately as a share and as a cutter, as the double mold board may be turned to turn the furrow to the right hand and to the left hand side of the plow. The division line between the two mold boards of a swivel or side-hill plow must necessarily be low, so that it does not properly turn the furrow sluice, and is liable to choke and clog. To remedy this, the inventor pivots a plate to the upper part of the double mold board. The lower part of the plate is so formed that when turned to either side it locks fast, and forms a continuation upward of the mold board of the other side, causing the plow to work much more effectively, turning a better furrow.

EXTENSION SHANK FOR BORING BITS.—William S. Pattin, of Portsmouth Ohio, has invented an improved means for locking a bit holder and bit, so that the latter will have no side play, but will tend to move constantly, without deviation, and in a perpendicular line, through the timber. If it be perceived to bind or work with unusual friction, a turn on a nut forces a sleeve upon the converging shank of the bit, and centers the latter in perfect alignment with the stock. An extension shank is fastened in the bit in the same way as ordinary bits. The end of the shank is provided with a fastening dog for securing the bit. The sleeve is square inside, and from the screw thread the extension shank is square to the end to fit the sleeve. When the sleeve is allowed to slide back on the extension shank, the fastening dog, being pivoted loosely to the shank, falls back, and allows the end of the bit to enter. When the sleeve is forced up by the nut, the dog is inclosed by the sleeve, and a hook enters the notch in the end of the bit shank, while the end of the sleeve incloses the shank of the bit and firmly holds it in place.

FURNACE FOR MELTING ORES AND METALS.—This invention relates to a new and important improvement in the process of melting iron in cupolas, or melting pots, which, it is claimed, has demonstrated its utility in actual use. It consists in allowing one or more currents of air to enter the cupola or pot above the tweers, during the process of melting, thus supplying an additional quantity of oxygen to the carbon in the cupola, thereby converting the carbonic oxide evolved into carbonic acid, greatly increasing the temperature in the furnace by producing a more perfect combustion, and consequently more perfectly liquefying the iron. One or more pipes are introduced into the cupola, at any point above the tweers, and either above or below the feed door. Each has a funnel attached to it, the lower end of which extends to near the floor, or as low as may be found desirable. The upward rush of the gases in the cupola, produced by the blast below, causes a strong draft of air through the pipe into the cupola, producing the results before stated. By this simple device it is claimed that the iron is rendered more fluid, its quality is improved, and certain castings, which have hitherto baffled the most skillful foundery men, are produced with the utmost ease, sound and perfect in all respects. W. S. Wood, of Newtown, N.Y., is the inventor.

SASH LOCK.—This is the invention of Robert R. Ball, of West Meriden, Conn. It is a simple, and at the same time effective, sash holder and lock.

WATER GATE.—William C. Hopwood, Fillmore, Ind.—This invention consists in the combination of a gate for water-course fences, with an iron rod stretched across the stream, either in one piece, or in as many different sections as may be necessary, said rod being properly fastened at its ends to the banks of the stream, and, at as many intermediate points as may be expedient, to posts or stones in the bed of the stream. The gate aforesaid is also combined with braces, which, when the water is low, rest on the bottom of the stream and keep the gate upright.

APPLICATIONS FOR EXTENSION OF PATENTS.

PUMP.—J. D. West, East Orange, N. J., has petitioned for an extension of the above patent. Day of hearing, September 13, 1871.

HORSE POWER.—George E. Burt, of Harvard, and Abram Wright and Geo. F. Wright, of Clinton, Mass., have petitioned for an extension of the above patent. Day of hearing, September 6, 1871.

ROCK CUTTING AND DRILLING MACHINE.—William Plumer, Boston, Mass., has petitioned for an extension of the above patent. Day of hearing, September 20, 1871.

HAND STAMP.—T. J. W. Robertson, Washington, D.C., has petitioned for an extension of the above patent. Day of hearing, September 6, 1871.

Value of Extended Patents.

