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IMPROVED STEAM ENGINE.

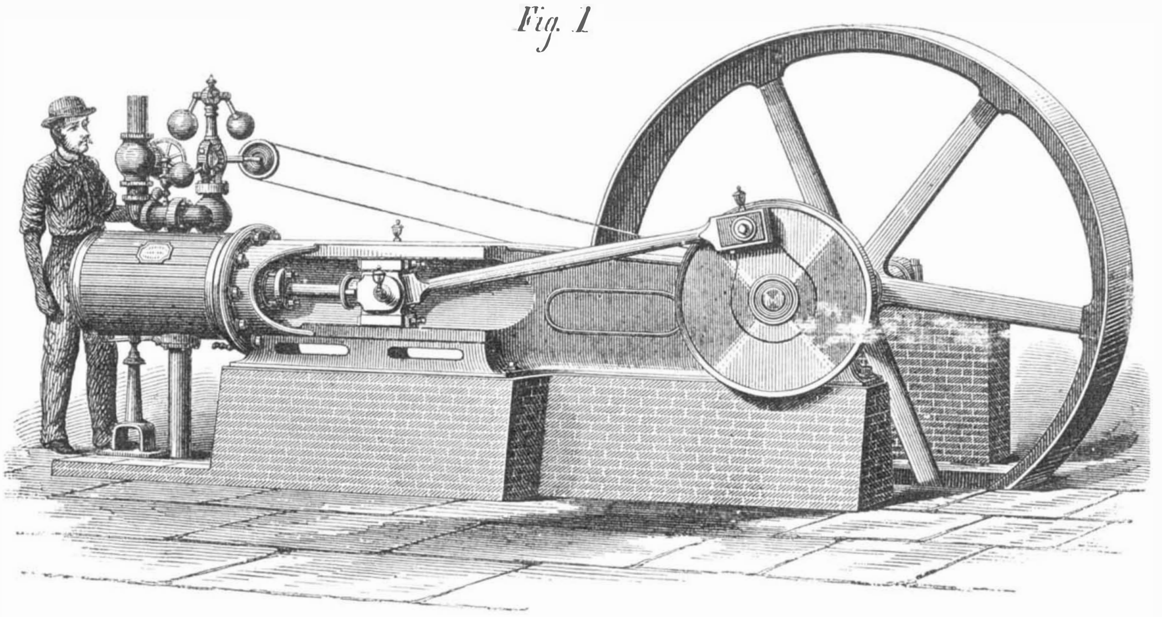
The accompanying engravings, Figs. 1 and 2, convey a clear idea of the construction of a new form of steam engine, in which the improvements relate more especially to increased durability, strength, and consequent economy of wear. It is unnecessary to enter into any detailed description of the working parts, as their arrangement will be easily understood by the mechanical reader from a glance at the illustrations. It will be noticed that the metal in the bed or main frame is so disposed as to insure the greatest possible strength. The working strain acts in a line through the center, thus relieving the engine from the powerful and unequal leverage incident to many common though defective modes of construction. The masonry composing the foundation forms a support against the upward or downward pressure on the guides by the leverage due to the distance between the main bearing and the crank wrist. The guides, as shown, are cast to the main frame, and are bored out, from the same centers by which the ends are faced, to receive the cylinder and main bearing. It is therefore almost impossible for the machine to become out of center line, while the common difficulty of the foundation settling, thus throwing the connections in a twist and causing hot bearings, is entirely obviated. The counterbalanced crank insures a smooth and equable motion, so that the engine may ~~be run at a high rate of speed without in-~~jury.

A special point of advantage in this machine is a newly devised balanced slide valve, of which a sectional view is shown in Fig. 3. A is the slide valve, entirely through which the exhaust openings pass. B is a balanced metal plate to which is attached, as shown, a stem, on which is a piston, C, inclosed within the cylinder, E. The cylinder is open and the piston communicates with the external atmosphere at F. Between this cylinder, E, the steam chest cover, G, and the piston, C, is a copper disk, H, which forms a steam tight joint. A groove in this disk permits of a sufficient motion of the piston to be self-adjusting, and to compensate for the wear of the valve. The area of the piston, C, being a trifle smaller than that of the exhaust openings, it is evident that the steam pressure exerted on the former will be less than would be the case if the areas of both piston and exhausts were equal. Consequently, the pressure, towards the seat, of the steam which fills the chest is just sufficient to hold the plate, B, tightly against the slide valve, A. The latter will therefore move easily, whatever the pressure of the faces in contact which, though perfectly free, are in every way steam-tight. Friction on the valve, and resistance to its motion of every kind, is thus done away with, while the wear on the faces is reduced to a minimum. It will be seen that this device is all contained in the steam chest cover, and can therefore be readily attached to any engine, either locomotive or stationary, requiring only a new valve and cover to the ordinary steam chest. For railroad locomotives, this device is peculiarly valuable, as the very high pressure of steam used and rapid speed, combined, render the wear of the valve and its connections a source of continual annoyance and the expense of the considerable outlay to keep the parts in repair.

It will be seen that this arrangement does not, in any way, complicate the machine, but leaves the engine in operation as simple as those of the ordinary plain slide valve class.

Further information may be obtained from the manufacturers, Messrs. Frick & Bowman, of Waynesboro, Pa.

Fig. 1



THE FRICK AND BOWMAN STEAM ENGINE.

Fig. 2.

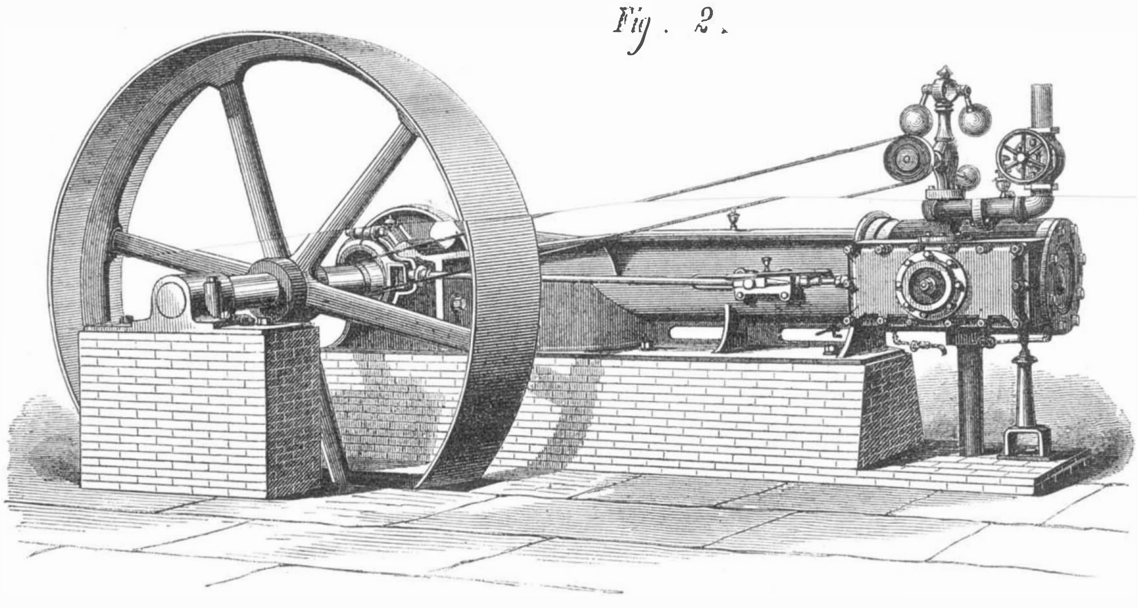
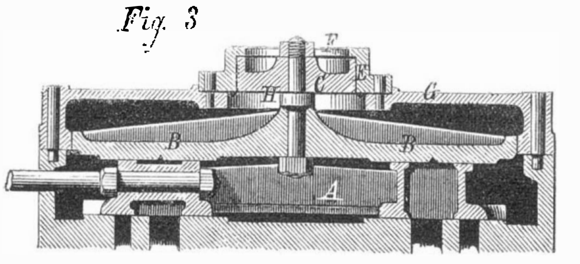


Fig. 3



Fragrant Bisulphide of Carbon.

It will be a matter of interest to some of our readers, says the British *Journal of Photography*, to know that the usually offensive liquid, bisulphide of carbon, can be obtained free from unpleasant smell, and this as an article of commerce. The value of the liquid as a solvent for resin and other purposes is very well known, but its extremely unpleasant ~~odor has hitherto greatly limited its use, notwithstand-~~ing the fact that it is very much cheaper than ether, and can be employed for many of the purposes to which ether is at present solely applied.

~~We do not know by~~ what process the commercially purified bisulphide is prepared; but, on a small scale, the following plan succeeds very well: Shake up about one per cent by weight of corrosive sublimate with the liquid bisulphide, and allow the bodies to stand for several days with repeated agitation. Some sulphur compounds appear to be removed in great part or decomposed by this treatment, for the mercury salt is rendered nearly black, owing to the formation of sulphide of mercury. This treatment so far reduces the unpleasant smell that, in distillation, a comparatively sweet smelling liquid is obtained; but a much better product is prepared if the bisulphide, after the treatment with the corrosive sublimate, be mixed with one third of its volume of almond oil, and then distilled after the mixture has rested for some time. Of course the bisulphide only distils over, since the oil is not volatile, but the former is now found to possess a rather agreeable ethereal odor. It is probable that the oil acts in somewhat the same way that fat or oil does in retaining the perfumes of flowers.

Paper Car Wheels.

The American Paper Car Wheel Company, at Pittsford, Vt., manufacture R. M. Allen's patent paper car wheels, which are coming into use quite largely. They are now in use on some of the Pullman palace cars, and are said to give perfect satisfaction. They are more expensive than the common wheel, but it is claimed that they will wear longer, injure the track less, and run with less noise and jar, than any other kind. They are manufactured by bringing a pressure of 350 tuns upon sheets of common straw paper, which forces them into a compact mass which is then turned perfectly round; and the hub is forced into a hole in the center, this requiring a pressure of 25 tuns. The tire is of steel and has a one quarter inch bevel upon its inner edge, thus allowing the paper filling to be forced in, 250 tuns' pressure being required in the process. Two iron plates, one upon each side of the paper, are bolted together, which prevents the possibility of the fillings coming out. The tire rests upon the paper only, and partakes of its elasticity.

Tempering Steel.

All sorts of mixtures and methods of tempering steel have been invented, and the sales of patent rights therefor have, in many cases, brought in fortunes to the patentees. One of the most promising, profitable, and apparently excellent of these patented processes is that of Garman & Siegfried, owned by the Steel Refining and Tempering Company, Boston, Mass. Congress has appropriated ten thousand dollars to pay for the right of use in the Government shops. It is said to impart an extraordinary hardness and durability to the poorest qualities of steel.

The following description of the process is from Siegfried's specification, patent of July 16, 1872:

I first heat the steel to a cherry red in a clean smith's fire, and then cover the steel with chloride of sodium (common salt), purifying the fire also by throwing in salt. I work the steel in this condition and while subjected to this treatment, until it is brought into nearly its finished form. I then substitute for the salt a compound composed of the following ingredients and in about the following proportions: One part, by weight, of each of the following substances: chloride of sodium, sulphate of copper, sal ammoniac, and sal soda, together with one half part, by weight, of pure nitrate of potassa, said ingredients being pulverized and mixed. I alternately heat the steel and treat it by covering with this mixture and hammering until it is thoroughly refined and brought into its finished form. I then return it to the fire and heat it slowly to a cherry red, and then plunge it into a bath composed of the following ingredients in substantially the following proportions for the required quantity: of rain water, one gallon; of alum, one ounce and a half; of sal soda, one ounce and a half; of sulphate of copper, one ounce and a half; of nitrate of potassa, one ounce; and of chloride of sodium, six ounces. These quantities and proportions are stated as being what I regard as practically the best, but it is manifest that they may be slightly changed without departing from the principle of my invention.

"What I claim as my improvement in the art of refining and tempering steel, and desire to secure by letters patent, is the successive processes or steps of the process, with the use of the materials or their equivalents, substantially as set forth.

EXHIBITION OF DOMESTIC ECONOMY IN PARIS.

We have already alluded on several occasions to the exhibition of domestic economy now being held in Paris. This exhibition is advancing towards completion, and on our last visit we noticed a large addition to the objects of interest. We noticed at first various types of velocipedes, made with particular care. Upon this class of toy appeared to have been lavished the utmost attention of a large number of constructors, who have attempted especially to give the utmost lightness and ease of seat to the rider. The velocipedes of M Jacquier, suspended on springs and with spokes of wire, are worth attention; the wheels are of iron, with the rims india rubber covered. M. Meyer has sent implements of the same kind. Those of M. Rocquemont are remarkable for their lightness and their elegance.

MM. Barbou et Fils exhibit some iron lifting jacks. This firm is well known for the large trade it has made in bottle racks of iron. The jack is worth notice. The rack by which it is actuated has a free movement until in contact with the object to be raised. A ratchet wheel regulates the movement of the rack, which can be fixed at will, and a vertical movement given it by means of a bent lever. This apparatus weighs only about 11 lbs., and can be placed in the carriage so as to be always on hand. Its lifting power is 1,100 lbs. The Beziat jack is intended for cellar use, in lifting casks gradually as they are emptied. A handle gives movement by gearing to a screw, by which the cask can be elevated or depressed.

M. Paillard exhibits a simple form of balance suitable for the perambulating vendors of coal and wood from house to house. The coal is thrown into the balance as it passes from the cart.

The horse stalls and stable fittings are conspicuous, and a word may be said for the mechanical shears of M. Adie. It is composed of two steel plates, one of which, placed on the other, is movable. The ends of both are notched teeth. The lower row have the points rounded, and project beyond the upper one, in such a manner that they entirely protect the skin of the horse from being injured; they serve at the same time as a comb, lifting the hairs, and drawing them between the cutting teeth. The Courtois circular shears are made on the same principle.

M. G. Gavillard (Chemazé Mayenne) exhibits impassable artificial fencings. They consist of galvanized iron wires twisted together and bristling with points, or with triangular pieces of zinc, or with ribands of zinc of which the edges are notched out in triangles and striking out right and left. Perhaps this system of fencing might be adopted with advantage on railways.

Messrs. André and Fleury exhibit a great variety of locksmith's work, wirework, gratings, and cagework for protecting trees. All these samples exhibit the application of iron bars having a triangular section, the angles of the triangles being rounded off and the sides being concave. This form has the advantage of great strength and a pleasing appearance.

Let us say a word here about the hand punching and shearing machines of M. Lecacheux. They consist, in principle, of a bent lever working the tool by means of the short branch, the long branch receiving the movement from a second bent lever. The workman, holding the long arm of this second lever by its extremity, makes it describe half a circle rapidly, and it is the impulse thus given to the machine which is utilized for punching or shearing. These tools punch and shear through sheet iron ½ of an inch thick, the punching machine punching holes half an inch in diameter. These cheap and simple machines may become very useful in command.

We stopped with much interest before the envelope making machine of M. Antoine (Paris). The envelopes are brought to the machine ready cut out but still open. The side which has to remain open is already gummed, but the the machine does all the rest of the work; by it the three other sides are gummed, folded, and pressed, as many as 25,000 envelopes being made per diem.

MM. Jaunot and Sons, mechanical engineers at Triel (Seine-et-Oise) exhibit products of their manufacture, mills with vertical millstones, crushing machines, collecting machines, sifting machines, hoists for raising mortar, etc. Their crushing machine consists of a wheel on a horizontal axle revolving round a vertical arbor, which receives its rotary motion by means of spur gearing. In its circular motion the wheel runs in the bottom of an annular trough with an open bar bottom containing the material to be crushed. When crushed, the material falls between the bars into a screen of conical form, where it is divided into two parts, the parts sufficiently fine passing through the sieve sides, while the others slide along the inclined surface of the screen and are collected and replaced in the trough.

M. Chameroy exhibits his piezometric gage and his intermittent tap. In towns where there exist, as at Paris, waterworks supplying many houses up to their highest stories, it often happens that the tenants, after having turned a tap to obtain water, forget to turn it off. This, in the long run, on the aggregate supply, is a serious loss. The intermittent tap is arranged in such a manner that the flow of water in a short time stops itself. This little instrument is therefore decidedly useful.

The caoutchouc valves of M. Perrot, mechanical engineer, Paris, are of an ingenious simplicity. They have been used for some time for water and gas. These valves are molded in one piece. The lower part consists in a thick tube grooved inside, into which the collar on the end of the pipe is fitted. The upper part of the tube is terminated by two oblique planes which join, following a diameter. These "lips" in their ordinary state are in contact. If a pressure comes on them, they give a perfectly hermetical seal. Internal ribs give the necessary strength to stand the pressure. If pressure, however feeble, takes place in the opposite direction, the lips open and give passage to the fluid. The valve is used also for the piston of pumps, and the inventor exhibits a garden suction and force pump, in which the piston and suction valve are both formed on his system.

The paper cutting machine, Coisne's system, exhibited by MM. Coisne and Didion, mechanical engineers, Paris, enables great thicknesses of paper to be cut. It is worked by hand or steam. The motion, which is continuous, is communicated to the blade by means of lengthening gear, which allows of the length of the blade being adjusted according to the work to be done.

MM. Frey and Sons, mechanical engineers, Paris, exhibit different samples of their work, boring tools, morticing machines, saws (fixed and portable) for felling trees in forests, etc.

MM. Oeschger, Mesdach, and Co. exhibit the production of the founderies and rolling mills at Biache St. Vaast (Nord), copper, lead, and zinc, in sheet and tubes, etc. We notice amongst these productions unions for joining small pipes and larger ones at right angles (for water or gas pipes). These unions are in brass. The end which has to join the smaller pipe is cylindrical, the other which has to fit the larger pipe is saddle shaped. Different types are made, varying from 15 to 100 millimeters diameter in the cylindrical part.

Continuing our walk, we find ourselves in the presence of various types of stoves. M. L. Aubert's portable stove, in sheet and cast iron, shows the application of a new movable grate, with compensating contraction and dilating arrangement.

MM. E. D'Hallu and L. Derchen, ventilating contractors, exhibit a bellows for domestic use, in which a blowpipe emits a blast of ordinary illuminating gas. The jet of gas directed on to a fire soon increases the combustion.

We may also take note of M. Pavy's dovetailed union bricks, by means of which the inventor erects different constructions, amongst other round towers.

Just a word for the fish shop on trucks, with iron frames and plate iron panels, of M. Maurice Grand. The same inventor exhibits a system of building in iron panels and bricks which forms a criterion of this mode of construction, the employment of which though not dating far back, seems to promise a great future. We have gathered on the spot the following figures, which, will enable our readers to form an idea of the price of a building on the Grand system. For a covered superficial area of 64 square meters, the price would be 4,500 francs, and for 54 square meters, 3,700 francs, or about 70 francs ($14) per square meter.

We find close by, also, exhibits of the economical structure of M. Stanislas Ferrand, architect and engineer (Paris). It consists in a type of house, costing 1,500 francs, comprising a living room, a lobby, a children's room, a kitchen, water closet and shed, the whole covering a surface of 33·65 square meters, or about 350 square feet, equal to a house measuring 17½×20 feet. The cost per square meter of ground covered thus comes, therefore, to only 44 francs 90 centimes, or about 81 cents per square foot. The foundations are cast iron, the floors are of cement and iron, the roof is in iron. The walls are hollow, built in ordinary brick, the facings and ornaments are in earthenware. The space between the two sides of the wall communicates with a basement cellar. This arrangement is intended to maintain in the walls a cushion of air at the mean temperature of the earth, that is to say 13° C. Thus we should have the same conditions of temperature as in a cellar; that it is to say, we should have comparative warmth in winter and coolness in summer. This is, according to the inventor, a part of the advantages of the method of construction.

Between this unpretending dwelling and that of M. Grand, we find the bricks of M. Jandelle (Paris). They are hollow bricks of various shapes, fitting to one another, and by means of which floors and vaulting can be constructed. M. Jandelle exhibits also silicious tubular stones.—*Engineering.*

The Temperature and Physical Conditions of Inland Seas.

In a paper by Dr. Carpenter, on the "Temperature and other Physical Conditions of Inland Seas, considered in Reference to Geology," read at the meeting of the British Association, he stated that the earlier experiments with thermometers in ascertaining the temperature of deep soundings could not be depended upon, on account of the pressure having interfered with them. Recent soundings, recently taken under the equator with protected thermometers, at two thousand fathoms gave a temperature of about thirty-two and a half degrees. He thought that, if they went deep enough in sounding equatorial seas, they would invariably find the temperature to be glacial, which must exercise great influence in dwarfing animal forms. This could not be understood except by supposing the cold water from the poles to creep along the sea bottom. Dr Carpenter then pointed out the ridge which arose from the Mediterranean floor, and so shut it off from the Atlantic, making it an inland sea. In consequence of this, the cold water flowing at great depths along the bottom of the Atlantic could not get into the Mediterranean, and soundings at the greatest depths of the latter showed a uniform temperature of 54° to 56°. This exception could only be understood on the theory of a general polar circulation in open seas like the Atlantic. The fact that no circulation could take place in the Mediterranean had an important bearing on its animal life. They expected, when sounding, to come on an abundant *fauna,* instead of which the dredge brought up nothing but mud. The blue color of the water in the Mediterranean, and also in the Lake of Geneva, was due to the minute diffusion of fine particles of mud. This fine mud had borne on the distribution of marine life in the former waters, as it choked them, so to speak, and thus prevented their multiplication. The organic matter at the bottom of this sea used up most of the oxygen when decomposing. This organic matter was poured into the Mediterranean by the rivers. Turning his attention next to the physical conditions of the Red Sea, Dr. Carpenter showed that its upper waters had a very high temperature. Even at a great depth there was a general temperature, even in winter, of over 70°. There was no large amount of organic matter poured into it, and hence he thought that an abundant *fauna* would be found along the Red Sea floor, simply because there was no decomposition of oxygen by organic matter. This was proved by the abundance of corals in that sea, as these forms cannot live except in pure water. He thought that the reason why reef-building corals could not live at a greater depth than 25 fathoms was entirely due to the temperature. Wherever the colder sea currents kept up a temperature of less than 68°, coral reefs could not grow, and in fact these animals could not live where the temperature was less than 68°. Hence the limited vertical distribution of coral reefs. If this was true, then they ought to find reef-building corals at greater depths in the Red sea, where the deep temperature was so much higher, and he ventured to prognosticate that such would be found to be the case. In the sea, shut out by islands, etc., the temperature was the same as that of the neighboring ocean, but it had not a lower temperature than 51°. He thought the fissures in the barrier rock allowed water of that temperature to flow in. In conclusion, he showed how different would be the animals entombed in the deposits of these different seas, and the large bearings the question had on geological deductions.

Professor Phillips then referred to the movements of the atmosphere as illustrating the circulation of water in the ocean. He thought Dr. Carpenter's theory about the vertical distribution of reef-making corals being due to temperature would throw great light on geology, and enable geologists better to ascertain the physical conditions of ancient seas. He thought nothing had been read for many years, before the section, which would prove so suggestive to geologists.

In reply to Mr. Balls, Dr. Carpenter remarked that all rivers contained a large amount of organic matter —a sort of dilute protoplasm. In the Black Sea, the specific gravity varied according to what was poured into it by rivers, and the conditions of life were the reverse of those of the Mediterranean. The Doctor stated, in conclusion, that he did not himself lay any claim to being the author of the theory of general oceanic circulation.

A Great War Ship.

The sea-going turret ship Peter the Great was lately launched from the Admiralty Dockyard, St. Petersburgh, Russia, in the presence of a great concourse of people. The wedges were withdrawn simultaneously, and the great ship glided without check or noise into the Neva. In a few days she will be lifted into a floating dock, which will be towed, with its enormous burden, over the shallows to Cronstadt, where the engines will be fitted, the ship's sides and turret sheathed with massive plates, the four great steel cannon shipped, and in less than a year's time Russia will have at sea by far the most powerful man of war yet built. The vessel was designed by Admiral Popoff, an officer of the highest distinction. His ship differs in many respects from the American and English turret ships, and the design is said to have many excellences. She is, in size, hight, form, buoyancy, stability and engine power, able to make a long voyage of seventeen days at a high speed in any condition of weather.

The Peter the Great is three hundred and twenty-nine feet eight inches in length between perpendiculars. Her greatest outside breadth is sixty-three feet. The builders measurement is five thousand three hundred and fifty-two tuns, and the displacement, with coal, stores, and water in boilers, will be nine thousand six hundred and sixty-five tuns, at a mean draft of twenty-three feet nine inches. The plates on the ship's sides and on the raised building amidships vary from twelve to fourteen inches, and the armor plate protects the ship to a depth of six feet below the water line. The vessel has no spur, but the upright stem is heavily plated and of enormous strength. The strong straight stem of the Peter the Great will, it is supposed, deliver a most effective blow with little or no risk to herself. The ship has two large turrets, which are plated with sixteen inches of iron in two thicknesses of fourteen and two inches. She has no masts, but depends entirely on her engines, which were built at St. Petersburgh by the Widow Baird. The engines are on the compound principle, and in construction resemble Messrs. Rennie's latest types. Each engine is of seven hundred horse power, and connected with two four-bladed screws. There are twelve boilers, which will require at full speed one hundred and thirty-two tuns of coal in twenty-four hours, and at this rate of consumption the engines will work at ten thousand effective horse power, and the ship will be driven at fourteen and a half knots speed per hour. If the engines are worked at the second grade of expansion, she will have coal for seventeen days, steaming twelve and a half to thirteen knots per hour.

With the single exception of the teak wood backing, all the materials of the ship, engines and armament have been produced in Russia, by Russian workmen.

American and European Railroads Compared.

A correspondent of the *Railroad Gazette* says: The first thing that an American notices in the European railroads is the greater solidity of the track. This massiveness is, perhaps, more noticeable in England than anywhere else. The bed is an elaborate piece of work, and not merely a temporary embankment thrown up. Bridges are very numerous, because there are very few level crossings. Even farm roads are carried over or under the track. These bridges and tunnels, as well as their approaches, are of the most substantial stone or brick masonry. The rails, as a general thing, are heavier than with us. The best lines have a complete system of drainage by means of tiles laid under ground along the bed. Wherever the cuttings are deep or the fillings high, the whole surface is turfed over or covered with grass. The grassy slopes add very much to the comfort of the traveler by softening the glare, and by diminishing the dust and reverberation.

CARS.

The European cars, not even excepting those of Southern Germany and Switzerland, are lighter than ours. This may be one of the reasons why broken axles, heated boxes and broken rails are almost unknown there. The passenger coaches are about 25 feet long, not any wider than ours, and much lower, not above seven feet in the center. There are three compartments or sections to each car. First class in the middle, second class at each end, third class generally by themselves. In Germany there is sometimes a fourth class. The English and Continental second class compartments are upholstered with plush (third class with morocco or oilcloth) and carpeted, and the seats, of which there are only six in each compartment, placed face to face, have arms dividing them. The Irish second class have seats for eight in each compartment; and the Continental third class, for ten. The class arrangement has its advantages; there is more room generally; many a mile I had a whole compartment to myself, and still more frequently divided between myself and friend. It is pleasant for companies and acquaintances. But it is a very expensive arrangement for the railroad companies. It leads to very long trains and these hardly half filled; so that, though their cars are much lighter than ours, it is doubtful whether they carry any less dead weight than we do. On the Continent the system is run more economically, because there the officials see that as many places as possible are filled. An English "guard" shares the exclusiveness of his countrymen and respects it; but on the Continent sociability is more spontaneous, and travelers are herded more. The compartment system gives a cl se and confined air to the car. It lacks room and light. The middle seats are not comfortable for seeing or reading; and sitting *vis à vis* is as unpleasant under some circumstances as it is pleasant under others. With us you can choose your *vis à vis* company; in England, you can't refuse it. It must be a positive discomfort to many passengers that they are compelled to ride backwards. The smoker is well provided for on all the roads, and the smoking compartments are generally well filled. In the Continental cars, there are ash boxes provided. Spittoons there are none; chewing is not a reputable or recognized habit, and spitting and putting up one's feet on the opposite seat are peculiarly American. There is no water or water closet on the train, and, of course, there are no stoves. Every traveller carries a knee blanket, and, in very cold weather, a bag of warmed sand is furnished on some of the Continental lines. It is a continual wonder to an American how the claims of decency, health and comfort should have been so long overlooked.

Except on some of the German and Swiss railroads, there is no cab for the engineman. He stands in an open box, with an iron or board partition between him and the smokestack. This barrier has in it two bull's eyes 8 or 10 inches in diameter and glazed. Sometimes this partition is bent back a foot or so at the top, and that is all the protection he and the stoker (fireman) have.

SIGNALS.

There is a hundredfold less whistling (or, as the *Evening Post* has it, "diabolical screaming") on these roads than on ours, and of course a hundredfold more ear comfort. Starting signals in Europe are a bell or a low whistle by the engineer, in answer to the boatswain whistle of "the guard," or the word "right" in England, or *fertig* (ready) in Germany and Switzerland. As there are no cows on their tracks, so there are no cow catchers on their engines, and no whistling them off. Every level crossing is guarded by a gate and a watchman. The telegraph is in constant use on the Continent for starting and running trains. Every precaution is taken for the safety of the train and its passengers; but much less care is had for the comfort of either the passengers or the employees than is taken with us.

There is no bell rope or other readily accessible means for communicating with the engineer, should it be necessary. After the passenger is shut in at the station and the key turned on him, he must generally wait till the train stops before he sees the conductor—except on the Prussian lines, when occasionally, while the train is in motion, the guard creeps along on the outside and can be communicated with. On some of the English roads there is a cord that is in communication with the engineer, but the directions for using it and the penalties for abusing it make such a complicated notice that I doubt whether one in fifty of the passengers would know how to proceed if he wished to call the engineer.

On the Belgium express train from Cologne to Paris, I found the following arrangement: In each compartment there is a signal bell enclosed with glass, which, if occasion demand (in the words of the notice to travelers), "is to be broken with the elbow, the string pulled, and the arms to be agitated through the right hand window."

The Range of Sound in Moving Water.

In the *Comptes Rendus*, we have an account of some acoustical experiments, made during the earlier part of the investment of Paris, with a view to the establishment of a system of telegraphic communication between the city and the country in rear of the besiegers' lines, through the medium of the waters of the Seine. Certain experiments made by Sturm and Colladon in the Lake of Geneva, 43 years before, appeared to encourage hopes of success in the undertaking.

In the experiments here referred to, which were carried out in 1827, a bell, weighing 170 lbs. avoirdupois (65 kilos.), was moored to a barge and lowered beneath the surface of the water, in the neighborhood of Rolle. The observers, who were provided with a long metallic ear trumpet, one orifice of which was covered with some membranous substance and submerged in the water, were on board another barge at anchor off Thonon. The distance between Rolle and Thonon is 13,500 meters, or 31½ English miles, nearly. The range traversed by the sound was, therefore, very considerable.

The experiments at Paris were made in November, 1870, and were of three kinds:

In the first series, a bell weighing 104 lbs. was furnished. The bell had an internal clapper, to which were attached a couple of iron wires, by which it could be moved at will. The eye of the bell was made fast to a cable wound upon a capstan placed in the fore part of a lighter. The latter having been moored in a suitable position, the bell was lowered carefully to the bottom of the river and then drawn up a foot and fixed there. Two men were told off to strike it, with the aid of wire pulleys, at certain predetermined intervals indicated by a watch previously regulated by the observer, who was himself in a boat which was allowed to follow the course of the stream, the rudder only being used to keep it in the current. He was provided with an ear trumpet, similar to that employed by Sturm and Colladon, which was attached to the side of the boat, and its submerged mouth, covered with membrane, kept constantly turned in the direction of the bell. The total length of the trumpet was 5 feet nearly (1 m. 50 c.). At a few yards distance from the bell, each stroke was distinctly audible, producing a dull sound like a blow upon a drum head. As the distance increased the sound became weaker; and beyond 1,960 yards it was no longer distinguishable. A like result was obtained on every occasion.

In the second series of experiments, a large bronze bell weighing over 8 cwt. was used. It was mounted on a timber framework in the form of a truncated quadrilateral pyramid, and was struck by means of a 40 lb. hammer, which was also attached to the framework and moved by pulleys.

The carriage of this ponderous bell, so that it might be submerged at will, presented not a few difficulties. It was found necessary to form a raft of two large lighters lashed abreast, at a sufficient distance apart to allow of the free movements of the bell and its frame between them. The four uppermost angles of the framework were attached each to a separate cable wound upon a capstan on board of the lighters. It may be observed that, in lowering and heaving up the bell, it was found necessary to bring it nearly into a horizontal position, so as to allow of the egress or ingress of the air within it. Four seamen, one to each capstan, were told off to manage the bell, and to strike it at pre-arranged intervals. Some yards distant from the bell, a slight metallic sound could be detected, caused, doubtless, by a vibratory movement communicated to the metal of the ear trumpet by the membrane. As the distance from the bell increased its sound became dull, its intensity diminished rapidly, and at 1,500 or 1,600 yards it was almost inaudible.

Comparing the above results, it would appear that the great volume of sound emitted by a bell of 8 cwt. had a less range than the weaker sound produced by a bell of 104 lbs weight.

In the third series of experiments, a small 4½ in. hand bell was fastened to a vertical wooden rod attached to the side of one of the lighters, so as to admit of its being raised or lowered in the water at will. The large bell and the hand bell were sounded alternately. The sound from the former, as in the second series of experiments, was not distinguishable at a distance of more than 1,600 yards, while that of the latter was audible at more than 1,000 yards distance.

The conclusions drawn from these experiments were:

1. That the range of sound in running water, even in the direction of the stream, is much less than in still water, as in a lake.
2. That when the volume and depth of sound are greatly augmented, a very small increase and in some cases even a decrease of the distance at which the sound is audible are the results.
3. That it is probable that, with equal volumes of sound in moving water, the auditory distance will increase with the sharpness of the sound. It is suggested that powerful steam whistles might be used with great effect; but we do not learn that any attempts were made to put this suggestion in practice.

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HOW COMPLICATED soever the motions of animals may be, whatever may be the changes which the molecules of our food undergo within our bodies, the whole energy of animal life consists in the falling of the atoms of carbon and hydrogen and nitrogen from the high level which they occupy in the food to the low level which they occupy when they quit the body. But what has enabled the carbon and the hydrogen to fall? What first raised them to the level which rendered the fall possible? We have already learned that it is the sun. It is at his cost that animal heat is produced and animal motion accomplished.—*Tyndall.*

The Petroleum Trade at Berlin.

The annual report of the Chamber of Commerce at Berlin for last year gives an instructive insight into the petroleum trade of that city, and shows the rapidity with which it has now become an indispensable article of general and extensive consumption; so much so, indeed, that it has been deemed absolutely necessary to erect buildings at a suitable spot for the exclusive storage of this oil. Says the London *Grocer:* This ought to have been the business of the Government, or at least of the municipal corporation; but they have both been relieved of this expense by the combined efforts of private industry. Two years ago a joint stock company was formed, with the consent and approval of the authorities, for the purpose of building petroleum warehouses, which, though erected on a very liberal scale of dimensions and surrounded by a high wall, were soon found to be so inadequate to the demands of the trade for warehouse room that the company have already doubled their capital by a fresh issue of shares—of which the original shareholders were offered the refusal at par, and they were all taken up by them with alacrity, and now bear a premium of 20 per cent—and extended the store to twice the original size. Berlin consumed alone last year 116,070 barrels of refined petroleum, against 94,947 barrels in 1870, and only 73,000 ditto in 1869. The dealers are also beginning to emancipate themselves from being dependent on the outports for their supplies; and already several large contracts have been made by them with American export houses direct for autumn delivery, the goods to be shipped to Hamburg, and forwarded thence in transit by railway to Berlin. Thus the indirect trade has fallen off very considerably: in 1870, the quantity received from Bremen was 28,170 barrels, while last year it was only 2,383 barrels, and the supplies furnished by Stettin fell from more than 5,200 barrels in 1870, down to 2,505 barrels in 1871. The only exception to this decline was the trade with Hamburg, which emporium, being better situated and closer to the German metropolis, was enabled to beat all the other competing markets. Thus the Berlin and Hamburg Railway conveyed to Berlin alone 97,055 barrels, against only 64,937 ditto in 1870, while the remainder was sent by river conveyance as slightly cheaper, though requiring a much longer time on account of the uncertain quantity of water in the Elbe at all seasons—sometimes there not being enough to float the barges, which are then detained for whole weeks and even months together, and at other times overflowing the banks and rushing down with the force of a torrent that nothing can resist, and thus preventing the upward progress of the flat boats.

Filtration of Water.

Artificial filters may be made by having basins of masonry, on the bottom of which large stones, then smaller, then gravel, and finally fine sand is laid, and allowing the water to percolate this layer; about an inch of the upper layer of sand will hold the most of the filtered impurities, and when this is removed and replaced by a fresh amount of sand, the filter may be considered as cleansed. Filtering by causing the water to pass up from below through such a layer has been found to be insufficient. The filter, as first described, may last for some months before requiring to be cleansed, or, in some cases of heavy rainfalls, only some days. A clear water basin is necessary for the reception and distribution of the water after filtering, and should be covered over and at least large enough to hold one day's supply. The filtering bed of the Chelsea waterworks is given as follows:

Fine sand, Coarse "	4 feet.
Pieces of slate	6 in.
Fine gravel, Coarse "	1 ft. 6 in.

◆

A SOLVENT FOR SHELLAC.—Dr. I. Walz describes the following process for obtaining a neutral solution of shellac in water. The shellac is broken up and covered with a concentrated solution of carbonate of ammonia, and boiled upon the water bath until the ammoniacal smell has disappeared. More of the solution is added, and the boiling is continued until the shellac forms a coherent, sponge-like mass. The carbonate of ammonia is then expelled by further boiling, and the mass will readily dissolve by pouring boiling water upon it. A kind of soap will be found floating on the surface, which may readily be removed by straining. The solution, brought on paper, cloth, etc., dries rapidly, and leaves a thin, lustrous and adherent film of shellac behind.

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SOLUTION OF CARBONATE OF LIME BY CARBONIC ACID.—T. Schlœsing states that:—When carbonate of lime, in excess, is placed in an atmosphere containing a constant proportion of carbonic acid, water simultaneously dissolves free carbonic acid, neutral carbonate, and bicarbonate of lime. The carbonic acid is dissolved according to the well known proportions, and as if the water contained no carbonate of lime; the solution of neutral carbonate takes place as if in pure water free from carbonic acid; as regards the solution of bicarbonate of lime, its proportion depends, for a given temperature, on the tension of the carbonic acid gas contained in the gaseous mixture experimented with.

◆

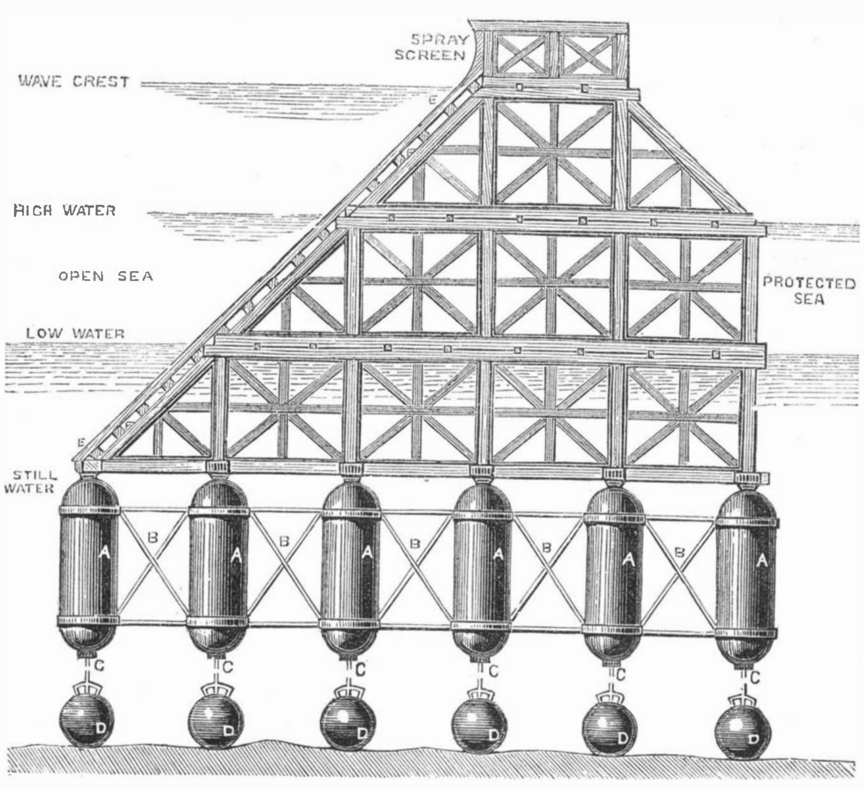
A CEMENT to stop cracks in glass vessels to resist moisture and heat. Dissolve caseine in cold saturated solution of borax and with this solution paste strips of hog's or bullock's bladder (softened in water) on the cracks of glass, and dry at a gentle heat; if the vessel is to be heated, coat the bladder on the outside before it has become quite dry, with a paste of a rather concentrated solution of silicate of soda and quick lime or plaster of Paris.

FLOATING BREAKWATER.

The annexed illustration represents a form of construction for ocean shields, breakwaters, piers, harbors, gun banks, lighthouses, and other marine objects. The agitation of the sea in British regions is supposed to be limited to a depth of about 15 feet, therefore a platform at that distance below the surface would be undisturbed by wave commotion. Such a platform is presented by the tops of a series of vertical cylinders of great buoyancy, kept in their position by struts and braces, and held down to the proper level by weights or anchors. The immobility of the framework must depend on the smallness of its solids relatively to the supporting base, and would, perhaps, be promoted by the employment of iron instead of timber, as here suggested.

A A are air-tight cylinders, B B the strutting, C C the cables, and D D the weights at the sea bed. From the motionless foundation thus formed, the framing rises through the section of tidal and superficial action. The sloping screen formed by the timbers, E E and F F, presents meshes to the waves, by which their force is arrested and their effect destroyed.

The invention is by Mr. Thomas Morris, architect, of London.—*Building News.*



FLOATING BREAKWATER.

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The Vienna Exhibition.

The works of the International Exhibition of 1873 are now sufficiently advanced for a visitor to be able to form an idea of their extent. The compartments within the area of the Exhibition are advancing so rapidly that all the works will have been practically finished at the time specified.

The construction of the rotunda and cupola offers the most interesting feature of all, in an engineering point of view. The ring, which is to form the base of the cupola, has a diameter of 350 feet, and, according to Mr. Scott Russell's plan, is to be gradually screwed up from the ground to a hight of 80 feet, where it is permanently fixed upon thirty-two iron pillars or standards, which will bear the arched roof, open in the center and surmounted by two turret-shaped lanterns.

Each of the thirty two columns will rest upon a large bed of concrete, over a foundation of piles which are driven in the ground, and the ring has been riveted together while resting upon this foundation, from which it is to be lifted up to its proper place, though it alone weighs about 650 tuns. Upon each of the thirty-two foundations is a strong timber structure, 20 feet high, which bears two capstans, from which are suspended two enormous screws fitting in the projecting ends of the central ribs over each pillar. By turning these 64 screws or spindles simultaneously, with only two men at each capstan, the whole ring is lifted up; and when raised to some extent, it is propped up by a structure of heavy timber struts between every two pillars. This operation began on July the 8th, and within three days the ring was raised 5 feet from the ground.