Did patentees realize the fact that their inventions are likely to be more productive of profit during the seven years of extension than the first full term for which their patents were granted, we think more would avail themselves of the extension privilege. Patents granted prior to 1861 may be extended for seven years, for the benefit of the inventor, or of his heirs in case of the decease of the former, by due application to the Patent Office, ninety days before the termination of the patent. The extended time inures to the benefit of the inventor, the assignees under the first term having no rights under the extension, except by special agreement. The Government fee for an extension is $100, and it is necessary that good professional service be obtained to conduct the business before the Patent Office. Full information as to extensions may be had by addressing

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116,252.—GUN LOCK.—J. Albright, Pleasant View, Mo.
116,253.—DIVIDING POWDERS.—G. P. Allen, Woodbury, Conn
116,254.—HORSE HAY RAKE.—F. Andrews, Galesburg, Ill.
116,255.—BOILER.—J. F. Antisdell, G. W. Cronk, J. H. Haviland Janesville, Wis.
116,256.—GAGE.—Wm. E. Babcock, East Pembroke, N. Y.
116,257.—FASTENER.—A. G. Batchelder, Lowell, Mass.
116,258.—PATTERN CUTTER.—J. Bean, Jr., Pent Water, Mich
116,259.—SECTIONAL BOILER.—B. F. Bee, Harwich, Mass.
116,260.—BOLTING FLOUR.—L. G. Binkly, Baughman, Ohio.
116,261.—SERVING RIGGING.—I. W. Bowden and J. D. Leach Penobscot, Me.
116,262.—CORN SHELLER.—O. A. Bryhn, W. T. Farre, Montreal, Canada.
116,263.—SCREW MACHINE.—A. Buckminster, Boston, Mass.
116,264.—TWEER.—John Cappon, Rochester, N. Y.
116,265.—BLOWER.—E. Carleton, Cape Elizabeth, Me.
116,266.—TEMPERING SPRINGS.—A. Cary, New York city.
116,267.—TEMPERING OVENS.—A. Cary, New York city.
116,268.—CURRY COMB.—Jules Chaumont, Woodhaven, N.Y
116,269.—SAW FRAME.—W. Clemson, Middletown, N. Y.
116,270.—BOLT MACHINE.—D. S. Coe, Pine Meadow, Conn.
116,271.—CHAIR.—N., C. O., and A. Collingnon, Closter, N. J.
116,272.—HEAD LIGHT.—A. Collins, J. Hardy, Galesburg, Ill.
116,273.—VALVE.—A.A. Common, Regent's Park, London, Eng.
116,274.—SEASONING WOOD.—S. Constant, Peekskill, and J. Smith, Brooklyn, N. Y.
116,275.—MECHANICAL FIRING.—S. Danks, Cincinnati, Ohio.
116,276.—PENCIL SHARPENER.—S. Darling, Providence, R. I.
116,277.—IRONING BOARD.—J. W. Davis, Reno, Nev.
116,278.—PULVERIZER.—G. P. De Yo, Groton township, Ohio
116,279.—DRYER.—E. Drevet, New York city.
116,280.—EGG CARRIER.—W. Duchemin, Charlottetown, P.E.I.
116,281.—CANAL BOAT.—W. T. Duvall, Georgetown, D. C.
116,282.—DREDGING MACHINE.—John Ebert, Chicago, Ill.
116,283.—STEAM GENERATOR.—N. T. Edson, New Orleans, La.
116,284.—VEHICLE.—Clark Elliott, Woodland, Cal.
116,285.—DYNAMOMETER.—James Emerson, Lowell, Mass.
116,286.—ATOMIZER.—James J. Essex, Newport, R. I.
116,287.—SAFE.—John Farrell, New York city.
116,288.—PUNCHING MACH.—D. A. Faulkner, Centreville, Cal.
116,289.—MOVABLE STANDARD.—W. D. Fink, Windsor, Ill.