The pillars each consist of four lengths of 20 feet each, and when the ring is 20 feet from the ground, the set of thirty-two upper lengths will be fixed to it. Meanwhile the scaffolding and the lifting screws will be raised another 20 feet, and the operation continued; the second and third set from top will subsequently be placed, and at last the lower tier of the pillars will be fixed, when the ring will have exactly reached its intended position. These pillars or supports are constructed hollow, of plates and angle irons, and are 10 feet by 4 feet wide.

According to recent advices from Vienna, the whole lifting operation continues to be successfully performed under the superintendence of M. Sleiger, the engineer to J. C. Harkort, of Duisburg, in Prussia, who has undertaken to construct the rotunda and principal gallery. Within this rotunda, the central scaffolding is to be made 160 feet high, where the inner ring of the cupola is to be fitted and connected with the large outer ring by thirty-two central, or rather radial, ribs. Over the central opening, the two turrets or lanterns are to be constructed, one above the other, so that the total hight of the rotunda wiil be 250 feet from the floor to the top of the upper turret.

No exhibition has yet taken place in any country whose population have come forward as exhibitors in greater numbers than have the Austrians at the present time. More than 15,000 Austrian exhibitors have applied for space, and 3,000 Hungarian.

The demand for room, also, which has been made by foerign exhibitors is very great.—*Engineering.*

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Catching Shad with Hook and Line.

We recently published an account of the success of Mr. Thomas Chalmers, of Holyoke, Mass., in preparing bait and catching shad with hook and line. In a recent letter to the *Turf, Field, and Farm,* he gives the following additional particulars, which will be of interest to those of our correspondents who have written to us on the subject:

"I send you three flies used for shad (I used three on my cast). Two of them are dressed with hackle, one without. They take the hackle more freely. The most deadly fly I have used has a little lighter colored wing, with black spot through and green body—bright green from peacock tail, brown hackle. The best way of using that I have tried yet is to anchor the boat in or about the edge of a good current, twenty five or thirty yards above deep water, letting the current carry the fly out to within two or three yards of deep water. It does not matter whether the fly is on the surface or one or two inches under, as they take freely either way.

In casting your fly as in the ordinary way of trout fishing, you are annoyed with small fish of one and two years old, for as soon as the fly breaks water, every hook is full of the small fry. In the trailing process, you are not troubled enough to spoil the sport.

You want a rod with good spring to recover, and keep taut line when they jump, for a good lively shad, when hooked, will jump from two to four feet out of water, then make a break of ten or twelve yards before you can check him. If he cannot go freely, things have got to break. They are game, and fight harder and much longer than either striped or black bass. At the commencement of the season I dress No. 7 hook; as the season advances I come down to No. 4 I find old style Limerick hook best. Last year I used the Kirby and others, and lost a great many fish with hooks breaking off at barb.

Last year I used old Limerick, and at close of season I find four broken hooks."

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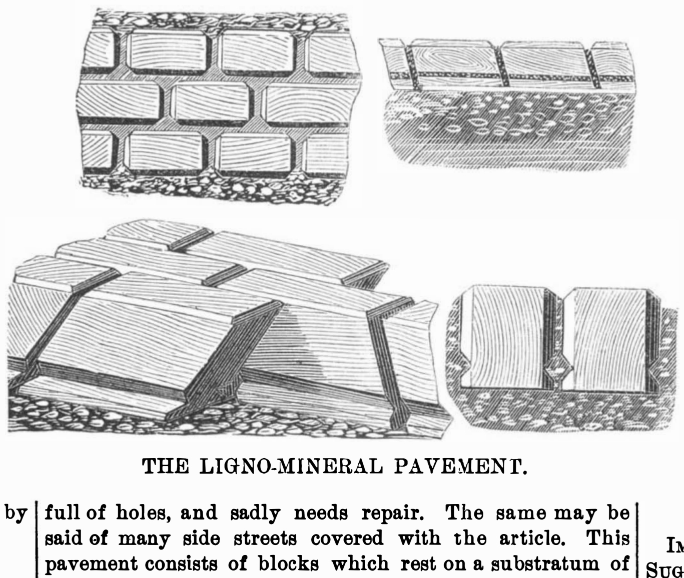
STREET PAVEMENTS.

Wherewithal shall we pave our streets is still an important question. In the city of New York, the use of wooden pavements has latterly been tried, with great satisfaction, so far as comfort for man and beast is concerned. Wood constitutes, while it lasts, an even, slightly elastic, and excellent roadway. Could it be made to endure, nothing more would be desired. But the methods of laying down wooden pavements heretofore used in this city are, it must be confessed, lamentable failures. The mile stretch of wooden Nicholson pavement laid on Sixth avenue, some four years ago, is now full of holes, and sadly needs repair. The same may be said of many side streets covered with the article. This pavement consists of blocks which rest on a substratum of flat boards. When the boards decay, which they do very rapidly, down go the blocks, and the pavement is destroyed. The two mile stretch of wooden Stowe pavement on Seventh avenue, laid three years ago, is also giving sad evidences of decay. In this pavement, the wooden blocks are fastened together laterally into squares of about three feet measure, and these are laid upon the ground, without boards or other under stratum. The blocks soon give way, holes are formed, and the pavement rapidly becomes worthless.



THE LIGNO-MINERAL PAVEMENT.

The most recent and best improvements in wood pavements are those which relate to the preparation of an enduring substratum, on which to lay the blocks. This once accomplished, good and lasting wood pavements may be expected, for it is an easy matter to preserve the blocks from decay.

The ligno-mineral pavement is an example of this kind, the introduction of which has been commenced in Paris and in London with success. We find an illustration of it in the *Mechanics' Magazine,* which we here present.

The foundation of the roadway is prepared in the usual way with concrete, and thereon the prepared blocks are set, with interstitial joints solidly filled in with grout, penetrating to the grooves on either side of the blocks, and binding the whole together compactly. The blocks are bevelled or mitered at the ends to an angle of 60°, the inclined joints being set in opposite directions in adjacent rows, so as effectually to break joint throughout. The mineralization is effected by a novel appliance of mineral oils, of which the hydrocarburets render the wood impervious to damp and proof against effects of variations of temperature. The wood is hard and unfriable, creates little or no dust or mud, and wears slowly, at the same time being noiseless, affording firm and easy foothold for horses' hoofs, and considerably diminishing the wear and tear of horses and vehicles.

This system has been tested and tried in Par is with excellent results, leading to its increasing adoption in lieu of asphalt, granite, and other pavements. Its qualities are satisfactorily vouched for by the official reports of the French Government engineer Alphand, Inspector General of Bridges and Highways, and Director of Public Roads and Promenades of Paris.

The City Commissioners of Sewers of London have allowed the patentees to put down a piece of specimen paving in Gracechurch street, immediately adjoining the asphalt previously laid down; and they have accordingly laid one half the street therewith, and propose shortly to complete the same as soon as similar operations on behalf of the American patent (since commenced, and now being finished nearer to London Bridge,) have been executed. [This last is a sample of our Nicholson pavement, and if it endures no better than it has in New York the London authorities will be soon disgusted with it.—EDS.]

These two systems are entirely different, and should not be confounded; in the latter, rectangular unprepared blocks of wood are laid down on a substratum of planking, a system *primâ facie* manifestly inferior to the beveled mineralized blocks of the patent which is the subject of the present notice. Of the other it is enough to say, remarks the *Mechanics' Magazine,* that it is an undistinguishable variety of ordinary wood pavement which *per se* has been found to fail; whereas, the homogeneous and thoroughly bonded system of Trenannay obviously has qualities which recommend it to the most superficial observer; and we shall be greatly surprised if the balance of advantage in point of wear, under practical test, does not strongly incline to the new pavement.

This pavement, it will be observed, resembles the Flanagan pavement illustrated in the last volume of the SCIENTIFIC AMERICAN; but the latter has the advantage of greater simplicity.

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Cleaning Wool.

A valuable recipe for the cleansing of wool has, according to the *Journal of the Society of Arts,* been invented and introduced by MM. Baerle & Co., of Worms. It is the employment of soluble glass in washing, which we are told is so simple and economic an application that it only requires to be once experimented with to have its advantages thoroughly recognized. Here is the method of its use and its effects:

Take 40 parts of water at the temperature of 50° to 57° Centigrade, and one part of soluble glass; plunge the wool into the mixture, stirring it about for a few minutes by hand, then rinse it in cold or tepid water, and it will be found completely white and void of smell. The wool, after this operation, remains perfectly soft, and loses none of its qualities, even when left for several days in the solution of the silicate, and being washed in hot water. Sheep may also be washed with the same preparation, care being taken to cover the eyes of the animals with a bandage, to perform the washing with the solution instantaneously, and to remove the surplus with tepid water. In the case of combed wool, the wool should first be steeped in the solution above given, and afterwards in another bath, composed of 80 parts of water, at 37° Centigrade, and one part of soluble glass.

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IMPROVEMENT ON THE PROCESS FOR EXTRACTING BEET SUGAR.—This consists in a proposal to add lime to the liquors, and then precipitate this out by a current of carbonic acid, thus purifying the liquors more rapidly, and thus allowing less to be lost by fermentation, at the same time driving out by means of the carbonic acid the air which would otherwise remain in the liquors and assist fermentation. The same treatment is to be applied to the raw sugar solution and to the "sweet liquor."

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PURIFICATION OF PETROLEUM.—It is claimed by M. Tatro, the inventor, that by adding sulphuric acid (from 2 to 4 per cent), and 4 to 6 per cent of dry lime, agitating the oil with it and distilling, a larger proportion of burning oil is produced.

[From Journal of the Franklin Institute.]

TRANSMISSION OF MOTION.

[A Lecture delivered by Coleman Sellers, at the Stevens Institute' of Technology, Hoboken, N. J., February 19th, 1872.]

The particular branch of the subject of the transmission of motion to which I call your attention this evening is what is technically called shafting and mill gearing, and relates to the transmission of motion from the motor to the machine. The motor, or source of motion, whether it be a windmill, a water wheel, a steam engine, or a lady's foot upon the treadle of a sewing machine, must be connected with the machine that does the work. This connection may be of the simplest and most direct kind imaginable, or it may be very complex. It often involves the use of long lines of shafting, may be much gearing, and various ingenious arrangements of belts and pulleys. In any large factory the shafting, with its couplings, pulleys and other adjuncts, considered as a machine to transmit motion, is most frequently the largest in the establishment; hence every consideration of economy requires that it should do its allotted work with the least possible loss of power in the transmission. It calls for economy in first cost, and economy in use.

The generation of power to be expended in operating machines to do work costs something; it may cost much money in fuel consumed, or it may cost something in energy expended. In any case, the more perfectly the whole power is transmitted to the work, the more profitable will be its use.

It is a noteworthy historical fact that economy in the generation of power in the motor, and economy in the utilization of the power in the machine, have been in most countries far in advance of the economical transmission of power from one to the other. Years ago there were excellent models of water wheels, and by them were driven machines of surprising ingenuity, but the power was conveyed by means of cumbersome wooden shafts upon which were wooden drums for the driving belts; gearing too, made of wood, slow moving, awkward contrivances for the purpose, and very wasteful of power.

One does not need to be a very old man to recollect the introduction of machinery for making clothing for cards, for forming and sticking into sheets of leather the delicate wire teeth used in carding cotton and wool. The card-making machines perforated the leather, bent the delicate wires into proper shape, inserted them into the perforations, then adjusted the final shape and left them of sufficiently uniform length. These were, and are now, machines of wonderful ingenuity; yet these machines were driven from wooden drums, on wooden shafts, held up in wooden bearings. These very same machines, used more than forty years ago, and so driven, are many of them running to day, answering all the requirements for which they were made; but they are now driven from metal shafts, running in metal hangers, coupled in an ingenious manner, and driven from iron pulleys, smooth turned on their faces and carefully balanced.

The high pressure engine of Oliver Evans was not a great deal behind the steam engines of the present day, and he, as a leading millwright, wrote a book on this very subject of transmission of power. He called it his "Millwrights' Guide," and, in describing the practice that obtained in his day, he tells of wooden shafts, wooden drums and wooden gearing only.

In the progress of the art, it is quite evident that early engineers in iron took their ideas from what had been done in wood. They copied in iron what had been the practice in wood. Cumbersome, slow moving iron shafts took the place of slow moving wooden shafts. Gear wheels were used to transmit the power from the motor to the shafts, and from shaft to shaft in the various rooms and situations requiring power; while belts or bands from pulleys were only used to transmit the power from the shafts to the individual machines. The practice of high-speeded shafts, and the entire substitution of belting for gear wheels, that I shall describe to you this evening, belongs essentially to this country. The value of high speed in belts has been long known in England and in some parts of Europe, and many wonderful examples there exist of its application. These examples are, however, exceptional, and have not come to be general mill practice.

When I explain to you the method of transmission in common use in this country, you will see that it bears the stamp of originality, and differs essentially from the more costly and cumbersome practice of the mother country.

It gives me pleasure to note this essential difference, for the first time in public, in the Stevens Institute of Technology, an institution founded by an enthusiastic engineer, and devoted to the teaching of what is the most useful to the practical engineer of this day.

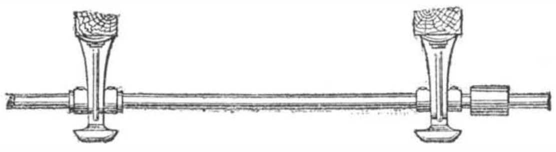
It may be well to note that in a book published in London, in 1841 ("Principles of Mechanism," by Robert Willis, M.A., F.R.S.), mention is made of the use of belts, and what was the practice in America at that time, in these words:

"Belts, on account of their silent and quiet action, are very much employed for machinery in London, to avoid nuisance to neighbors. It appears, also, from a recent work, that the use of belts is greatly extended in American factories. In Great Britain the motion is conveyed from the first moving power to the different buildings and apartments of a factory by means of long shafts and toothed wheels, but in America by large belts, moving rapidly, of the breadth of 12 or 15 inches, according to the force they have to exert."

What Professor Willis says in regard to American practice has continued to be the practice since this was written, but has been vastly extended; wider belts and faster running shafts have come into general use, while this extensive use of belting has been used in very few cases abroad, even up to the present time.

I have already mentioned line shafting as a *machine* for transmitting motion. I wish you to keep it in mind as a machine, as perfect a machine in its way as is a steam engine that drives the shafting, or as a loom driven by it. It is a machine of many parts and various functions. Its purpose is to convey the power entrusted to it with as little loss by the way as is possible. This machine, in one of its simplest forms, is shown in a single shaft revolving in bearings, such as I here show you; or a number of such shafts, coupled to form a longer line; that is, a number of round bars of iron, united by couplings so as to form a continuous cylinder of the required length.

FIG. 1.



It must be supported in bearings at intervals, so arranged as to allow the cylinder to rotate freely about its longitudinal axis, while they sustain that axis in a right line.

In the first place, the independent bars forming the line must be made truly cylindrical, and then be securely united one to the other. The uniting device is called the coupling. Since the introduction of turned iron shafts, a great many contrivances have been used to unite shafts.

It must be borne in mind that the coupling should be of such a nature that the strength and rigidity at the joint shall be as great, if not greater, than in any part of the line, so that if the line be subjected to flexure, it will bend anywhere else than in the coupling. In England, up to the present time, it is considered good practice to make the ends of all shafts larger than the body of the shaft by forging, and then to these enlarged parts secure the couplings by various and sometimes expensive means. Shafts so enlarged at the ends cannot be made to receive carefully bored pulleys unless the pulleys be made in halves, bolted together upon the shaft. Shafts come from the rolling mill, of certain merchantable sizes, as round iron. These round bars, when turned so as to be of uniform diameter, should be united without the extra cost of enlarging the ends. The first really good coupling used for this purpose was what is known as the plate coupling.

FIG. 2.

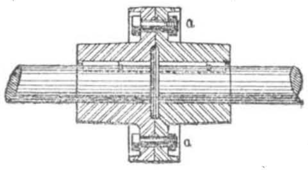
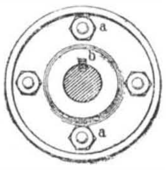


FIG. 3.



This coupling, Fig. 2, consists of two plates with stout hubs, fitted with great care to the ends of the shafts to be coupled, and the plates then held together by very carefully fitted bolts, *a a*, which are turned and fitted into reamed holes. There are also keys, *b*, provided to prevent the couplings turning on the shafts. This, when well made, is an excellent form of coupling, but it has manifest disadvantages; its first cost need not be very great, but it requires too much care in fitting. The method employed to insure its fit may be noticed as a very useful lesson in mechanics. I mentioned that keys are used to prevent its turning. They must be put in as a precaution, not as an actual necessity, and must be made to fit on their sides, not on their top or bottom. See Fig. 3. One section of shafting, with a half coupling on each end, would look a good deal like a car axle with a car wheel on each end; and the same rule that applies to putting car wheels upon their axles holds good for the placing of plate couplings. Car wheels are bored to some standard size, truly cylindrical in their eye. The axles are then turned to a size somewhat larger than the hole in the wheel; say, for instance, a four inch axle is made ·015 of an inch larger than the hole into which it is to be fitted. Then the wheel is forced on to the axle by means of a powerful screw or hydraulic press. The force required is about thirty or thirty-five tuns. Wheels so put on have no key to keep them from turning, and do not work loose. Plate couplings must be fitted in precisely the same manner. If a plate coupling be so fitted as to slide on and off easily, and an attempt be made to hold it in place by a taper key, fitting top and bottom, the pressure on the shaft will be on two opposite lines only, and sooner or later such coupling will work loose. To drive in a taper key is the very surest way to break or burst the surrounding metal, or at least make it run out of true. I cannot too strongly condemn the use of taper keys in all similar cases. A plate coupling, when properly fitted, requires great force to remove it, when its removal is needed for the placement of pulleys on the line, and frequent removal injures its fit. It also necessitates the use of open sided or hook hangers, as the coupling cannot be put on after the shaft is in place. These hangers, for equal strength, require double the metal used in a hanger with metal on both sides of the box. See Fig. 4. The greatest objection, however, to the use of this and similar kinds of coupling, is in the fact that skilled labor is required to insure accurate fits, and that no practicable system of inspection will enable the mill owner to know that the fits are good ones. The working out of any shaft from its coupling may result in the fall of the section of shaft, the breaking of valuable machinery, or, too often, the loss of life. I have the pleasure of presenting to your notice, this evening, a coupling which, while it fills all the requirements of absolute security, can be cheaply made, and admits of ready removal and ready adjustment when pulleys, etc., are to be added or changed. This coupling, Fig. 5, called by it manufacturers the double cone vice coupling, you will observe, consists of three principal parts—an outer sleeve, *a*, and two inner sleeves, *b b*. The outer sleeve has its interior surface made like two frustums of cones, with the apex of each meeting in the center of the sleeve. *b b* are conical sleeves, bored to fit on the shafts intended to be coupled, and having their outer surfaces so turned as to fit into the conical holes of the outer sleeve, *a*. The cones, *b b*, you will observe, have three equidistant square slots cut in them, and there are corresponding slots on the inside of the outer sleeve. These slots are to receive square bolts, *c c c*. The sleeves, *b b*, when put into place in the outer sleeve, will not quite meet, that is, they are too large to go in all the way. They are, however, split, each one in one of the square slots at *d*. This split makes them elastic, and if they be forced into the conical holes they will contract, and thus diminish the size of the center holes. The square bolts, *c c c*, while they serve as keys to prevent the inner sleeves from turning, also serve as a means of drawing the conical sleeves toward one another; so that if the ends of shafts be in these sleeves, such ends will be pinched or held fast by the pressure, and this in proportion to the force used in screwing up the bolts. Now I wish you to notice particularly this important feature. One cannot be drawn in with any more force than the other one; the resistance is the pressure on the shaft ends. The pressure on both ends of shafts in such a coupling must be equal, and is under the control of the person using and applying the coupling. The shafts need not be of exactly the same size; shafts of an appreciable difference in size may be as firmly held as if they were of the same diameter. Key slots are provided as a precautionary matter, as shown at *e e*; but the keys must, as I have before stated, fit sideways, and not touch top or bottom. That the shafts united by this coupling need not be of the same diameter is a very important consideration, and leads us to dwell for a moment on an important feature of shafting, namely, its cost.

FIG. 4.

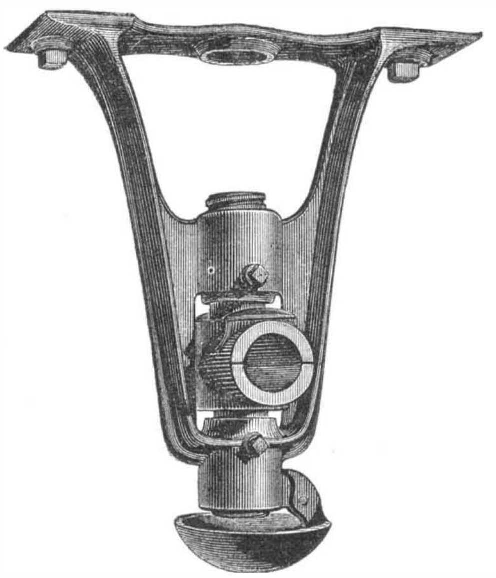
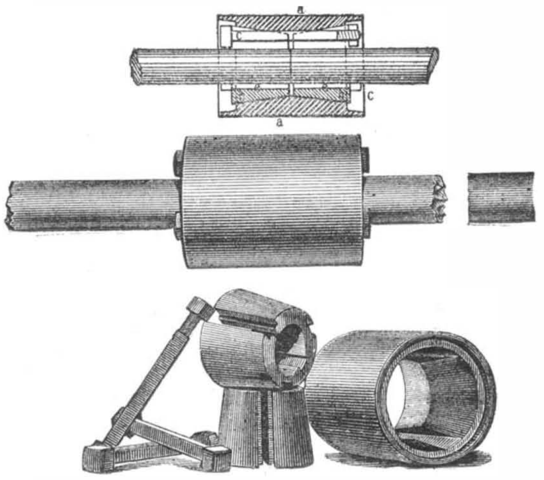


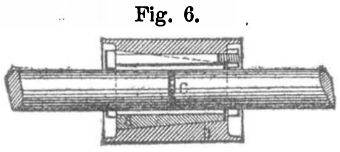
FIG. 5.



Machines can readily be constructed to turn bars of round iron in the condition they come from the rolling mill to a nearly uniform size, with great rapidity and at a very small cost. The expression, "nearly uniform," I use advisedly. I mean that shafts can be turned so that a standard hardened gage can slide over them and seemingly they will be of uniform diameter, but a careful measurement will show them to be only approximately alike in size. They are what may be called commercially accurate. This commercial accuracy represents a certain cost of production. Absolute accuracy, were such a thing possible, would represent a cost many times greater. Commercial accuracy is attainable by machines and by unskilled labor; absolute accuracy would involve more costly processes and the utmost skill of the most experienced workmen. When the plate coupling was in common use, the bodies of the shafts were made of one size, and the coupling ends reduced by skilled workmen to a smaller size and carefully fitted to the coupling. It was this fitting that was costly. With the cone coupling this fitting is dispensed with, and the shafts are sold as they come from the turning machines. An adjustable coupling, to be good for anything, must clamp each end uniformly. To impress this more forcibly on your minds, I will give you some negative information.

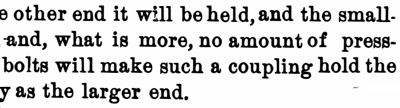
There are, and have been for years, many forms of adjustable couplings in use which do not fill this requirement. Let us take as an example one shown in Fig. 6, in which one long conical sleeve, *a*, fits in a conical hole in the outer sleeve, *b*, and the shafts to be coupled meet in the center, at *c*. The cone, *a*, being split as are the cones in the coupling before described, the conical sleeve, when forced in, will be compressed upon the two ends of the shafts, provided these ends are of exactly the same diameter; but if one is ever so little larger than the other end it will be held, and the smaller end will be loose, and, what is more, no amount of pressure exerted by the bolts will make such a coupling hold the smaller one as firmly as the larger end.

Fig. 6.



So, again, a coupling made as shown in Fig. 7 (which represents a plain cylindrical sleeve, split through at *a* and partly through at *b*, so as to render it elastic) which is compressed by bolts *c* —such a coupling will hold shafts of exactly the same size, but will produce an unequal pressure on shafts of slightly different diameters. In practice, this latter coupling is made to hold by means of a peculiar key, which extends over the two ends of the shafts to be united, and is provided with pins at its end, fitted into holes drilled in each shaft. While on the subject of adjustable couplings, it may be well to remark that, in putting them on the shafts, they should be put on with a view to removal. All parts should be well and carefully oiled, so as to avoid all chances of their rusting fast. And in event of required removal it is best to slack up the bolts, and if not then loose, a few blows upon the outer shell with a billet of wood may start it loose. In case of the double cone coupling, a wedge, say a cold chisel, driven into the split in inner cone always loosens the cones and frees the coupling.

Fig. 7.



When the double cone coupling was first made, it was subjected to severe trials to test its utility. The experiment was made by coupling two shafts, which were placed on three bearings 10 feet apart, the coupling being near to the middle one. The hangers were so placed as to bend the shaft 1¾ inches out of line. These shafts so coupled were then made to revolve 250 revolutions per minute for many weeks during working hours, and yet the coupling did not loosen under this severe strain. Since that time they have been made by thousands, and are in use in all parts of our country.

Correspondence.

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

Ellis' Vapor Engine.

To the Editor of the Scientific American :

In your article on binary vapor engines in the SCIENTIFIC AMERICAN of September 28th, you speak of Du Trembley's engine as being essentially like the Ellis engine; there is a very marked difference between them, that you, in common with many others, seem to have overlooked. Allow me to briefly point it out. Du Trembley exhausted the steam from his cylinder into a surface condenser in which he maintained a vacuum by the evaporation of the volatile liquid contained in the pipes of the condenser. To do this effectually, he was obliged to keep the temperature of his vapor boiler or condenser down to 120° or below; a good vacuum would not allow a temperature above 100°. To make use of heat at this low temperature, and produce with it a vapor at any considerable pressure, he was compelled to use a liquid that boiled at less than 80°. Bisulphide of carbon would not do, as this temperature would not raise it to the boiling point, and he used an ether, made from wood spirit, that cost at that time five dollars per pound and boiled at 70° or less. This enabled him to get a pressure of nearly 20 pounds to the inch in his vapor boiler and, to use this vapor to advantage at this pressure, it was necessary to maintain a vacuum for the vapor cylinder. To do this, an immense quantity of water was required for the vapor condenser, as the temperature in it could not be permitted to go above 60° or 65°: and in the Gulf stream the temperature of the water was so great that he could not condense. If the pressure in the vapor boiler from any cause was permitted to go above a certain point, say 20 pounds to the inch, the vacuum on the steam cylinder was lost and a back pressure produced on the steam piston, nearly or quite equal to the pressure in the steam boiler, and so the engine stopped. The air pump for the vapor condenser must have caused a constant loss of the ether used in his vapor boiler; and these difficulties were sufficient to have condemned the whole process, in the mind of any practical engineer, and to account for its failure.

In the Ellis process, all these difficulties are avoided by one simple but important change. The steam is exhausted through the tubes of the vapor boiler into the atmosphere instead of a vacuum, and the temperature of the exhaust, in this case, is 212° instead of 112 or thereabouts, as in the former case, a difference of 100°. This permits the use of bisulphide of carbon (which costs only ten cents a pound) in the vapor boiler instead of ether at five dollars a pound, as in Du Trembley's case, and gives a pressure in the vapor boiler of 65 pounds to the inch instead of 20 pounds. It also permits an engine with a moderate sized cylinder to be worked with the vapor to advantage as a high pressure engine, thus doing away with all the difficulty of loss through the air pump and allowing the temperature of the water in the vapor condenser to be raised to 100°, which is as high as any steam condenser will permit where a vacuum is obtained so that no excess of water is required to condense the vapor and there is no difficulty in condensing with the water in the Gulf stream or in the tropics. Mr. Ellis has also constructed an atmospheric condenser that condenses for the vapor engine perfectly, with less water than is saved by condensing the exhaust steam in its passage through the tubes of the vapor boiler. This enables him to use his engine in localities where water is scarce, as he can run one of his engines with this condenser with less water than is required to produce the same power with any steam engine in use. And the difficulty arising from back pressure in the steam cylinder is entirely avoided, as the exhaust steam that is not condensed in passing through the tubes of the vapor boiler has a free escape into the atmosphere. Another difficulty that troubled Du Trembley has been very easily overcome, namely, the leakage through the stuffing boxes. This is prevented by using a very simple double stuffing box which catches the leakage through the first packing and conveys it, by means of a pipe, into the exhaust pipe. This does its work so efficiently that the loss of liquid from the boiler is next to nothing, not amounting to twenty-five cents per week for a fifteen horse engine.

Having overcome the difficulty which caused Du Trembley's failures, let us see what has been accomplished, by the Ellis' vapor engine in the way of saving fuel. Repeated indications, made by experienced engineers, of two engines, one run by steam and the other by the vapor made with the exhaust from it, show that where the steam engine indicates ten horse power, the vapor engine indicates fifteen horse power, the two producing twenty-five horse power with the same fuel previously required for the ten horse steam engine; and the same proportionate gain is made where both engines are of the same quality, whether it be good or bad; for there is the same advantage in working vapor expansively in a first class engine that there is with steam, and the exhaust from an engine that expands the steam down to the atmosphere is equally as good to heat a vapor boiler as that from an engine that takes steam the full length of the stroke and exhausts at boiler pressure, as it is not the sensible but the latent heat of the exhaust steam that is used in this process, and this can only be obtained at a temperature below 212°. Moreover, a given number of cubic feet of steam at atmospheric pressure contains a given quantity of latent heat; and by condensing it in a vapor boiler, this will produce the same amount of vapor whether it left the cylinder at 50 or at 5 pounds pressure. It is true that a first class engine exhausts less cubic feet of steam per horse power than an inferior engine; so a first class engine requires less cubic feet of vapor to produce a horse power than an inferior engine, one just balancing the other as long as both engines are of the same quality

But, it may be asked, how it is possible to obtain more power from the exhaust steam than from the live steam that drives the first engine ? Because the bisulphide of carbon produces more cubic feet of vapor from a given amount of heat applied to it than water does, fully fifty per cent more; hence it is that we do more work with the vapor than with the steam because we have more of it. We get in the exhaust steam nearly all the heat for the vapor boiler that was imparted by the fire to the steam boiler, more than 95 per cent of it if we condense the exhaust steam as completely as we should do; and this heat, used a second time in the vapor boiler, will do the same amount of work and produce the same amount of vapor that the fire under the steam boiler would have done had we placed it under the vapor boiler in the beginning. Thus we use the heat twice and produce two results, each equally as good as the fire would have produced if we had applied it to either of these boilers separately, and then let the heat escape in the exhaust. And if Du Trembley's process was not a failure, we could take the exhaust vapor from an Ellis' vapor engine and use it in a condenser filled with ether, as he did, and produce equally as good a result with our third engine as he did with his second one, thus using our heat a third time; for the temperature of the exhaust vapor of bisulphide of carbon is 110°, and the quantity of heat it contains is still the same that was imparted to the water by the fire in the steam boiler, less a small percentage that has escaped, by radiation from the pipes, cylinders, etc., in its passage from one point to the other. The theory that heat is converted into power in an engine and thereby used up and lost does not prove true in practice, as the experiments of Mr. Ellis' fully show; for it requires the same amount of water to condense the vapor of bisulphide of carbon, after it has been worked in an engine, as would be required to condense the exhaust steam, that was used to make this vapor, when it escaped from the steam cylinder.

Thus it will be seen that no matter how economical a steam engine is, or how little coal it burns to produce a horse power, (provided the exhaust from it is not condensed) it can be taken and used by the Ellis process and be made to produce more work the second time it is used than it does the first, provided an equally good engine is used for working the vapor as was used for the steam. To illustrate this more clearly, if possible, let us suppose that we have a forty horse steam engine to drive our workshop, and desire to increase our business so as to use one hundred horse power. By putting into our works, at any convenient point within three hundred feet of our steam engine, a properly constructed boiler filled with the bisulphide of carbon, and conducting our exhaust steam in a suitable pipe to and through the tubes of this boiler, we can make vapor enough to run a sixty horse power engine without any additional heat or fuel.

Now what have we accomplished ? Presuming that our steam engine is of the best kind and works steam economically, it will require a consumption of 1,600 pounds of coal per day of ten hours to supply the steam for it; this at seven dollars per tun will cost five dollars and sixty cents per day, or 14 cents per day for each horse power produced. Now having added a sixty horse power engine that is run by the exhaust, we have 40 horse power *plus* 60 horse power = 100 horse power, and our fuel account remains the same, namely, $5.60 per day, or six-tenths cents per day for each horse power instead of fourteen cents per day as before; or in other words, we have increased our power 150 per cent without increasing our expenses. And this is no fairy tale; engines are running to-day and have been for months past driving workshops with precisely these results, and one Yankee is running his engine and workshop entirely with his neighbor's exhaust, conveying it one hundred feet into an adjoining building, and running his engine without coal, arch, chimney, or attention, for it runs like a water wheel, without being looked after and without danger of explosion, as the heat of the exhaust steam will not carry the pressure above 70 pounds to the inch under any circumstances. And as the neighbor does not charge anything for his exhaust, he may be said to have the cheapest steam power in the world.

J. A. H. E.

Atlantic Works, Boston, Mass.

On Cylindrical Boilers.

To the Editor of the Scientific American:

I have occasionally addressed to you, and to various scientific institutions, communications relative to the prevailing error of estimating that the steam force required to rupture a cylindrical boiler is as the pressure on the diameter, instead of on the semi-circumference, the error involving the dangerous under estimate of 57 per cent. From several of my correspondents I have received favorable replies; and the firm, so extensively known in scientific engineering, of Fairbairn & Co., of Manchester, England, have sent me the following letter:

"Manchester, 28 August, 1872.

"To Thomas Bakewell, Pittsburgh.—Dear Sir:

"I think you are perfectly correct in your views that the force to rupture a cylindrical boiler is not as the diameter, but as the semi-circumference of the circle. The general opinion, however, is that the force is as the pressure on the diameter, and I think this was first promulgated by one of your own distinguished professors, W. R. Johnston, of the Franklin Institute. Your diagram and illustration gives a clear demonstration of the formula, by the result contained in your paper. I am at present engaged, by request of the Royal Society and the British Association, on experimental enquiries into the powers of resistance of rivets to the shearing force, being of important interest in the construction of boilers and iron shipbuilding, and shall have much pleasure in sending you a copy of the results.

Very respectfully and truly yours, W. FAIRBAIRN."

[The theory attributed to Professor Johnston had been previously stated by Oliver Evans.]

Waiving the advantage for explanation, by references to the diagram, I subjoin a part of my paper to Messrs. Fairbairn, namely:

Let the diameter be 1, the half circle 1·57, and the steam force 1 lb. per inch; then, in the resolution of the radial forces into horizontal and vertical, a steam pressure of ·637 lbs. will be the mean horizontal pressure on the half circle; or $1{\cdot}57 \times {\cdot}637 = 1$, the diameter, so far agreeing with the current error. But in the resolution of the vertical forces thus obtained, we have a mean horizontal force from them of ·363 lbs. steam pressure on the half circle, or ${\cdot}363 \times 1{\cdot}57 = {\cdot}57$, in addition to the former horizontal pressure of ·637 lbs. Recapitulation: By resolution of the radial forces, ${\cdot}637 \times 1{\cdot}57 = 1$; by resolution of the vertical as independent forces, ${\cdot}363 \times 1{\cdot}57 = {\cdot}57$: total horizontal force to part the circle at top and bottom, 1·57, those points being selected for investigation.

The steam pressure of ·637 lb. (say ·63662) is the mean of the cosines, and that of the ·363 lbs. (say ·36338) the mean of the complement of the cosines.

THOS. W. BAKEWELL.

Pittsburgh, Pa.

A Supposed Meteorite.

To the Editor of the Scientific American :

I send you herewith a specimen of a mass, resembling cinder, of black color, quite porous, which was found on the prairie, three or four miles from this place. It is supposed to have fallen from the heavens. Will you please examine and tell us what it is ? It was found by a farmer about the fifteenth of last May, while looking after his stock; and as he was over the ground almost every day, it is certain that it could not have lain there long before he discovered it. A month or so later, some of the neighbors broke it up and have since carried most of it away. A few days ago, some one brought to town a specimen which excited considerable curiosity. Yesterday afternoon, a party of us drove out to the farm of the man who made the discovery; he went with us to the spot where the supposed meteor fell. He thinks it must have come down in a soft or plastic state, as it lay on the ground in the form of a huge pancake, six or seven feet in diameter and ten inches thick. The grass, which was green around the mass when discovered, has since died and there is a white substance on the ground resembling alkali. There is no indentation or depression of the ground where it fell, which seems a little singular. The substance is too light for coal cinders, or we might be led to think that some one had deposited a huge cake of cinders there for a joke. The mass is the same color and texture throughout.

Butler, Mo., August, 1872. P. A. B

[Professor Shepard, of Amherst College, Mass, to whom we submitted the above specimen, instantly recognized it as a potash glass, containing perhaps traces of lime, phosphoric acid, alumina and iron, the result of a burned hay stack. The white substance was occasioned by the leaching out of the carbonate of potash.]

Curious Hotels.

While on a trip to the terminus of the southern half of the Midland Railroad, to see the heavy works of tunneling and making cuts and bridges, now going on at Liberty and Liberty Falls, south of the Catskill Mountains, N. Y., we espied through our pocket telescope a new hotel on one of the tops of the Shawangunk Mountains, and hearing that it just had been built and was a singular specimen of architecture, we took the side branch to Ellenville, near which it is situated. It is built on ground some 3,000 feet high, and notwithstanding that it is only about three miles from Ellenville, the roundabout but excellent carriage road is twelve miles long. No carriage was to be had that day, as the youthful population of that flourishing town had engaged all possible vehicles to go up the mountain, with a music band, and have a ball in the hotel: where it is always cool, and where thus dancing can be indulged in without discomfort even in July and August, when the heat in the valley below is such as to deprive this healthful exercise of all its charms. We found it an excellent idea, and wished that we in New York had also such a ball room 2,000 feet high in the air, where we could go to refresh ourselves any day or night, with or without having a hop.

There was no choice left but to walk up the mountain by a shorter road, which makes the distance five or six miles; and when coming at last in sight of the hotel, it looked as if it had partially fallen in, but a nearer approach showed that it was built against the base of an overhanging rock, which more than half served as a roof. The hotel has no back wall, being built against the perpendicular rock, in which the accidental large crevices are finished up and used as provision closets and little rooms, in which it is always delightfully cool. The kitchen is arranged at a spot where there is a spring coming out of the rock, the water of which is always sufficiently cold, so that ice water never need be used; however, Nature has provided for ice also, as in a large cleft of the rock, a quarter of a mile distant, the water which runs down in winter is gradually frozen up in large masses of ice, which are protected from solar heat almost as in an ice house, so that there is a natural supply which lasts through the whole summer season. Such natural ice caves are, by the way, very common in these mountain ranges, and also in the Catskill Mountains.

In regard to the expense of building, the owner informed us that, by making use of this natural rock as back wall, nothing had been saved, as the inequalities of the rock required so much extra labor that it absorbed all the saving of leaving out the back wall. In regard to our question if he had not experienced trouble in making a watertight connection between his partial roof and the natural rock as roof, he answered that all attempts to close that unprecedented seam with asphaltum had failed, but that he had at last perfectly succeeded by using as cement a mixture of plaster of Paris with melted tallow.

A few steps from the hotel is another spring, where a never changing jet of water of about two inches diameter spouts from the perpendicular rock wall. Between this spring and the hotel is a large crevice in which slabs of stones have been piled up so as to form a rough staircase by which the top of the plateau, about 100 feet above the hotel, is reached. This is nearly level, almost bare of trees, and surrounded on three sides with a precipitous perpendicular rock wall. The view from here is unsurpassed. It has an extent of some ten miles long by three wide, and a round lake in its center, of about one or two miles in diameter. This lake, of course, supplies most of the springs around this elevation.

But of all the hotels in the world, the very oddest is a lonely one in California, on the road between San José and Santa Cruz. Imagine ten immense trees, standing a few feet apart and hollow inside; these are the hotel, neat, breezy, and romantic. The largest tree is sixty-five feet around, and contains a sitting room and that bureau of Bacchus wherefrom is dispensed that thing that biteth and stingeth. All about this tree is a garden of flowers and evergreens. The drawing room is a bower made of red wood, evergreens, and madrona branches. For bed chambers, there are nine great hollow trees whitewashed or papered, and having doors cut out to fit the shape of the holes. Literature finds a place in a leaning stump, dubbed the "library." If it were not for that same haunt of Bacchus, it is certain that the guests of this strange establishment would feel like nothing so much as dryads.—*Manufacturer and Builder.*

New Uses of Cellulose.

Chemists have long known that cellulose resists the action of the most powerful reagents; boiling it with potash, soda, soap, chloride of lime, etc., has no effect. Chloride of aluminum attacks it somewhat; the best solvent has recently been discovered by Schweitzer, and it consists of an ammoniacal solution of the oxide of copper, or cupro-ammonium, which has the property of completely dissolving cellulose without in the least destroying its chemical or physical properties, as it can be precipitated in a perfectly pure state from the solution. It is proposed to make practical use of this important discovery by acting upon woody fiber, vegetable tissue, paper stock, rags, refuse, and seaweed, in a way to prepare a numerous class of objects from them. The solution of woody fiber is accomplished with more or less rapidity, according to the condition of the material; old linen and cotton rags dissolve immediately. Several applications have already suggested themselves to inventors; for example, to render paper impermeable. Sheets of paper are immersed for a few moments in the cupro ammonium solution, then pressed between rollers and dried. Paper thus treated becomes impermeable even to boiling water, and watertight bags could be constructed of such material. By multiplying the sheets of this prepared paper and rolling them together, a multitude of objects of value in domestic economy and the arts could be prepared. Another property of the cupro-ammonium solution is to impart greater tenacity to linen and paper. If we plunge a strip of paper, the tenacity of which has been previously tested, into the ammoniacal solution, and press and dry it between rollers, it will be found to have increased as much in strength as parchment paper prepared by immersion in sulphuric acid. Here again, by employing a number of strips of paper, it is possible to form a band nearly as strong as leather, and it is a question whether numerous substitutes for leather could not be made in this way. The discovery of Schweitzer has already been applied to the manufacture of roofing, pipes, water conductors, safety fuses, hats, boats and clothing. We should suppose that the treatment of all kinds of cellulose, wood, grass, linen, cotton, sawdust, etc., as a preliminary step in the preparation of gun cotton, collodion and dualin, would prove to be of great practical value. Dr. H. Vogel has already shown that precipitated gun cotton affords the best film for photographic purposes, and it is possible that by dissolving cellulose in cupro-ammonium, then precipitating it, and subsequently converting it in the usual manner into tri-nitro-cellulose, or gun cotton, a very superior article could be obtained from inferior stock. There are various ways of preparing the cupro-ammonium. One is to dissolve sulphate of copper in caustic ammonia on a large scale. Copper turnings can be digested in caustic ammonia with access of air, until a concentrated solution is obtained. Only a concentrated cupro-ammonium solution attacks the fiber, and when the liquid is diluted, the cellulose is at once precipitated. The discovery of Schweitzer opens up an important era in chemical manufacture, and will lead to many valuable applications.—*Journal of Applied Chemistry.*

The Constitution of Matter.