116,290.—RING DRIVER.—A. Fisher, Whitinsville, Mass.
116,291.—FLESH FORK.—Paul Fisher, Brooklyn, N. Y.
116,292.—LAMP BURNER.—S. W. Fowler, Brooklyn, N. Y.
116,293.—STEAM ENGINE.—S. B. Freeman, Ashland, Ohio.
116,294.—HOT AIR REGISTER.—D'A. T. Gale, Fort Wayne, Ind
116,295.—LAWN MOWER.—H. R. Gard, Chicago, Ill.
116,296.—LIFTING JACK.—E. R. Gard, Chicago, Ill.
116,297.—SPADING MACHINE.—L. H. Gibbs, Brooklyn, N. Y.
116,298.—ROASTING COFFEE.—J. W. Gillies, New York city.
116,299.—TREATING COFFEE.—J. W. Gillies, New York city
116,300.—HAY ELEVATOR.—C. E. Gladding, Towanda, Pa.
116,301.—SPINDLE.—D. P. Glines, Manchester, N. H.
116,302.—SASH BALANCE.—Lewis Goodwin, Bangor, Me.
116,303.—SEWING MACHINE.—T. Green, Brooklyn, N. Y.
116,304.—STEREOTYPE MOLD.—Louis Guex, New York city
116,305.—SHIELD.—C. S. Hall, Rochester, N. Y.
116,306.—SHOW CASE.—G. A. Hearn, Jr., New York city.
116,307.—CLAMP.—E. Hedge, Liverpool, T. H. Fleming, Canton, Ill
116,308.—WAGON BED.—S. Heffley, J. D. Pettit, Rochester, Ind.
116,309.—WATER CONDUCTOR.—L. B. Hill, Albany, N. Y.
116,310.—MEDICAL COMPOUND.—M. Holst, Memphis, Tenn.
116,311.—SPRING HEAD.—G. Hopson, Bridgeport, Conn.
116,312.—STEAM ENGINE.—John Houpt, Springtown, Pa.
116,313.—SLEIGH PROPELLER.—C. H. Hudson, New York city.
116,314.—PLOW.—Edwin Jennings, Candor, N. Y.
116,315.—MOWING MACHINE.—S. Johnston, Brockport, N. Y.
116,316.—CALENDAR WATCH.—A. C. Ionais, Chaux-de-Fond, Switzerland.
116,317.—JOURNAL BEARING.—A. F. Jones, New York city.
116,318.—SAFETY POCKET.—Elias Jones, Grand River, Iowa.
116,319.—VENTILATOR.—N. Jones, Buffalo, N. Y.
116,320.—EARTH CLOSET.—W. A. Jordan, New Orleans, La.
116,321.—GAS REGULATOR.—P. Keller, New York city.
116,322.—RUBBER COMPOUND.—P. J. Kelly, New York city.
116,323.—PUNCHING MACHINE.—C. Keniston, Somerville, Ms
116,324.—FURNACE.—F. Kesseler, San Francisco, Cal.
116,325.—HAND TRUCK.—T. F. Kiff, Fairbury, Ill.
116,326.—FAUCET.—John Knoche, Cincinnati, Ohio.
116,327.—SEED PLANTER.—Wm. Knowland and K. Collings, Henryville, Ind.
116,328.—FLAX BRAKE.—J. C. Kurtz, Wooster, Ohio.
116,329.—FENCE.—John A. Kysor, Leon, N. Y.
116,330.—PAN LIFTER.—W. H. S. Lawrence and C. I. Collamore, Bangor, Me.
116,331.—SHUTTLE.—G. H. Lenher, Elizabeth, N. J.
116,332.—GANG PLOW.—M. Likes, Mansfield, Ohio.
116,333.—DRYING MACHINE.—J. O. Luther and Peter Staab, Grafton, Wis.
116,334.—STOVE DOOR.—D. N. Martin, Lawrence, Mass.
116,335.—LITHOGRAPHIC PRESS.—C. C. Maurice, New York.
116,336.—PISTON PACKING.—J. McAlonan, New York city.
116,337.—HOT AIR REGISTER.—J. W. McGlashan, Montreal, C
116,338.—WASHER AND BLEACHER.—H. Monroe, Baldwinsville, N. Y.
116,339.—FURNACE.—H. Mooers, Chicago, Ill.
116,340.—STEAM ENGINE.—C. Moore, New York city.
116,341.—BRICK MACHINE.—A. Morand, Leeds, England.
116,342.—PARING MACHINE.—S. H. Morse, North Jay, Me.
116,343.—CURTAIN FIXTURE.—B. Moser, Waltham, Mass.
116,344.—REFRIGERATOR.—C. E. Munroe, Cambridge, Mass
116,345.—DIE.—W. Noble, Derby, Conn.
116,346.—SCRUBBING BRUSH.—P. O'Brian, New York city.