Matter, as we conceive it, is inert, that is to say, is unable to change of its own accord its condition of motion or of rest. That which is capable of communicating a movement is known as force.

There are several forces of which we have knowledge—heat, light, electricity, magnetism, attraction of gravitation, life. For many centuries these various forces were considered as so many distinct entities, but in our age it is understood that they are merely different manifestations of a single force. In fact, these forms are converted one into another with the greatest facility. When we heat an iron bar, it lengthens, mechanical action is produced, heat is absorbed. If we could reduce the bar to its original size by compression, the mechanical work produced by the heat would be destroyed, but the heat absorbed would be set free. When we pass an electric current of certain intensity through a fine copper wire, the wire becomes hot; and at the time that the ~~intensity of the~~ current diminishes, electricity is converted into heat. The identity of light and radiating heat has, moreover, been distinctly demonstrated, as well as that of electricity and magnetism. It may be considered certain, then that but a single force exists, manifesting itself to us under different aspects according to circumstances

At the time when the different manifestations of force were thought to be so many distinct entities, the disappearance of heat, of light, and of electricity could only be accounted for by assuming a total annihilation of these agencies. On the other hand, since heat, light, and electricity are always everywhere found in Nature, besides their possible annihilation, some were led to conjecture the possibility of their creation and to seek for perpetual motion. We have passed this period of errors; mathematical calculation as well as experiment demonstrates that force can neither be created nor destroyed. A constant ever-living force exists in the universe, manifesting itself sometimes in one way, sometimes in another, but the sum of which is absolutely invariable.

Should we then preserve these two entities, force and matter, as having a distinct existence? I think not. Force and matter: these are abstract ideas serving to assist our comprehension of that which exists under a two-fold aspect. Actually, then, we should admit but one thing, matter endowed with motion.

All these forces with which we are acquainted are but the resultant of the motions of matter, and differ from one another only in the nature of this motion.

Finally, then, minute indivisible particles or ultimates grouped in atoms, molecules, and tangible bodies, each endowed with motion capable of being communicated from one to another without the possibility of the quantity of matter or motion being increased or diminished—such we hold is the grandest conception of the universe.—*Naguet, in the American Chemist.*

Flower Garden and Pleasure Ground.

The Gardener's Monthly, a most excellent periodical, devoted to horticultural and rural affairs and published by Charles H. Marot, 814 Chestnut street, Philadelphia, gives, in the September number, the following timely hints on autumn gardening:

So soon as the leaves begin to fall, and the hot dry summer weather passes away, people begin to think of planting Dutch bulbous roots.

Of all fertilizers, well rotted cow manure has been found best for them, and especially if mixed with a portion of fine sand. They should be set about four inches beneath the surface of the ground, and a little sand put about the roots when being planted. A very wet soil usually rots the roots, and a dry one detracts from the size of the bloom. A soil in which garden vegetables do well is one of the best for these plants.

In selecting kinds to plant, the hyacinths have of course the first place. They are usually set in beds where the summer flowers have bloomed, and are best set wide enough to allow of the summer bedding plants being put between them. They die soon after the spring flowers are set out, and can easily be taken out before the summer flowers grow strong enough to crowd them.

In selecting, a very good show of bloom can be had from the moderate priced mixed kinds. These, where one has not much acquaintance with them, will look nearly as well as the choice named kinds. The last, however, are indispensable to those whose taste has been somewhat cultivated by years of hyacinth growing. For window blooming, the bulbs are usually set in four inch pots, about level with the surface of the soil, and the pots buried under ashes or sand until they begin to push. It is also as well, before hard frost sets in, to cover the bulbs in the open ground with a little light litter. They are hardy enough; but the litter keeps the ground from thawing, which, oft repeated, draws the bulbs out of the ground. When the bulbs are to be grown in glasses of water, it is best to set the whole concern in dark places for some weeks, as darkness always favors the production of roots. When the tops are to grow, then all the light possible is necessary. But we want roots before we can have tops. Beside hyacinths, other bulbs which are hardy and can be set out in the fall are tulips, narcissus, squills, jonquils, crown imperials, crocus, snowdrops, and Japan lilies. The gladiolus is sometimes seen in these catalogues, but these summer flowering things are planted in spring.

In many parts of the Northern States, the leaves will have changed color previous to the incoming of winter, and the planting of trees and shrubs will commence as soon as the first fall showers shall have cooled the atmosphere and moistened the soil. Further south, where the season will still remain "summer" awhile longer, the soil may at any rate be prepared that all may be in readiness when the right season does come. When there is likely to be a great deal of planting to be done and only a limited number of hands employed, planting may commence early in the month. What leaves remain on should be stripped off, and the main shoots shortened. They will then do better than if planted very late. In fact, if planting cannot be finished before the middle of November in the Northern and Middle States, it is better, as a rule, deferred till spring. In those States where little frost occurs, this rule will not apply. The roots of plants grow all winter, and a plant set out in the fall has this advantage, over spring set trees, that its roots in spring are in a position to supply the tree at once with food. This is, indeed, the theory fall planters rely on; but in practice it is found that severe cold dries up the wood, and the frosts draw out the roots, and thus more than counterbalance any advantage from the pushing of new roots. Very small plants are, ~~therefore, best left till spring for their final~~ planting The larger things, of which we recommend planting in the fall, should be pruned in somewhat at planting. The larger the tree, the greater in proportion should it be cut away.

Before the summer flowers are gone, make notes for the best things to be had for the next year, and arrange now what are to go in the beds then. There will then be time to get all together. A friend has a bed of the early flowering cannas which have made a pretty show on his grounds; but last year he thought there was hardly gaiety enough with the curious leaves. He planted a few scarlet gladiolus amongst them, and found they grew very well together. The leaves of gladiolus hardly showed amongst the cannas, so there was no incongruity. The effect was as if the cannas bore the scarlet flowers. It is such ideas as these which give interest to a flower garden. So with leaf plants. The coleus, acbryanthus, belgonias, and such like have much the best effect in partially shady places. There are other things which do best in the sun—such as the cannas and gladiolus aforesaid.

The best way to propagate all the common kinds of bedding plants is to take a frame or hand glass and set it on a bed of very sandy soil made in a shady place in the open air. The sand should be fine and sharp, and there is, perhaps, nothing better than river sand for this purpose. The glass may be whitewashed on the inside, so as to afford additional security against injury from the sun's rays. Into this bed of sand, cuttings of half ripened wood for the desirable plants may be set and, after putting in, slightly watered. Even very rare plants often do better this way than when under treatment in a regular propagating house. In making cuttings, it is best to cut the shoots just under a bud—they root better, and are not so likely to rot off and decay. A cutting of about three eyes is long enough for most strong growing things, such as geraniums, fuchsias, etc.

Small growing things, of course, will take more buds to the one cutting. From one to three inches is, however, long enough for most cuttings. They should be inserted about one third of their way under the sand, which latter should be pressed firmly against the row of cuttings with a flat piece of board—not, however, hard enough to force the particles of sand into the young and tender bark, which is often the first step to decay. For a few cuttings, they may be inserted with a dibble; but where many are to be put in, it saves time to mark a line on the sand with a rule or straight edge, and then cut down a face into the sand, say one or two inches deep, when the cuttings can be set against the face like box edging. All amateurs should practice the art of propagating plants. There is nothing connected with gardening more interesting.

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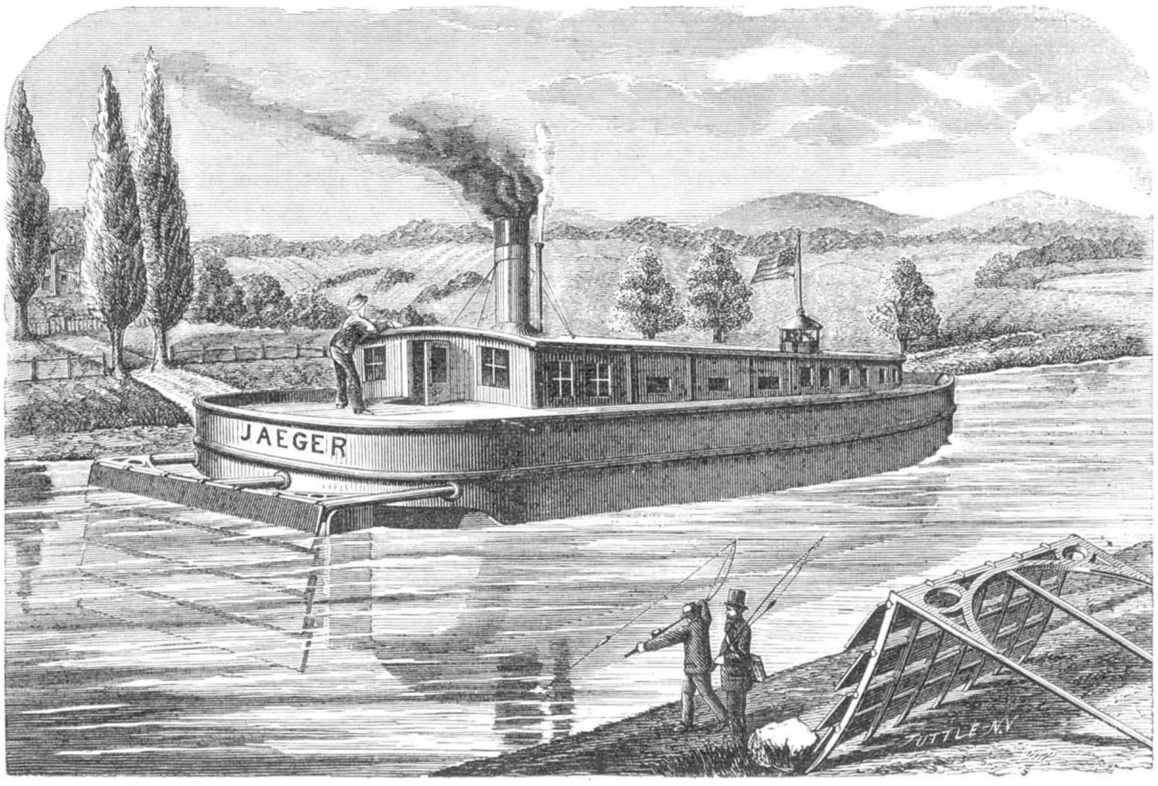
THE Osage orange is a native of Arkansas and southward.

NEW METHOD OF PROPELLING CANAL BOATS.

The novel and simple method of propelling canal boats by steam power, shown in our illustration, is claimed by its inventor to be fully as efficacious as the more complex devices which, from time to time, have been brought into public notice.



NEW METHOD OF PROPELLING CANAL BOATS.

The piston rod of the engine which forms the motive power of the vessel is extended out through the middle of the stern. To this rod is attached a strong crosshead of a length equal to the width of the boat, its ends being supported by two other rods which enter and freely move in stuffing boxes and guides in the quarters of the vessel. Along the length of the crosshead, supports of steel or iron are fastened. These extend vertically downward for a distance equal to the load draft of the boat, while on their rear sides, at suitable points, are hinged a number of flat blades, the length of which is the same as that of the crosshead. The entire device is strengthened by heavy bracing between the piston and supporting rods. The invention, as it appears out of the boat, is shown on the bank of the canal in the right foreground of our engraving.

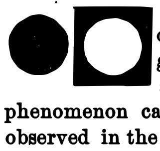
Its mode of working is easily understood. The steady powerful stroke of the engine forces the propelling apparatus backward from the stern. This motion causes the blades to close against the supports, thus presenting a surface in opposition to the water and pushing the boat bodily ahead. On the return stroke, the propeller is drawn back to its starting point, the blades now opening and turning edgewise to the water, offering but little resistance. One large blade, similarly hinged to the crosshead, may be substituted for the abovementioned numerous smaller ones, but the latter are the more convenient, as the vertical length of the propeller can be regulated, according to the draft of the boat, by removing the pivot pins and thus detaching one or more of the blades. The pushing surface of the propeller is made slightly concave so as to obviate any washing of water upon the banks, a defect from which the inventor claims this device to be entirely free. By placing another similar apparatus on the bow of the boat, and by properly arranging the blades, the vessel may be pulled as well as pushed through the water. Both bow and stern propellers may be worked by the same engine by extending the supporting rods entirely through the length of the boat and attaching them to both crossheads; or separate engines may be employed.

It is claimed that this mode of propulsion is much more effective and economical than the screw, because it utilizes a large amount of power, while it wastes none by slipping in the water. It makes no wash to injure the banks; the size of the propelling surface can be altered at pleasure, so that, no matter what the draft of the vessel may be, an effective area is always presented.

The inventor claims that his device need not be confined to use in canal boats, but is adapted to sea-going vessels. It may be modified by making the propeller double, or in other words, dividing it vertically in half. Two engines would then be used, their piston rods extending through the quarters of the vessel and working each set of blades alternately. The rudder, as shown in the engraving, is placed in position under the stern overhang, and between the boat and the propeller; or, if necessary, as the inventor states, two rudders may be employed, one attached to either side of the stern.

Letters for further information may be addressed to the inventor, Mr. James M. Jaeger, New York city.

Irradiation.



If two circles of equal diameter, one white on a black ground, the other black on a white ground, are looked at together, the white one appears larger than the black. This is the phenomenon called irradiation. Its influence is very well observed in the appearance of the moon when only a few days old, the bright crescent apparently extending beyond the darker portion of the disk, and holding it in its grasp. Dispersion of light is an assigned cause of irradiation. The amount of irradiation varies in different individuals; it is increased by fatigue of the eyes; and it is influenced by reflection.

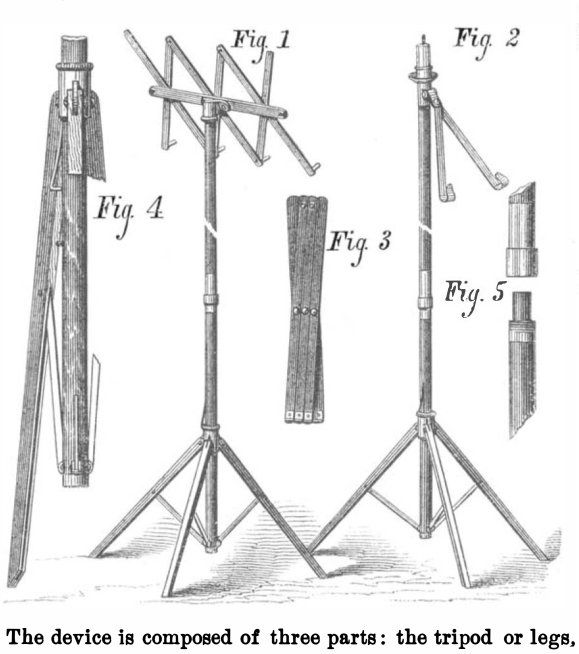
The Importance of Indicators.

Mr. Bramwell, in an address before the British Association, referring to the uses of steam and other indicating devices, said:

There are implements which record the horse power exerted from moment to moment, and register it on indices as readable as those of an ordinary counter of an engine, or as those of a gas meter. One of the greatest incentives to economical working which owners could offer to engine builders and engineers would be the application of such implements. Were they employed, the ship owner would know at the end of the voyage how much horse power had been exerted as a whole, and that so much coal had been burnt, and that the result, therefore, was a consumption of so many pounds per horse power per hour. In the same way, the proprietor of the engine for manufacturing purposes, the cotton mill, the woolen mill, the corn mill, and even the highly irregularly working rolling mills and saw mills, would be able at the end of the quarter to know that his engines have exerted so much power, burnt so much coal, and that therefore such and such have been the economic results. Assuming that steamboat proprietors and the owners of fixed land engines would go to the expense of applying such continuous recording implements as these to their engines, and would become members of an association for the purpose of visiting, inspecting, and reporting upon their machinery, and in giving prizes to the men in charge for careful attention: prizes to the manufacturers for original good design and workmanship of the engines; and prizes to the proprietors for their public spirit in having bought that which was good instead of that which was bad and cheap, and for having employed intelligent and careful workmen instead of ignorant and careless ones: within a few years a great improvement might be seen among the marine and manufacturing class of engines.

PORTABLE MUSIC STAND.

A complete music stand that can be folded up and, if necessary, transported in the same case with a violin, or which, if carried in the hand, takes up no more space than a roll of sheet music, cannot fail to meet with the ready appreciation of all instrumental performers. Such is the invention shown in the accompanying engraving, which, though capable of being packed in small compass, provides ample means for holding either large sheets or the smaller bound books used by string or brass bands.



The device is composed of three parts: the tripod or legs, the staff, and the racks, two in number. The tripod, Fig. 4, consists of three legs pivoted to a movable metal sleeve, which encircles the lower part of the staff. Attached in a similar manner to a ring, on the end of the latter, are three braces, the outer ends of which are also pivoted in narrow mortises cut in the lower edges of the legs. The sleeve to which the legs are attached slides freely upon the staff, so that, when held down by a spring, the tripod is expanded similar to the springs on an umbrella stick; and, *vice versâ*, when the sleeve is raised, the legs and braces are folded together in compact form.

The staff is made in jointed sections, or may be constructed after the telescopic or sliding pattern. That depicted in Figs. 1 and 2 of the engraving is made in the first mentioned style. The number of separate pieces depends upon the required hight of the stand which, by fewer or additional sections, may be adapted for holding the music, when the performer is either in a sitting or standing posture. The separate rods may be joined together by screws and nuts, as in Fig. 5, or by tenons and sockets.

The rack represented in Fig. 1 is intended for large sheet music, and is formed of a series of rods connected on the principle of lazy tongs. The central pivot of this rack attaches it to a bar or plate to which is fastened the metal socket which is placed over the end of the staff. The adjustment of this portion of the device is effected by opening out the rods and moving the rear piece across until the notches in its ends are even with metal projections on the back of the points of crossing of the two end pairs of rods. Then the rack is slightly closed, the projections enter the notches and slide into mortises cut in the front part of the crosspiece. The latter, when the rack is folded as in Fig. 3, is in a line with the rods.

In Fig. 2 is shown a simple device for holding music books. It consists of two brass arms pivoted to a socket in such a manner as to have free vertical and lateral motion, so that their angle of inclination, as well as the distance between them, may be altered at pleasure. Their lower extremities are bent in the form of hooks, which hold the pages of the book open. On the upper part of the socket, a candlestick is affixed, for convenience in holding a light. Both this rack and the one before described are constructed to fit on any joint of the staff.

The stand and rack for large music are neatly made of walnut, and are both light and durable. They may, when required, be constructed of metal. The total weight of the entire apparatus, with either rack, is about one and one half pounds.

Patented Sept. 13, 1870, and Aug. 6, 1872, through the Scientific American Patent Agency. Letters with proposals for the manufacture of this invention, or for further general information, may be addressed to the patentee, Mr. L. V. Brown, Salisbury, N. C.

Deep Drilling through Rocks.

The following facts, relative to the apparatus contrived by Mr. Bosworth for the sub-Wealden exploration, appear in the *Mining Journal*: He drives by steam a cutting tube, a sort of closed auger, at the end of an iron rod weighted on the top, and fresh joints of rod are screwed on between the auger and the weight as they are required. The auger itself is about 2 feet long; and it produces a perfect core of the strata through which it has passed. Mr. Bosworth has elsewhere carried boring to a depth of 2,000 feet; and he exhibited to the Geological Section some cylinders of rock that his augers had brought up, so hard as to be almost polished by the friction required to cut it. When great depths are attained, the revolution of the rod at the top of the bore is not immediately communicated to the auger, but may be said to take time to reach it, so that the rod twists. Theoretically, each 20 feet of rod makes a three quarter turn before communicating the rotation to the portion below; so that every 100 feet require six complete revolutions at the top before the auger feels the movement. The workmen soon learn to tell, by the sensation communicated by the rod to the hand, whether the auger bites, and at a depth of 100 feet, if it did not bite on the completion of six, or at most seven or eight revolutions, it would be pulled up, and a faulty joint of rod looked for and removed. In theory, of course, the six turns would be distributed over the whole length of the rod, but the iron is not perfectly homogeneous; and so, in practice, it is the weakest or softest part of the rod that receives all, or nearly all, the twist, and that would break if the twist were carried too far. Mr. Bosworth has contrived an ingenious device for seizing and dragging up the lower portion of the rod and the auger, if at any time the rod should break; but it is better and more economical in practice to anticipate a breakage, and to replace any portion of the rod that may twist instead of communicating the rotation. For the mere surface soil, the auger is 9 inches in diameter, but a 3 inch auger soon replaces the first, and in deep borings is itself replaced by one of 2 inches, or of only 1 inch in diameter.

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A CORRESPONDENT, J. W. K., in Colorado makes the following alarming suggestion: "Why not have a whole city furnished simultaneously with the latest telegraphic news upon the instant of its arrival, by means of a steam whistle or whistles, or a gigantic speaking machine, instead of waiting for it to go through the tedious process of type-setting, printing, folding, and distribution by the carrier? The old way is too slow, even with carriers on horseback as we have here in Denver."

Scientific American.

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NEW YORK, SATURDAY, OCTOBER 19, 1872.

Contents:

(Illustrated articles are marked with an asterisk.)

THE LONDON INTERNATIONAL EXHIBITION OF 1873

In the last issue of our journal we laid before our readers various reasons which render it undesirable, at least under the present state of Austrian laws now in force, for American inventors to forward their products to the coming Vienna Exposition. We now desire to call attention to the importance of another International Exhibition shortly to take place, regarding which no such caution is necessary and to which ample contributions from the United States should be forwarded.

We allude to the series of yearly Expositions open to all the world, which has recently been inaugurated by the British Government in London. One of these great fairs has just closed, but eight more have yet to be held. Each Exhibition is devoted to certain special subjects, the plan being to distribute among the series everything covering the broad field of Arts, Sciences and Industries. By this means each branch can be exemplified in much greater detail and elaboration than would be possible in a single grand display, in which probably a few specimens would serve to represent an entire class. The coming Exposition of 1873 is the third of the series and is to be devoted, first, to fine arts; second, certain manufactures, including silk and velvet fabrics, steel cutlery and surgical instruments, carriages not connected with rail or tram roads, substances used as food and in cookery and the science thereof. Third, and most important, *Recent Scientific Inventions and New Discoveries of all kinds.*

The formal opening will take place during the month of April, 1873, and the closing in October of the same year. The regulations governing admission are few and substantially are as follows: Applications for space must be made before January 31, 1873, to the Secretary of the Commission of the Exhibition. Only one specimen of each kind, illustrating the invention or discovery, will be admitted. Objects exhibited in previous International Exhibitions, unless greatly improved or altered, will not be admitted. No rent will be charged for space. Glass cases, stands and fittings, steam and water power and general shafting is also free. The officers of the Exposition will arrange the objects, except in cases of special machinery and other articles requiring skilled assistance, which must be provided by the exhibitor. The Commissioners of the Exposition, while taking all possible care of articles forwarded, are not responsible for loss or damage. Exhibitors must find their own pulleys, driving belts and counter shafting, and must also give certain information relative to the plan of the machine, space occupied, weight, amount of power required from shafting, and also quantities of water, steam or gas needed. All inventions must be delivered on the 11th or 12th of March, 1873.

We strongly advise inventors and others to lose no time in preparing their products so as to forward them in due season. In regard to patents, the laws of England are as liberal toward the foreigner as our own. There are no regulations requiring the manufacture of articles within any given time—nor does the government interfere in any particular, so that the inventor is free to make, use, and sell his invention or rights as he pleases, the same as in this country. The English patent does not extend to the colonies; but free trade with the colonies exists, and there is always a large colonial demand for improved articles made in the mother country. It will thus be seen that it is directly to the interest of American inventors to give this subject their attention, and we trust that all will use their best endeavors to secure a proper and complete representation of the inventive genius and scientific advancement of the people of the United States.

BINARY VAPOR ENGINES.

We publish elsewhere a communication referring to our remarks, under the above head, in our issue of September 28. Our correspondent is somewhat apprehensive that our article may prove inimical to the interests of Mr. Ellis, but, after reviewing it, we feel confident that he has misconstrued the statements therein made, as well as our sentiments. Nothing is further from our intention than to discourage in the slightest degree the labors of inventors in so important a field.

The only likeness pointed out by us between the Du Trembley and the Ellis engines arose from the fact of their both belonging to the "binary vapor" class of heat engines. The new engine has important and advantageous points of difference, as will be seen on reading the letter of our correspondent, who also presents arguments, already familiar to well informed engineers, in favor of binary vapor engines.

The point which is to be settled in the minds of engineers is not whether the binary vapor engine is superior to the average steam engine which forms one of its parts, but whether, in economy of fuel and durability, or first cost and running expenses, it is, when properly made, superior to the steam engines produced by our best builders, or to these same engines rendered more effective by the addition of a good condenser and air pump. Manufacturers of the best expansive steam engines in the market have, for many years, been building non-condensing steam engines and guaranteeing a consumption of fuel, in engines of fifty horse power, of not more than 3½ pounds per horse power per hour, and have, with good boilers, considerably under-run that figure; while, on large engines, they years ago attained frequently 2½ pounds and occasionally less, as a minimum, with condensing engines. Messrs. A. M. Perkins & Sons, a firm of Americans doing business in London, guarantee their engines at two pounds, and assume all expense for repairs for five per centum per annum. They claim, in at least one instance, to have obtained the horse power on a consumption of one pound of coal per hour.

That an economical binary engine may be obtained by the "conversion" of a wasteful steam engine is an admitted fact; and if time shall show that the engine just introduced has the durability and is as economical in running expenses as we hope it will prove, its proprietors have a most lucrative field of operation before them. What engineers are in doubt about, in the matter, is whether a binary engine can be built which can exceed in economy the most economical steam engines; and we repeat the sentiment already expressed that we hope that we may be given "statements of power developed, fuel consumed, and loss of bisulphide by leakage, during a period of considerable length, together with a statement of actual costs in dollars and cents," in one or more individual cases. Give us exact figures, as well as names of proprietors and locations, in every case, so that the most unbelieving Thomas among our readers shall be convinced; and we shall be glad of an opportunity to make them public.

It must, finally, be remembered that the fact that one liquid will yield a vapor of higher tension than another at the same temperature is not a proof that it is better fitted for use in a heat engine. If perfectly utilized, the heat rendered available for power by an engine driven by any vapor whatever is simply dependent upon the range of temperature adopted, and is the same for all perfect engines working between the same limits. The superiority of one engine over another where working between the same limits is due, as we stated in the previous article, to differences arising out of the inability of man to construct a perfect machine. They come from defects in the practice of engineering, rather than from any natural law which confers upon one fluid a higher power in the utilization of heat than another; and we hope that the ingenious inventor, whose letter has furnished us a text, may attain the full measure of the success for which he is so bravely striving, through the improved practice in engineering which he has described.

ADVANTAGES OF A TECHNICAL EDUCATION.

If "a little knowledge is a dangerous thing," no knowledge whatever must be absolutely stupefying. This assumption will, we think, be recognized and admitted by such of our readers as come in contact with persons of all trades, who profess to know them but who are found upon trial to be inexpert.

In the Machinists' and Blacksmiths' Convention, held at Albany, lately, a resolution offered by a New York delegate was adopted, deploring the general deficiency of mechanics in a knowledge of the theory and higher branches of their trade, and recommending that some means be taken for affording opportunities for elevation in this respect.

We have not the pleasure of knowing the Machinists' and Blacksmiths' Convention as an organization, but we may say to them, in view of the very sensible resolution offered, that the means of gaining information in the theory and practice of their callings is liberally provided in this and sister cities. Aside from the Cooper Union night schools, there are the Rensselaer Polytechnic Institute of Troy, the Stevens Institute of Technology at Hoboken, N. J., and one or two others of similar aims and objects in some other parts of the country. In either of the above colleges, for such they are in reality, thorough and precise courses of study can be pursued; so that, if the pupil has the capacity, he has the opportunity of becoming the peer of any scientific man in the world. Of course, some of these sources of information are closed to members of handicrafts who rely upon their daily labor for support, but the Cooper Union schools are accessible to all.

Our association with mechanics has been intimate, and we confess to a disappointment in not discovering among them that thirst for knowledge in the higher branches so often alluded to. In fact, a very superficial knowledge suffices for their ambition; and so long as they obtain as much wages as the mass, they are content. But they do not see, while they are organizing trade strikes or joining labor unions, that it is to the educated mind, the trained observation, and ready application of familiar principles that the draftsman or the superintendent owes his advancement and obtains higher wages and a better social position. While their fellows spent their substance in riotous living, these exceptions to the rule took advantage of the sources, for obtaining theoretical knowledge, that were open to them and profited thereby. The demand for skilled labor is never supplied. We have been in certainly a dozen workshops this summer where the managers inquired if we knew where they could procure twenty efficient men.

It does not follow by any means that because a man is quick at figures or has mechanical principles at his fingers' ends that he is a better lathe hand or finisher than his comrade who knows nothing of these things; but he has a better general knowledge of his calling and is more fitted to undertake the management of a concern, leaving the burthen and heat of the day to such as choose to encounter it.

Aside from the pursuit of trades and the acquirement of information concerning them as a means of support, technical studies are not to be discountenanced. To any of a practical turn of mind or who seek a general knowledge of the methods by which the various arts are carried on, such schools afford an absolute medium which many are availing themselves of to the exclusion of a purely classical education; and we call the attention of parents and guardians, who are about placing out their wards or sons, to institutions of this class.

AN INVENTION WANTED.

There is still a demand for a safe and simple method of lowering boats from vessels. Most of the contrivances heretofore invented seem to fail at the moment of danger, and, instead of launching the boat squarely upon the water, dump it down either sidewise, or bow first, or in some other bungling way, whereby the boat is capsized and the occupants lose their lives. The British Admiralty have lately tested a number of improved boat-lowering devices, with a view to the general adoption of an effective invention, on all the vessels of the Royal Navy. Although they found merit in one or two of the plans tried, they were unable to recommend the adoption of any, and concluded that the old fashioned method, blocks, hooks and thimbles, was the most satisfactory.

THE LATEST NEWS ABOUT THE MOON.

No celestial body has attracted more interest than the moon, and none has given rise to more speculation; the greater portion of the theories are utterly absurd, and in direct contradiction to observation and to positive knowledge founded on such observation, and to the circumstances in which we know that the moon exists. Our knowledge of the nature of its surface is more positive than that of any other celestial body, simply by reason of the short distance it is placed from us; while the distances of all other heavenly bodies is counted by many millions of miles, the distance of the moon is only 30 times the diameter of our earth. The result of this is that we possess a more correct knowledge, of the topographical details of that part of its surface which is always turned toward us, than we do of many regions of our own planet, for instance, the interior of Africa, Asia, Australia and South America, which have been either not at all or only partially investigated.

The first point we know positively is that the moon is some 50 times smaller than the earth, and is of the same density; consequently gravitation, which is always in a direct ratio to the mass, is 50 times less than on our earth, if we go to a distance, from the moon's center, equal to the terrestrial radius, 4,000 miles. But as on the moon's surface we are about 3·7 times nearer to its center (its radius being so much shorter), gravitation is increased in the ratio of the square of this number, by the law that the attraction is inversely as the square of the distance; we have thus to take $3{\cdot}7^2$ or 13·7 nearly, and multiply this by $\frac{1}{50}$ which gives nearly 0·275, or somewhat more than a quarter, for the gravitation on the moon's surface compared with that of the earth. If, then, everything on the moon's surface weighs only a quarter of what it weighs on the earth, the volcanic action, which is the agent in lifting up mountains, must be subject to only one quarter of the resistance, and is able to lift, under the same circumstances, four times as much material as it does on our earth. This theoretical view is in perfect accordance with observation, which has shown that the mountains in the moon are much higher than those on our earth, particularly if we take in account the smaller size of the moon; of the two spherical bodies, the moon therefore has the most irregular conformation.

As the rotation of the moon is so much slower than that of our earth, being only once on its axis during 29 days, the time of its revolution around the earth, there is no appreciable difference in the lengths of its polar and equatorial diameter; while in the case of our earth, the equatorial diameter is some 27 miles longer than the polar axis, an amount surpassing the highest mountains on our earth some five times. As the moon turns always the same side toward us, it is argued by some that it has no axial rotation, and this is true in regard to the earth, but in regard to the sun, it really revolves, and its different sides receive successively the solar rays, as we may observe during the so called phases of the moon.

When those phases are carefully noticed with a good telescope, especially some days before or after the new moon, it is seen that the uneven projecting parts throw long shadows, which become shorter in proportion as the solar rays come nearer to the perpendicular; by measuring the lengths of these shadows, the hight of the mountains has been calculated with the same accuracy as we may perform the same operation on our planet, and the different mountains and plains have been mapped out, in doing which photography has recently been of great assistance. The study of these details by means of the modern appliances has exploded some old notions about the existence of land and water on the moon, about its atmosphere, and even about its inhabitants. There is no such a thing as water or an atmosphere in the moon, and consequently no rain, no seasons, no alluvial lands, no place were plants can grow, and no animals to be fed by the plants, consequently there is no life in the moon; it is, to all intents and purposes, a dead satellite. In order to obtain a clear insight into the conditions of Nature there, we have only to investigate the natural condition of the tops of our snow-capped mountain ranges, the Andes or the Himalayas. They project so high up from the earth's surface that we practically may consider them as without an atmosphere, and at mid day the sun pours its tropical rays on their tops without raising their temperature enough to melt the snow. Suppose, now, that a large mountain top of this kind is raised 240,000 miles high; there is no reason to believe that the sun would communicate more heat to the same, and if we increase its mass to the size of the moon, the solar effect will be all the same. This shows the absurdity of such reasonings as those which ascribe, to that side of the moon on which the sun is shining, a burning heat, and to the other side the opposite; no doubt the latter side is still colder than the former, but the whole moon is always at a temperature far below the freezing point, and even far below that of our highest mountain tops. This view is corroborated by several eminent astronomers, who, being familiar with the details of the moon's surface, found the very same details when ascending the Peak of Teneriffe, which is an extinguished snow-covered volcano. The examination of the moon shows indeed more indications of volcanic eruption than the earth, where the greater portion of these indications have been, as it were, washed away by the effects of the atmosphere; succession of heat and cold, rain and frost, has abraded mountains, decomposed rocks and changed them into earth and clay, and distributed them in valleys and basins, and brought the earth's surface to the condition in which we see it, and which, next in importance to an atmosphere containing oxygen, carbonic acid and water, is essential to the existence of vegetable and animal life.

We must then conclude that the moon is the opposite of the sun. In the latter body, a temperature prevails, perhaps, exceeding any heat we shall ever be able to produce; in the moon a most intense cold exists. If this body has not yet cooled down to the temperature of the absolute absence of heat, which most probably is 460° below the zero of Fahrenheit, it has at least reached a temperature certainly far below the freezing point of water and even of mercury, of which the solidification takes place at 70° lower.

It is, at the present day, very amusing indeed to read the old published accounts of the observations of the German astronomers Schroeder and Gruithuizen, the latter of which imagined, in 1822, that he saw a city in the moon, with regular streets and surrounded by a wall; and in 1826, he believes he saw three new streets added, and two walls broken down, and even the color of the vegetation change with the heat, and further, a large structure resembling the Egyptian pyramids, a temple dedicated to the adoration of the stars, a public park similar to that of the city of Brussels (thus also resembling the Central Park of New York), and, in its neighborhood, a steam factory.

In the beginning of the last century, several astronomers asserted that there was a hole or tunnel in the moon, of 40 miles diameter, as during an eclipse of the sun they had seen the solar rays shining through this hole. They maintained this assertion with the utmost obstinacy; but as this tunnel has never been seen since, and its existence is next to impossible, the matter is now forgotten. Such a tunnel, indeed, if going through the lunar center would have to be over 2,000 miles long; and if it passed through prominences on the moon's surface, the Mont Cenis tunnel would be nothing at all compared to it. Speculations were already indulged in at that time that it was constructed by the inhabitants of the moon, who were far in advance of us in the mechanical arts. If they are so, they have closed the tunnel, perhaps in consequence of war.

THE FAIR OF THE AMERICAN INSTITUTE.

WOOD WORKING MACHINERY.

This class of apparatus is well represented by an unusually large display of band and scroll saws, most of which are of well known patterns. Plass's safety band saw is worthy of attention on account of its blade being entirely enclosed, so that, in case it should break, it is not liable to injure the workman. In the matter of cheapness, the Rollestone machine is in advance. A scroll saw, known as Moseley's Eureka, is noticeable for the facility with which its motion may be governed. A single movement stops the machine and throws off the belt.

The usual assortment of circular and other saws from well known makers needs no special allusion. Ely's Ne Plus Ultra saw mill is a novelty combining many improvements. The head blocks, by the intervention of suitable mechanism, are actuated by a single lever, so that all move exactly alike. Anti-friction rollers are employed by which the heaviest log may be moved without strain upon the machinery.

Young's diamond saw, which, though not a wood working machine, may be here mentioned in connection with similar devices, is another instance of the application of the diamond to industrial purposes. Its use is for cutting stone, and on each of its teeth are three carbons or black diamonds. It has cut at the rate of seven inches per hour into solid gneiss rock—a material into which ordinary saws, at their best, rarely penetrate more than one inch per day.

RITCHEL'S BRUSH BORING MACHINE

is a novel invention for boring any number of holes at once. Motion is communicated to a series of three eccentrics which connect with and impart a rotary motion to a vertical plate. In the latter are previously inserted the bent rods of a number of drills which, passing through holes in guides, constitute the boring apparatus. Each drill, having a bent spindle, has, as it were, a separate crank of its own, which is turned by the motion of the abovementioned vertical plate. All the boring points, therefore, have uniform rotary motion. It will be seen that this is a novel application, the crank arm forming an oblique angle with instead of a right angle to the spindle. The machine works double, that is, there is a set of drills, eccentrics, etc., at its either end, so arranged that both sets act alternately. An automatic feed motion supplies one brush-back at a time to the boring points. It will be seen that the work is continuous, as the drills at one end just enter the material while those at the other are withdrawing. The capabilities of this invention seem almost unlimited, as it bores with equal facility toothbrush backs or heavy boiler plates. The motion is positive, so that there are no cogs or intricate mechanism to get out of order. Any number of holes of different or uniform sizes can be bored at any distance apart. The apparatus is a decided improvement upon the method now in use of boring each hole separately.

THE NEW DEPARTURE WOOL SPINNER,

invented by Mr. L. W. Felt, of Keene, N. H., is destined to work a revolution in the woolen manufactures of the country. Its utility may be readily imagined when we state that it entirely obviates the necessity of mules and jacks, occupies one half the space, and can be operated with much greater rapidity. To appreciate this device it must be seen, as, being a novelty throughout, it is exceedingly difficult to convey even a superficial idea of it by a mere verbal description. Briefly and without detail, we may point out that the roping is led from a reel or beam and under four armed skeleton wheels. The thread then passes through twisting tubes to the spindles. The machine being set in motion, the twist tubes throw a twist in the rope. This twist extends back only for about a foot, for at that distance from the tubes the thread is nipped by the lower arm of the skeleton wheel, which binds it against a rotary apparatus below. Before the thread is released from this position, a swinging rod is caused, by a cam, to rise just inside of the holding arm of the wheel. This rod draws up a quantity of slack roping. Then the wheel revolves, releasing the thread. The twist is thus communicated to the slack gathered by the swinging rod, which falls out of the way, but is prevented from extending back to the reel by the next arm of the wheel, which again binds the thread down. This brief and necessarily imperfect description will perhaps serve to show that the chief points of importance in the invention are that it supplies enough roping for a draw, and meanwhile gathers up slack, to which the twist at the proper moment is uniformly communicated. The movement, in short, is precisely the same as in the antiquated mode of hand spinning. The first part of the draw is fast and the latter part slow, so that the thread is thus made uniform and even in size. The twisting tubes are slotted to receive the threads and are actuated by a single belt. By changing gear, any amount of twist may be given.

RIEHLE BROTHERS' TESTING MACHINE

consists of a combination of a horizontal differential lever and a hydraulic jack. The lever is kept balanced by adding weights until the material under examination breaks. The capacity of the machine is 40,000 lbs. No tests have been made as yet for want of specimens. The attention of founders and others is called to this need, as it is desirable that the merits of this invention should be determined. Pieces of any metal which it is desired to test are requested; the size is not to exceed ½ inch in thickness by 2½ inches width. This machine was illustrated on page 207, Volume XXVI of the SCIENTIFIC AMERICAN.

A new form of lathe center grinder deserves a word of commendation. It consists of a small wheel, easily moved to any angle or position on suitable frame work, and actuated by a belt from the lathe pulley. Jarboe's emery wheel has the peculiarity of being saturated and combined with oil, so as not to draw the temper of tools sharpened or ground upon it. The same inventor uses an endless belt of canvas covered with emery composition for polishing fine work. An admirably built

AIR COMPRESSOR,

from the Rand & Waring Drill and Compressor Company, is well worth careful examination. In this machine, the air cylinder is horizontal, while the steam cylinder is situated obliquely above it. The piston and rod of the former are hollow, the latter passing through the cylinder. A stream of water passes through these portions and around the air cylinder, thus keeping the parts always cool. The steam cylinder, unlike the Burleigh and other machines of this kind, does not have a piston rod acting directly upon the air pump, but is connected with the latter by a bell crank motion. By this arrangement, the first and most powerful part of the steam stroke causes the last and most resisting portion of the stroke in the air cylinder, and *vice versâ*, so that regularity of motion is insured. The cut-offs are adjustable, so that the steam may be used expansively in making the first part of the air cylinder stroke, thus greatly economizing power.

THE HOWARD SUPERHEATED AIR ENGINE

is a novel and ingenious device, which is constructed to avoid that common defect of machines of its class—hot valves. The principal portions of the apparatus consist of a hot air cylinder and air pump, which are connected by a passage fitted with a suitable valve. In the hot air cylinder soapstone is used as a lining, and also as a packing for the piston. The fire is made in the bottom of the cylinder. The cranks of the air pump and the cylinder are at right angles. The exhaust, leading into the passage between the cylinder and pump, opens when the hot air piston is at the end of its up stroke. The latter then descends, but when at mid stroke the pump piston commences its descent. The cold air from the pump cylinder and the hot exhaust meet in the communicating passage, the temperature of the combination being sufficiently low to keep the valve cool. Finally, cold air passes through the exhaust, cleaning the valve and blowing away all dust, etc., so that it will rest fair on its seat. The exhaust closes a little in advance of the hot air piston, and also before the pump piston reaches the end of its down stroke, so that a compression of air results, or rather the latter is banked up, so to speak, in the passage. This air on the opening of the valve and at the beginning of the upward motion of the hot air piston, rushes into the fire pot from under the fire, and, becoming rapidly expanded, forces the piston to the end of its up stroke.

It will be seen that the valve, which, we should have mentioned is operated by a cam, and rod leading from the shaft, is always kept cool by the reduced temperature of the air that surrounds it. The machine on exhibition, we are informed, has made 150 revolutions per minute, burning 1¼ pounds of coal per hour, and developing a power of 60 foot pounds per stroke. We cannot leave this engine without reference to a remarkably ingenious

COAL FEEDER

with which it is supplied, and which automatically serves to supply fuel as required. This apparatus consists of a hemispherical receptacle, in the bottom of which is a groove; in this groove is a sliding piece worked by mechanism from the engine. This piece acts to push a piece of coal which may rest in the groove along the same up to the edge of the receptacle. Here, a wire fastened to a moving standard sweeps the coal into a hole cut nearly through a small shaft. Then this shaft turns over and throws the lump into a horizontal, straight passage leading to the fire. In this passage is a piston which strikes the coal and pushes it into the grate. Suitable tubes serve to convey the small pieces of coal to the hemispherical receptacle.