116,347.—Bottle Stopper.—J. Park, Philadelphia, Pa.
116,348.—Churn.—T. B. Parke, Downieville, Cal.
116,349.—Gas Regulator.—C. C. Place, Boston, Mass.
116,350.—Folding Lounge.—W. Prufrock, St. Louis, Mo.
116,351.—Copying Apparatus. W. J. Purcell, New York city.
116,352.—Steam Engine.—W. Race, Lockport, N. Y.
116,353.—Piston Head.—J. Rees, Pittsburgh, Pa.
116,354.—Bed Bottom.—G. W. Robinson, Galesburg, Ill.
116,355.—Plow.—A. Roden, Mumford, Ala.
116,356.—Thrashing Machine.—C. E. Roper, Canton, Ohio.
116,357.—Steam Engine.—C. F. Roth. Osceola. Iowa.
116,358.—Gaselier.—J. H. Seaman, Brooklyn, N. Y.
116,359.—Gaselier.—J. H. Seaman, Brooklyn, N. Y.
116,360.—Gaselier.—J. H. Seaman, Brooklyn, N. Y.
116,361.—Cooling Bone Black.—C. H. Senff, New York city.
116,362.—Water Meter.—J. C. Slaughter, New York city.
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116,364.—Firearm.—W. T. Snedden, Johnstown, Pa.
116,365.—Heater.—G. B. Snider, New York city.
116,366.—Tank.—H. F. and G. S. Snyder, Williamsport, and A. Snyder, Freeport, Pa.
116,367.—Dowel Brad.—J. Sowle, Boston, Mass.
116,368.—Pessary.—H. Spillman, New Orleans, La.
116,369.—Seat.—D. I. Stagg, New York city.
116,370.—Valve.—N. P. Stevens, Hopkinton, N. H.
116,371.—Pipe Machine.—J. W. Stockwell, Portland, Me.
116,372.—Die.—H. Thompson, Concord, N. H.
116,373.—Cigar Box.—J. L. Thomson, Syracuse, N. Y.
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116,456.—Die.—W. W. Knowles, L. S. While, Plantsville, Ct.
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116,467.—Folding Machine.—J. C. Mayall, Boston, Mass.
116,469.—Hasp Lock.—W. C. McGill, Cincinnati, Ohio.
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116,472.—Body Loop.—R. R. Miller, Plantsville, Conn.
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116,485.—Cylinder Cock.—J. Porteus, Cincinnati, Ohio.
116,486.—Shaft Protector.—A. S. Porter, N. Bridgewater, Ms.
116,487.—Crank.—E. Quinn, Brooklyn, N. Y.
116,488.—Washing Machine.—H. Richardson, Lyndon, Ill.
116,489.—Fuel.—E. H. Richter, Taunton, Mass.
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116,492.—Trunk.—E. A. G. Roulstone, Boston, Mass.
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116,494.—Rail Joint.—J. C. Rupp, Newark, Del.
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116,517.—Tool Rest.—J. S., A. N., and O. Wheeler, Worcester, Ms.
116,518.—Saddle Tree.—P. H. Wiedersum, New York city.