A new

GERICKE'S TURBINE WATER PUMP

has been placed in position since our last visit. The name of the machine explains its construction. The results thus far obtained are quite satisfactory, as a ten inch stream is thrown, lifting 4 feet—belt 5 inches.

Several kinds of packing are exhibited; that of the Silver Lake Company is incorporated with soapstone. "Hitchcock's" is, by some secret process, made with plumbago. Stephen's parallel vise, we notice, has a new arrangement consisting of a movable piece in the jaws adapted for holding bevelled articles.

The Machinery Department is receiving new and improved inventions almost daily, so that in succeeding notes we shall doubtless have many other novelties to present.

THE FROZEN WELL OF BRANDON, VERMONT.

About a mile southeast of the village of Brandon, Vermont, there is situated a well, 41 feet deep, the water of which has the remarkable peculiarity of remaining frozen all the year round. In 1859 the owner of the property began the usual excavations for water. After passing through 4 feet of clay and 10 feet of soil, a bed of frozen gravel, 16 feet in thickness, was encountered, which rapidly changed to mud when exposed to heat. Further digging penetrated another bed of clay, and finally a layer of clean gravel, in which water was found. As the winter months approached, ice began to form in the well at the rate of from 2 to 4 inches over night, while during the succeeding summer, though the well remained open, an occasional skim of ice would appear on the surface.

Eventually the well was abandoned, but since it has remained unused, it is found that if the winter ice is not removed when the weather is quite warm, the water remains frozen through the hottest months. During April last, ice 20 inches in thickness was taken out, but as the atmosphere at that time was chilly freezing again took place. On July 16 of this year, the temperature in the shade was 85°; at two feet from the surface of the ice in the well, the mercury sank to 32°.

In 1860, four shafts were sunk in immediate proximity to the well without striking frozen ground; a fifth endeavor was more successful but the experiment was never completed, though we learn that it will be once more undertaken next summer. There is considerable speculation in scientific circles as to why this particular locality, possibly 200 feet square, should permit the winter cold to descend through from 12 to 29 feet of clay and gravel and freeze a mass of material averaging 14 feet thick, and yet not affect any other spot composed of similar strata. Professor Hager is of opinion that the phenomenon is due to glacial remains. The beds of clay, which intercept the sun's heat and besides shed off surface water, together with the favorable arrangement of the strata in connection with its dip and the proximity of the outcropping limestone, it is believed, have protected the frozen mass from thawing for thousands of years, while the remainder of the glacier has long since melted away, leaving only its moraines in the neighborhood. Mr. Clarence Sterling, of Bridgeport, Conn.,who has already spent some time in the investigation of the subject proposes next year to carry down the fifth well to a greater distance.

THE MOSCOW INDUSTRIAL EXPOSITION.

At the Great Industrial Exposition, now open in Moscow, Russia, there have lately been three competitive trials of steam fire engines, the only engines exhibited being those of English and American make. The superiority of the American machine—made at Seneca Falls, N. Y.—was established after three sharp competitions, and the highest prize was accordingly awarded to the Yankee.

Among other novelties to be seen at this Exposition is a railway fish car, for conveying live fish from the Volga to Moscow. The car is furnished with water tanks, which are supplied, at proper intervals, with fresh water at the railway stations. In this manner, live fish are conveyed to market in the best condition, with much success.

EXPECTED ADVANCE IN CRUDE PETROLEUM.

The petroleum oil producers of Pennsylvania have been holding conventions of late, and have finally agreed to suspend the pumping of oil and the drilling of new wells for a period of thirty days. The object of this movement is to secure an advance in the prices of crude oil, which at present are ruinously low, to wit, $3 per barrel, placed on the cars.

The total production of oil in this country is stated to be about 18,000 barrels per day, and there are now above 900,000 barrels in stock. On account of this immense surplus, the producers are in the power of the refiners and exporters, who are able to keep the price of crude oil down. It is expected, by stopping production for thirty days, the stock on hand will be reduced to somewhere about 400,000 or 500,000 barrels; and some favor a suspension of production for sixty days, which would reduce it to 200,000. The productiveness of the wells would not be over 1,000 barrels per day on resuming, and the price of crude oil, it is calculated, would go up to $5 per barrel, or nearly double the present rates. The producers have also agreed to suspend the use of torpedoes until March next.

FRANCIS LIEBER.

Doctor Francis Lieber, the distinguished German author and publicist, died suddenly in this city on the 2nd of October. He was born in Berlin in the year 1800, and at an early age entered the Prussian army, taking part in the campaigns that culminated in the fall of Napoleon I. In 1827 he took up his residence in this country, living first at Boston. In 1835, he was appointed Professor of History and Political Economy in the South Carolina College at Columbia, which position he held until he accepted, in 1858, a similar professorship in Columbia College in this city. Professor Lieber, though advanced in years, was at the time of his death a powerful and eloquent writer, his latest works being striking essays on the subject of prison management and punishment.

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MR. THOMAS GREAVES BARLOW, C. E, proprietor and editor of the London *Journal of Gas Lighting*, died recently in that city, Æ. 61.

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.

Notes & Queries.

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

1.—CATGUT.—How is catgut prepared for fiddle strings and other purposes?—G. A. B.

2.—HYDROGEN LAMP FOR HEATING PURPOSES.—Can a hydrogen lamp be used for heating purposes?—F. G. V.

3.—GRINDING LENSES.—How are lenses ground and polished, and what substances are used for the purpose?—G. A. B.

4.—POLISHING STEEL.—Will some one tell me a good method of giving hardened steel a high gloss polish?—E.

5—DEXTRIN PASTE.—Will some one inform me how I can make dextrin paste which will not ferment or become sour?—H. A. H. G.

6.—POWER OF WATER WHEEL,—What power can be obtained, from an overshot wheel thirty-five feet in diameter, with sixteen cubic inches of water?—W. C., Jr.

7.—CURING BLADDERS.—What is the best process for curing beef bladders for putty makers' use, and what cheap article, that will not injure the bladders, can be put on to them to keep the bugs from eating them?—J. H. S., of Mo.

8.—DARWINISM.—When the rats, in the ingenious trap described in a recent number of your journal, "fit" all night and only one survived, was it what Darwin meant by the survival of the "fittest?"—J. F.

9.—PRESERVING INSECTS.—How can I preserve insects without putting them in alcohol? Sulphate of iron and copper does not do.—P.

10.—KILLING INSECTS.—How can I kill insects which I wish to preserve as specimens? Cyanide of potassium in solution is dangerous and unhandy.—P.

11.—STUFFING BIRDS.—What can I substitute for arsenic, used in combination with cotton wool, for stuffing birds, etc.?—P.

12.—DIMENSIONS OF AIR PUMP.—How large an air pump do I want, and at what speed shall I run it, to keep up a constant pressure, through a pipe three eighths of an inch in diameter, of 100 lbs. on the square inch? What power will it take to run the pump, and how large should the air chamber be?—O. O. W.

13.—TROUBLE WITH TOMATOES.—My tomatoes have frequently turned into water of a disagreeable odor and acrid taste. What causes this? I use perfectly air tight jars, and follow the best recipes. What produces the change, and what becomes of the solid tomato?—P.

14.—QUARTZ GLASS.—Quartz is insensible to the blowpipe flame. How then is it possible to make quartz glass, which I think is used for some purposes? Is not the blowpipe the fiercest flame known? It seems to me that if this is true, quartz must be very difficult to work upon the rod of the glass blower. But how is it accomplished?—P.

15.—MOTHER IN VINEGAR.—Has the substance called mother in vinegar ever been analyzed? I find that the mother appeared through the microscope like a piece of moss. Upon the contact of nitric acid, it became contracted and lost all the hairlike branches. The most curious part is that, when washed and thrown upon a piece of ice, it suddenly regained its former appearance. What causes this?—P.

16.—REMOVING RUST BY DIPPING.—Will some one inform me whether there is a liquid by which rust can be removed by dipping? I have about 800 tools covered with thick rust, not spotted but covered; some of the tools are of such shape that the rust cannot be removed by friction.—S. A. T.

17.—HORSE POWER.—Which will secure the best result, a horse walking on the periphery of a wheel near the summit, or the same horse walking at the same speed on an ordinary horse railway power, commonly used for agricultural purposes? The two machines are supposed to be at the same angle of inclination.—E. M. K.

18.—ANTS IN AIR TIGHT BOXES.—Can some of the learned readers of the SCIENTIFIC explain the following phenomenon? Some time ago I placed a fine beetle in what I should consider a perfectly air tight box. I was called upon, perhaps a month afterwards, to open the box. There lay the beetle, literally overrun with red ants and peculiar looking white ones resembling the crab. Can any one explain this?—P.

19.—SPLICES OF LEATHER BELTS.—I am advised to run my leather belts so that the inside splice will run against the joint over the pulleys, as in this way the outside joint will run with the current, and will do much to obviate the starting of splices. This advice being at variance with the general and opposite way of running leather belts, will you inform me as to the best manner of so doing?—J. J. K.

20.—FRICTIONAL GEARING.—Can I put an intermediate friction pulley, say 36 inches in diameter, between a 72 inch pulley on the main shaft with 250 revolutions and a 30 inch pulley on the saw arbor with 600 revolutions, and do the work as well as with a belt running under a binder? Should both the main 72 inch pulley and the 36 inch intermediate pulley be made of wood, the 30 inch on the saw arbor being of iron? I propose to have the intermediate pulley so arranged as to be thrown out and in when stopping the saw and starting.—W. P. W.

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.

PAINT STAINS.—R. L. H., asks: How can I remove paint stains from white shirt bosoms? Answer: Apply sulphuric ether, and have a bowl of cold water ready to plunge the linen into immediately after using the ether.

J. F. W. says:—I send a piece of ore of some kind. What is it? It is plentiful on top of the ground, but to what depth it extends, I cannot tell. Answer: The specimen is iron pyrites. When abundant, it is valuable, not for the iron, but for the sulphur and the copperas it affords.

A. J., of Ohio, sends us a mineral and asks what it is. Answer: The specimen is a nodule of iron ore, chiefly the carbonate. Such nodules are disseminated through the shales of Ohio, and in the coal regions generally. Any ore of iron, if abundant, is valuable.

CAR COUPLING DANGERS.—A lady correspondent, C. P. P., of Ill., writes to say that an efficient system of coupling without going between the cars is in operation on some of the roads in her State.

W. C. W., of Ind.—The transparent mineral that you send is quartz. The other is iron pyrites. Neither are of value. Whether you will find coal or bismuth if you continue to bore, remains to be seen.

FRICTION.—S. M., Jr., asks "why a rolling motion produces much less friction than a sliding one"? Answer: Let S. M., Jr., watch the progress of a wheel of a railway car, when it is securely locked by the brake, along the rail. The friction will soon wear a flat place on the the tire of the wheel; but the moment the brake is released, the wheel begins to turn, and the rolling motion takes the place of the sliding one. The tire of the wheel will then move at the same rate as the vehicle passes along the rail, and there will be no friction other than that occurring at the point of contact, which is perpetually changing both on the tire and on the rail. S. M., Jr., will see, if he will observe carefully, how the friction in the rolling motion is so slight compared to that of the other.

REVOLUTION OF THE EARTH.—A. F. M.'s query, No. 8, page 202, whether the earth's velocity upon its axis will be increased by moving matter from the equator to the poles is to be answered in the affirmative. A very simple experiment will give a pretty good illustration. Tie, to one end of a thin string of about one or two feet length, a nail or any small body; hold the other end in your hand and swing it in a vertical plane, allowing the string to wind itself round a finger in order to shorten it continuously. As thus the body approaches its center of revolution, it will increase its velocity round the finger at a very remarkable rate. Its absolute velocity does not increase, but the orbit becoming smaller, the body can make its way in a shorter time in every succeeding revolution. —H. B., of Pa. [We fail to see the connection between H. B.'s experiment and the question.—EDS.]

PARASITE OF THE BLACK CRICKET.—The "brownish snake" more than nine inches long, found in the body of the crushed cricket mentioned on page 185, was a *gordius*, a genus of *vermes*. Such are frequently found in grasshoppers and various insects, and also in their larval stage in vegetables. They are often called "hair snakes" or worms; when a boy I was led to believe they were animated horsehairs, as they are frequently met with in streams in active motion. Any work on zoölogy will give an account of them. The cricket did not swallow the snake, nor did the snake originate there; it simply insinuated its slender form into the soft parts, between the scaly overlapping of the sections of the external shell.—J. S., of Va.

VERMIN IN FRUIT.—To M. S., query 23, page 138.—Put in with the fruit, when storing away, the leaves and small twigs of the China tree. A large quantity is not required, and the leaves, etc., can easily be taken out when the fruit is to be used. This is a certain preventive against worms in all kinds of dried fruit, and I have used it for several years.—H. A. H. G., of S. C.

TWIG GIRDLERS.—C. J., of Pa., writes as follows, with specimens: Enclosed you will find two twigs, as found on the ground under the trees in my grove. After a wind, dozens of them can be found on the ground. Sometimes long limbs nearly an inch in diameter are found, invariably dead, and always in each a worm, which I have plugged up in the smaller specimens; the larger I have left as I picked it up, but, as I have so many times found worms in them, I am quite sure there is one in it. Standing under the trees and looking up, one can see the dead branches, and when knocked off a worm is found in each. Sometimes a yard of pith is eaten clean out. What is it? Will they eventually kill the trees and can anything be done for them? Answer: It is very difficult to determine a species from the grub alone. This seems related to the girdling beetle, *onciderescingulatus*, common in Pennsylvania at end of summer, and fully illustrated and described on page 35, Volume XXV of the SCIENTIFIC AMERICAN. The parent girdles the branch below the spot where it deposits its eggs, so that the larva may feed upon the dead wood. Soaping or whitewashing the branches to prevent the beetle from laying its eggs is recommended. This specimen is doubtless one of the *cerambycidae* or longicorn beetles. The hickory borer, *chion cinctus*, makes similar long galleries in the trunks of hickory trees, the worm often working its way out of the wood after it has been made up into furniture or carriages.

Chloroform.—To C. T. B., query 1, page 170.—Put 30 fluid ounces of alcohol and three gallons of water into a capacious still; bring to a temperature of 100°, then add 10 pounds chlorinated lime and 5 pounds quicklime (slaked). Distil cautiously, withdrawing the fire as soon as distillation commences. When the product reaches 50 fluid ounces, the receiver is to be withdrawn. Pass its contents into a bottle with half a gallon of water and agitate, allow to settle, withdraw the supernatant fluid, and wash the heavy lower product three times with pure water. Now agitate the washed chloroform for five minutes with an equal volume of sulphuric acid. Allow it again to settle and transfer the upper stratum of liquid to a flask containing 2 ounces fused chloride of calcium and half an ounce dry slaked lime. Agitate well, and finally distil the pure chloroform by means of a water bath, using a Liebig condenser.—E. H. H., of Mass.

Relative Hights of the Atlantic and Pacific Oceans.—To J. P. W., query 12, page 170.—The weight or pressure of the atmosphere at the sea level is about 15 pounds to the square inch or 2,160 pounds to the square foot; and this would cause a uniform level of all the waters which surround the globe. Therefore there can be no difference in the absolute level of the Atlantic and Pacific oceans. Tides, currents, or prevailing winds might make a temporary difference in the locality indicated; too small, perhaps, ever to be ascertained by the ordinary methods. A recent survey has found the lowest elevation on the isthmus to be 45 feet.—W. L. W., of Ohio.

The Earth's Orbit.—In reply to O. F., query 6, page 106, D. B., of N. Y., states, on page 170, that the earth is nearest the sun in July and farthest in January. This is a mistake. Aphelion occurs in July and perihelion or nearest the sun in January, when we are about three millions of miles nearer the sun than in July. The reason we have not the hottest weather in winter, when the earth is nearest the sun, is on account of the inclination of the earth's axis to the plane of its orbit, when the north pole is inclined away from the sun, and at the same time the sun retreats to the southern tropic and shines obliquely on the northern hemisphere. The contrary takes place in the summer.—C. L. W., of N. Y.

Spectroscope and Microscope.—The simplicity and innocence of J. W. W., query 5, page 122, in asking for "plain directions for constructing" two of the most exquisite instruments in use for scientific research is really refreshing. The most experienced workmen are required to produce either of any real value. If J. W. W. can earn fifty cents a day at his trade, he can buy the instruments cheaper than he can make them. He can buy a very fair microscope for fifty dollars, and nothing worth having for less.—S., of Mass.

Designs on Steel.—Query 7, page 153.—Use double nitric acid (aquafortis) for engraving on steel, the design of course being drawn on a thin coating of beeswax. The time required depends on the depth desired. I. K. should experiment a little on a piece of steel to learn the time and strength for himself.—J. W. T.

Grates for Burning Sawdust.—Query 8, page 153.—These should not be too open, and should have greater area than those for solid fuel; but the success depends more on a good draft. If this is not attainable, a fan or steam blower should be used.—J. W. T.

Power of Engine.—Query 13, page 153.—W. H. P. does not state at what point in the stroke his engine cuts off, or whether it works expansively at all. Assuming, however, that it cuts off steam at three fourths stroke, it will have one and two thirds horse power, from which an uncertain amount must be deducted for friction. Under the most favorable circumstances, one and five eighths horse power would remain after friction was overcome. The speed, however, is very slow for so small an engine.—J. W. T.

Saw Mill Feed.—To P. P. S., query 4, page 185, current volume.—I am running a mill with just such feed gearing as you want; I can change the feed almost instantly, from slow to fast and *vice versa*, and that while the saw is at labor or at rest. The head blocks with their lever set arrangement are also superior to any other kind I have seen, and I have seen a good many. I can easily do the amount of work you require with my 54 inch saw, making 400 revolutions per minute. The wooden wheel you describe will not do the business; besides, a wooden wheel is a nuisance. I use an iron turbine wheel. It is not patented and is very cheap, and is equal to several wheels that run by the wind of their manufacturers.—E. G. D.

Iron Rust Stains.—E. H. H., of Mass., gives on page 170 a recipe for removing iron rust stains from cloth, by the mixture of one part sulphuric acid with two parts of water. This reminds me of the story of the Irishman who went to a physician for a prescription for preventing his dog from growing larger. The doctor directed him to go to a drug store and purchase ten grains of strychnia in crystals, and give it to the dog; and he would warrant that the dog would stop growing, charging Pat fifty cents for the prescription. Pat did as directed and the dog did stop growing, and breathing too. The prescription given by E. H. H. will not only take out the stains but will entirely destroy the cloth on which the stains are found. Now if E. H. H. or any body else will use a strong solution of oxalic instead of sulphuric acid, the stains will be effectually removed without injury to the cloth. Saturate the stained spots with the solution once or twice, and spread them in the sun. Oxalic acid is poison, and should be so labeled, and kept out of the way of children.—R. O. W., of N. Y.

Position of Eccentric on Crank Shaft.—M., query 11, page 122, is right; for the lead of the valve is the distance it is in advance of the piston, and can only be effected by setting the eccentric ahead of the crank. But this does not effect the lap. To produce the reverse motion by the link, as used on locomotives, the eccentrics should be set nearer together on the opposite side of the axle from the crank pin, which M.'s foreman can plainly see if he examines the eccentrics of a locomotive.—H. W. G., of Mich.

Cutting the Cogs of Mortise Wheels.—Query 20, page 153.—A machinist of my acquaintance cuts the teeth of "mortise" wheels,—core wheels we call them—in a large gear cutter. His cutters are made of thin plates of steel (hand saw blade is found to answer), cut to the shape of the space and inserted in recesses cut radially into the periphery of an iron blank, and wedged fast. He at first used six cutters, then four, then two, and finally found that one would answer every purpose. The cutting face being radial to the shaft and in the plane of its axis, the shape of the cutter is the exact shape of the space. The teeth are mostly made of hickory, though sugar maple is sometimes used. I cannot tell the speed proper for the cutter, but it is probably not less than 1,000 revolutions per minute, and certainly not faster than other wood cutting machinery.—J. W. T.

Specific Gravity.—Query 15, page 153.—At the level of the sea, there can be no difference between the weight of bodies at the equator and at the poles. If there were, the water of the ocean would sink where it was heaviest and rise where it was lightest till the equilibrium would be restored and the weight would be the same. This is what has taken place, for the centrifugal force due to the earth's rotation has enlarged its equatorial at the expense of the polar diameter. If the axis of the earth should change, the shape (not of the water merely but of the solid crust as well) would change also till a new equilibrium between centrifugal force and gravity would be established.—J. W. T.

Painting Roofs.—To L.M., query 4, page 217.—Good Venetian red, ochre, or mineral paints, mixed with one third boiled and two thirds raw linseed oil are the best for tin roofs. The rosin should always be thoroughly scraped off a new tin roof before painting. I find the best time in the year to paint a roof is when it needs it; there is no absorption in tin as there is in wood. The old paint, if solid, should be left i blistered, all that is loose should be cleaned off. A coat of paint on a roof might last five years, but a roof, to keep it in good repair, should be painted at least once in two years.—E. B. W., of N. J.

Radiation of Heat.—To H. P., query 9, page 202.—Since heat is a motion of the particles of matter, heat cannot pass where there is no matter; so, if the air could be perfectly exhausted, heat couldnot be radiated. Practically this exhaustion is impossible. Air is heated by convection, so H. P. must provide means for the supply of cold air to his furnace, as well as for the passage of the heated air to the rooms. This cold air may come from the rooms by separate registers, when there is no ventilation, or better from the outside, when the rooms, if kept warm, must be at least partially ventilated, and it should enter at the bottom of the furnace.—L. R. F. G., of Mass.