116,519.—Saddle Tree.—P. H. Weidersum, New York city.
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116,521.—Sewing Machine.—C. H. Willcox, New York city, C. Carleton, Brooklyn, N.Y.
116,522.—Sewing Machine.—C. H. Willcox, New York city, C. Carleton, Brooklyn, N.Y.
116,523.—Sewing Machine.—C. H. Willcox, New York city, C. Carleton, Brooklyn, N.Y.
116,524.—Evaporating Pan.—J. B. Williams, Glastonbury, Ct.
116,525.—Washing Machine.—G. L. Witsil, Beverly, N. J.
116,526.—Gate.—J. A. Wood, Crosswicks, N. J.
116,527.—Hand Car.—M. E. Hastings, Salisbury, Md.
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4,438.—Stovepipe Thimble.—C. A. Buttles, Milwaukee, Wis.—Patent No. 95,649, dated Oct. 12, 1869.
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4,440.—Lubricator.—H. Grogan, Flatbush, N. Y.—Patent No. 106,053, dated Aug. 2, 1870.
4,441.—Glass.—E. Ingraham, Bristol, Conn.—Patent No. 109,626, dated Nov. 29, 1870.
4,442.—Brush.—R. King, Brooklyn, N.Y.—Patent No. 60,013, dated Nov. 27, 1866.
4,443.—Fluting Iron.—M. H. Knapp, Fulton, N.Y.—Patent No. 105,953, dated Aug. 2, 1870.
4,444.—Imitation Braid, etc.—H. Loewenberg, New York city.—Patent No. 106,068, dated Aug. 2, 1870.
4,445.—Medical Compound.—D. Slade, Chicago, Ill.—Patent No. 112,858, dated March 21, 1871.
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5,043.—Shovel.—P. W. Groom, Philadelphia, Pa.
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5,045.—Black Lead Block.—W. C. James, Plymouth, Eng.
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5,048.—Boring Machine.—C. E. McBeth, F. Bentel, F. Margedant, Hamilton, O.
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5,050.—Photographic Card Frame.—M. J. Rice, Boston, Mass.
5,051.—Carriage Spring.—G. B. Robinson, Derby, Conn.
5,052.—Bobbin Score.—John Salisbury, Scituate, R. I.
5,053.—Buckle.—Louis Schindler, St. Peter, Minn.
5,054.—Buckle and Ring.—F. A. Schultz, Mt. Pleasant, Iowa.
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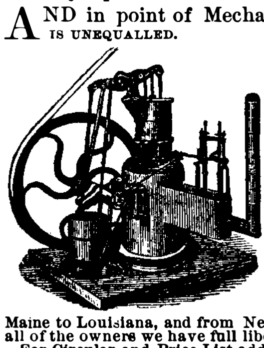

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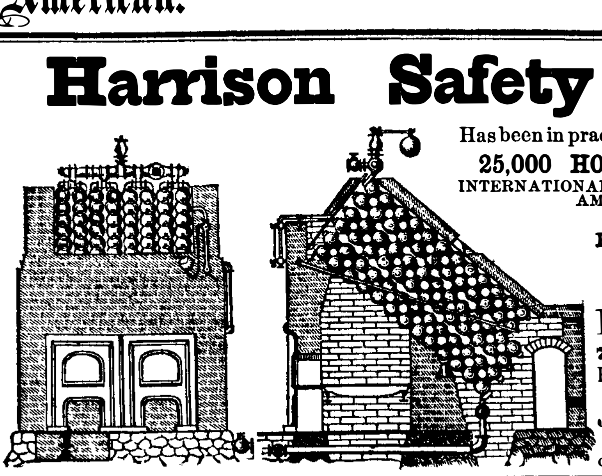

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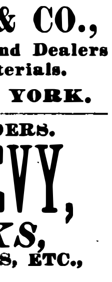

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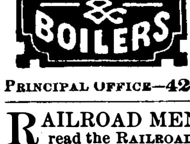

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