Attraction.—To A. F. M., query 7, page 202.—The pith balls placed on water come together because they attract each other. Every body attracts every other body. When bodies are free to move, as when floating on water, they come in contact.—L. R. F. G., of Mass.

Extracting Silver from Waste Products.—To J. H. P., query 1, page 217.—Boil your mixture of silver chloride, cream tartar, and salt, in water, which removes the two latter; dry the chloride and mix it with an equal weight of dry carbonate of soda and heat in a commonsand crucible to a white heat for half an hour. A button of pure silver will be found at the bottom of the crucible when it cools. Or boil the chloride with a strong solution of caustic potash until it has become perfectly black, then separate by filtration; after washing thoroughly with water, pure oxide of silver remains, which may be converted into nitrate by dissolving it in nitric acid, evaporating to dryness and heating to fusion to expel excess of acid. You can convert the metal into nitrate by the same process.—C. L. R. S., of D. C.

Brick Burning Questions.—To S., query 4, page 202.—Soaking the bricks with water and resetting will involve very considerable labor and expense, and I think the advantage would not compensate for the relighting of your fires and burning long enough to have good hard brick. Under any circumstances, probably more coal proportionately will be required than if they had been burned off at first.—E. H. H., of Mass.

Coloring Billiard Balls.—E. L. H., query 3, page 26, can color ivory billiard balls with an infusion of Brazil wood in stale urine, in the proportion of one pound to a gallon; or by a solution of dragons' blood in spirits of wine.—D. W. H., of Vt.

Extracting Silver from Waste Products.—Query 1, page 217.—J. H. P. should mix his waste product containing chloride of silver with carbonates of soda and potassa, and put in a crucible and fuse for 20 minutes. On cooling, the silver will be found chemically pure and separated at the bottom of the crucible in the form of a button.—W. L. R., of Md.

Construction of Life Boats.—Query 12, page 217.—A true life boat should be capable of self righting and self baling; that is to say, she must have considerable sheer, with large airtight tanks in the ends, and water ballast, or an iron keel, or both, so that she cannot remain bottom up. In order to free herself of water when she ships a sea or is capsized and righted, she must have small space internally where water can lodge, and large space filled with air chambers or cork and very large delivery valves. She must pull and sail well, and be large enough to carry at least ten men besides her crew of six men. When the Duke of Northumberland, in 1851, offered a prize of one hundred guineas for the best life boat for the coast of Great Britain, 280 models and plans of boats and rafts were offered. The reward fell to Beeching, of Great Yarmouth. His boat was 36 feet long, 9½ beam, 3½ deep, 3 feet sheer, with extra buoyancy of 8½ tuns. Her internal capacity up to thwarts was 5 tuns, and area of valves, 276 square inches. Her weight was 3½ tuns, her water ballast 2 tuns, and keel (of iron) weighed half a tun. Her draft with 30 men on board was 2 feet 2 inches; she was propelled by 12 oars in double bank, and 2 lug sails. She cost £250. Details are given, by the committee, of thirty of the best of the 280 boats. These varied in weight from 1,120 to 10,080 pounds, and in cost from £35 to £250—average, £107. It follows from these facts that a regular life boat is not the best thing for our coasting, river, and lake passenger steamers. She will be too heavy to handle in sudden emergencies, and too costly. Therefore in providing the means for sustaining the number allowed by law, we must have, first, a number of boats, each with sufficient buoyancy, in cork or air tanks, to enable her to be freed of water, as far as possible by large valves and then by baling with buckets. And sufficient of the buoyant properties must be in the ends, so that she cannot remain bottom up. This is all we can hope to accomplish in boats for passenger steamers. Next, we must have rafts of wood and cork, metallic air cylinders, or vulcanized rubber cylinders, covered with stout canvas to take the strain. The best of these is the latter, known as the Perry raft, or more recently the Monitor raft, of which I have had sufficient experience to recommend it as the best thing in all for saving life. It may be crowded with people, and will go on shore, end or broad side on, without being capsized through a heavy surf; it can be thrown overboard by a few men and cannot well be injured; it has oars, but they are not essential, as in a life boat, to keep her end on to the sea. Your inquirer is evidently not web-footed. The best life boat cannot be depended on to drift on shore or at sea guided by rudder alone. To his final question, as to whether a life boat full of people can be built to ride the sea safely until succor comes: I answer, yes, but she would be wholly unsuited to carry at the cranes of any steamer I know of. If inquirer is getting up plans to accomplish the object named, he may succeed in planning a boat that can be launched by machinery and carry 50 or 100 persons; but he will certainly fail in finding any steamboat company to pay for her. It is perfectly practicable and cheap to have all doors constructed as life preservers, and all saloons or upper structure decks should be arranged to float off and act as rafts. Volumes may be written on the subject, but I refrain from writing any more at present.—R. B. F., of Mass.

Communications Received.

The Editor of the Scientific American acknowledges, with much pleasure, the receipt of original papers and contributions upon the following subjects:

On Life Boats.—By R. B. F.

On the Wearing out of the Elements.—By F. F.

On Cylindrical Boilers.—By T. W. B.

On Gravity.—By E. W.

On Ball Lightning, With a Description of a New Steam Engine.—By. J. R. A.

On the Nature of the Hydrogen Atoms in Benzol, and of the SO^2OH group.—By R. D. W.

On the Force of Falling Bodies.—By R. C.

On Science in Court.—By A Subscriber.

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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.

Crib Attachment to Bedsteads.—Freeman Ryder, of Great Falls, N. H.—This invention consists of a crib attachment to bedsteads, easily removed or attached to the side, and which, being even with the top of the bedstead, renders every facility for the taking out or putting in of children by one lying in the principal bed.

Wall Paper.—Archibald W. Paull and John H. Ewing, Wheeling, West Va.—The invention consists in taking a section of wood whose grain is to be simulated and applying thereto a plastic substance to form the matrix; then casting molten gutta percha on this matrix, to get the stereotype plate; and finally transferring to paper whose quality and dimensions have been previously determined. This method is less expensive as well as more accurate and certain than the common etching or engraving process.

Oscillating Berth.—Lorenzo D. Newell, of New York city.—This invention relates to ships' berths that are pivoted so as to maintain a horizontal position when the ship either rolls or pitches, and is an improvement on the invention illustrated in the Scientific American, May 21, 1870. It consists in having the pivots at the ends of the berth mounted on slides, whereby the berth may be adjusted against the side of the stateroom and fastened thereto when not occupied and not required to oscillate, to save all the free space in the room in front of the berth for other purposes. The invention also consists in an adjustable balance weight and apparatus for shifting it, whereby a person in the berth can readily maintain the center of gravity by shifting the weight as he moves in the berth. The invention also consists of a convenient mode of fastening the berth against the side of the state room by a rod running through the lower part of it, and fastening to the side of the stateroom.

Ore Separator.—David Nevin, Georgetown, Colorado Territory.—This invention relates to a new ore separator, in which air currents, or rather puffs, are used to effect the desired separation of the heavier from the lighter metals, and also consists in the use of a continuous rotary wire screen under the hopper, in the use of a screw for regulating the same, and of a stationary tail screen ingeniously arranged for accomplishing the desired result.

Self Lubricating Stop Cock.—George Parker, Boston Highlands, Mass.—Faucets and stop cocks as usually constructed soon become loose from use and require to be screwed up so tightly that the friction soon renders them inoperative. The plug must be taken out and oiled frequently, or it leaks or sticks when screwed up. The object of this invention is to provide a remedy for this and to render the faucet self oiling, so that it will work easily and uniformly at all times without wear or undue friction.

Folding Crib and Cradle Combined.—Joseph B. Brolaski, St. Louis, Mo.—This invention has for its object to furnish an improved combined crib and cradle which shall be so constructed as to adapt it for use as a crib or cradle, and which, when not in use, may be folded into small compass, so that it may be rolled under the bed, stood on one end at the foot of the bedstead, or placed out of the way in a closet.

Tree Protector.—Frederick Bailey, Westborough, Mass.—The object of this invention is to provide convenient means for preventing grubs, worms, and insects ascending fruit and other trees; and it consists in a sack or bag and a box or hoop surrounding the tree, provided with an inwardly projecting cordon of bristles or similar material.

Temporary Binder.—John F. Adams, Irvington, N. Y.—This invention relates to a box or receptacle for letters, bills, and other similar papers which are to be preserved and filed. The invention consists in the use of a box whose one corner is cut away so that the corners of the papers may project at such corner, to be conveniently punctured and tied, sewed, or otherwise closed together.

Rotary Fan Wheel.—Thomas H. Walton, Ashland, Pa.—This invention relates to a new and useful improvement in apparatus for exhausting air from coal and other mines, and for any other purpose for which it may be adapted.

Sink Trap.—George Preterre, New York city.—This invention relates to a new trap to be applied to the discharge pipe of sinks, with the object of preventing the ascent of injurious gases or unpleasant odors through such pipe. The invention consists in the application of an enlarged chamber to such pipe, and in the arrangement therein of a transverse partition and weighted valve, simple in construction, and effectual in result.

Friction Clutch and Brake.—Darius Banks, Jr., Middletown, Conn.—This invention consists of a loose wheel on the driving shaft with a hollow conical hub, which is engaged with a friction hub on the shaft by sliding in one direction to set the wheel in motion; and when moved in the other direction, to disconnect it from the hub, it is engaged with a stationary friction brake to stop it, the hub acting on the inside of the said hollow conical hub and the brake on the outside, said brake being in the form of a hoop or band surrounding the said hollow hub of the wheel. The invention also consists of friction blocks or pads (on the hub, which is keyed fast to the shaft for acting upon the said hollow hub of the pulley) which are capable of a slight radial movement, and a cone on the pulley within its hollow hub, which comes against the inner ends of arms of said pads (at the time the pulley is shifted to be set in motion) and forces the said pads out against the inner wall of the hollow cone. The wheel is shifted on the shaft in one direction by a foot treadle and suitable connecting levers, and in the other direction by a spring. This foot treadle and the lever by which the motion is transmitted from the treadle to the wheel shifter are connected in a novel manner, by which the treadle may be shifted laterally along the lever as much as the width of the treadle, to allow of adjusting the treadle to suit the convenience of the operator.

Dry Goods Rack.—David Keiser, of Reading, Pa.—This invention has for its object to furnish an improved rack for prints and other dry goods for retail dealers, which shall be so constructed as to hold the goods in tiers and in such a way that the customers can see each piece and make their selection without its being necessary to throw a whole pile of calicoes or other goods upon the counter.

Hook for Draft Chains, Whiffletrees, etc.—Viram B. Paul, Merrill, Me.—This invention relates to the construction of iron or metallic hooks for various purposes; and consists mainly in a plate or shield of heart form, in which the point of the hook terminates. For instance, when the draft chain of a plow is attached with this hook, the connection is safe, and the same is the result in whiffletree connections—no turning or backing can disconnect it. Oxen and horses are much less liable to be injured by it than by the ordinary sharp pointed hook.

Stump Extractor.—Herman H. Rueter, of New Hope, Mo.—This invention has for its object to furnish an improved stump puller, so constructed that the stump may be drawn off by the same apparatus that pulled it; and it consists in an upright frame work, the four posts of which are connected near their upper ends by cross bars. The four posts of the frame work incline outward laterally as they extend downward, and the lower ends of the pair of posts upon each side are connected by a cross bar. The frame can thus be readily backed over a stump. By suitable combination of chains and pulleys, the advantage of leverage is so great that a small force applied to the ropes or chains will exert a great power at the chain attached to the stump. By this construction also, when the power is applied, the entire strain will come upon the frame, thus relieving the carriage from having to sustain said strain.

Sled Brake.—William D. Johnston, Harrisville, Pa.—This invention has for its object to furnish an improved sled or sleigh brake which can be applied with a force proportioned to the force with which the sled pushes forward. The rear end of the tongue rests upon the upper side of a roller, so that when the sleigh presses forward the resistance of the tongue will tend to revolve the roller and thus draw a rod forward, forcing dogs downward to take hold of the road bed. Suitable appliances prevent the tongue from turning upon the roller, which will prevent the brake from being applied. This arrangement also enables the sled to be backed without applying the brakes.

Invalid Chair.—Henry F. Siebold, of New York city.—The object of this invention is to furnish a chair which may, at pleasure, be converted into a lounge or a bed, and be adjusted so that a person may recline in any desired position. This chair is adapted for the use of patients in hospitals and sick rooms, as well as for comfort and ease in ordinary cases.

Roller Skate.—John A. Todd, of Sacramento, Cal.—This invention has for its general object to enable the skater to accomplish on roller skates, with ease, grace, and confidence, certain complicated and dextrous movements. In practice, when the skater wishes to turn he naturally inclines one or both feet inward, which causes a spring plate to assume an angle longitudinally to the floor, and, by consequence, the posts are turned outward, or inward, as the case may be. The axles, being rigidly connected with the hollow parts of the posts, are necessarily affected by this movement so as to throw them out of parallelism to each other, the outer wheels moving further apart and the inner wheels moving nearer together. Thus the skate will describe a circle whose radius is limited mainly by an elastic loop and the will or skill of the skater. Thus the skater has but to incline his foot or feet to one side or the other in order to describe a circle or arc of a circle.

Supplementary Steam Generator and Condenser.—Benjamin F. Bee, of Harwich, Mass.—The object of this invention is to enable an ocean steamer to make a voyage of indefinite length without pumping salt water into her boilers; and it consists in a supplementary steam generator interposed between the engine and the condenser, by means of which the fresh feed water of the boiler is constantly replenished. The salt water is evaporated by the exhaust steam in an apparatus interposed between the engine and the condenser, the steam thus generated being conducted into the condenser, mingling with the exhaust steam and adding to the amount of the water of condensation, to be pumped as feed water into the boiler. It is an invention likely to prove very important in marine engineering.

Head Block for Saw Mills.—John Cain, of Greenville, Pa., assignor to himself and Joseph W. Eberman, of same place.—This invention relates to a new arrangement of machinery for adjusting logs on a saw mill by means of the traverse motion of the head and tail blocks. It consists in a new combination of an intermittingly revolving shaft, which is worked by lever and ratchet and pawl connection to set the head and tail blocks. The invention also consists in combining with said shaft an eccentric rotary index.

Apparatus for Multiplying Power.—John R. Dubois, of Virginia city, Nevada.—This invention consists of one or more fly wheels, preferably two, weighted on one side, combined with a rotary frame and a stationary gear wheel in such manner that, being carried around the horizontal axis of said rotary frame, the weighted sides will be next to the shaft of the rotary frame on the ascending side and furthest from it on the descending side, and thus aid in the rotation of the said frame, by the difference in leverage thus gained and by the momentum of these weighted parts by the rotation imparted to the said wheels by the fixed wheels. The invention also comprises a connection of the shaft of a rotary frame with the machinery, to be driven by a spring in such manner that a light power will be capable of starting both the multiplying apparatus and the machinery driven thereby, by starting the one first while the spring is relaxed, and afterward the other when the first has obtained momentum to aid it in starting.

Mortising Machine.—Eli Wallace, of Huntsville, Pa.—This invention relates to a new mortising machine in which a series of saws are employed having a double motion—to wit, rotary and oscillating. The latter motion is in direction with the axle of the mandrel carrying the saws, and enables each saw to clear away as much wood as the length of its stroke will permit; such length of stroke, being equal to or exceeding the distance between the several saws, enables the gang to cut a rectangular mortise of suitable depth.

Non-conducting Covering for Steam Boilers.—Eleazer Ainsworth, of Wilmington, Delaware.—The object of this invention is to furnish a good non-conducting material, composition, or substance for preventing the radiation of heat and the consequent condensation of steam in steam boilers, steam pipes, and for all similar purposes; and consists in, first, a coat composed of ground sumac or spent tan bark, alum, hair, cocoanut fiber or jute, slaughter house blood, pulverized soapstone or ground clay, dextrin and rye flour. When these ingredients are well mixed together, a plastic material is formed which adheres together and forms a compact body. No alkaline substance is used in this composition, consequently the iron is not corroded thereby, nor does it adhere to the iron, but shrinks from it. This composition coating is inclosed by a coating of canvas or muslin or equivalent material, wound around spirally. The exterior coating is composed of a portion of the within named ingredients, as dextrin and pulverized soapstone.

Gang Plow.—Albertus W. Hoyt, Denver, Ill.—This invention has for its object to furnish an improved gang plow, and it consists in levers, the forward ends of which are connected with the forward ends of the plow beams. The levers are pivoted to the upper ends of an upright, and their rear ends extend back into such a position that they can be conveniently reached and operated by the driver from his seat to raise and lower the forward ends of the plow beams. The said levers may be secured in any desired position by pins inserted in holes in said standards, or by other convenient means. To a beam near the seat is pivoted a short transverse shaft, to the ends of which are attached, or upon them are formed, arms, the outer ends of which are connected with the rear ends of the plow beams by short chains or other convenient connections. To the shaft is also attached a lever, which may be operated by the driver with his foot to raise the rear ends of the plow beams from the ground. The lever may be secured in position to hold the plows suspended by a catch attached to the beam.

Blow-off for Boilers.—Esbon F. Husted, Harrisburg, Texas.—The object of this invention is to provide means for cleaning the boiler with as little waste of water as possible. It consists in a central box or vortex having one or more tubular perforated arms radiating horizontally therefrom, secured in the boiler in any manner at or about at the water line, said box having a pipe for the discharge of the gathered impurities or scum.

Hatchet.—Samuel Daugherty, Belle Vernon, Pa.—This invention has for its object to furnish an improved device for attachment to hatchets, hammers and other nail driving tools, to enable nails to be driven in places in which it is impossible to hold the nail with one hand while it is being driven with the other, or even to reach with the hands; and it consists of springs inclined toward each other so as to grasp the body of the nail between them and hold it securely. By this construction the nail can be started with the driving tool and then driven home with one hand, thus rendering it possible to drive nails conveniently in places which it is impossible to reach with the hands.

Ironing Machine.—George W. H. Calver, Burlington, N. J.—This invention has for its object to improve that class of clothes-ironing machines in which tubular revolving rollers are employed to effect the ironing operation. The principal feature of this invention consists in the employment of a pair of tubular ironing rollers, which are provided with an attachment for the reception of gas heating devices, thus avoiding the disadvantages and expense arising from the use of steam or hot air, as generally used. The second part of the invention relates to a method of insulating the ends of a spring employed for exerting pressure upon the ironing rollers by means of plates or blocks interposed between the spring and rollers, thus preventing the injurious action of the heat upon the temper of the former. The third feature consists in the application, to the inner surface of the ironing rollers, of annular flanges for preventing the escape of the scales, dust, etc., collecting within the same. The fourth part has for its object to furnish means for admitting the air necessary for the proper combustion of the gas at both ends of the cylinder.

Washing Machine.—Daniel M. Holmes, Westchester Village, N. Y.—In this invention, part of the clothes are placed upon each side of the beater, and as the said beater is swung upon its pivots, the clothes are compressed between the beater and the inclined side boards. As the beater is swung back, the clothes drop down upon the shoulder, which checks them and causes them to turn over in the water, so that they will be compressed each time in a new place, thus insuring their being thoroughly washed.

Turntable.—Charles P. Tibbetts, New Orleans, La.—This invention relates to a new self-setting turntable, to be applied to one or more tracks for reversing the position of engines or cars, or transferring them from one track to the other. The invention consists principally in connecting the turntable with a weight which will cause it automatically to resume the same ordinary position after every turn that winds the rope or chain holding such weight around the lower part of the table. By thus being made to turn into the regular position, the table is easily operated. The invention also consists in the arrangement of spring catches and stops, whereby the table is arrested opposite to any track desired.

Vent for Burial Cases.—William W. Woodward, Cincinnati, Ohio.—This invention has for its object to furnish an improved vent for burial cases, caskets, etc., so constructed as to prevent the case or casket from being burst open by the pressure of the gases developed by decomposition. The invention consists in a combination, with the coffin, of a valve, a locking cam, spring, and covering plate, said valve being provided with a guide stem, and seated in a plate secured to the coffin lid or cover, and the operative parts being so arranged that the valve may be locked to its seat, when desired, and at other times be held closed by spring pressure.

Cane Seat for Chairs.—Will F. Howe, Galveston, Texas.—The object of this invention is to facilitate the process of making chairs and economize cane in the seats. The invention consists in the use of a thin metallic frame, around which the cane is laid, and to which the same is fastened, and which is inserted in the wooden frame of the chair seat after the cane has been applied. By this arrangement it is unnecessary to perforate the chair frame for the reception of the cane; and also the drawing the cane through the chair frame is dispensed with, thereby economizing about fifty feet of cane on each chair. The invention also makes the cane binding unnecessary, and economizes further labor and material thereby.

Blotting Paper.—Nicoll Floyd, New York city.—This invention has for its object to furnish an improved blotting paper, having a smooth surface upon one side suitable to receive printing to adapt it for advertising purposes.

[OFFICIAL.]

Index of Inventions

For which Letters Patent of the United States were granted

FOR THE WEEK ENDING SEPTEMBER 17, 1872, AND EACH BEARING THAT DATE.

SCHEDULE OF PATENT FEES:

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APPLICATIONS FOR EXTENSIONS.

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

22,337.—Cleaning Rice.—W. Ager. Dec. 4, 1872.
22,379.—Boring Machine.—G. F. Rice. Dec. 4, 1872.
22,381.—Brushes.—R. Shaler. Dec. 4, 1872.
22,432.—Corsets.—A. S. McLean. Dec. 11, 1872.
22,439.—Axle Bearing.—D. Matthew. Dec. 11, 1872.
22,532.—Manufacturing Corsets, etc.—D. Lamoureux. Dec. 18, 1872.

EXTENSIONS GRANTED.

21,554.—Inkstand.—S. Darling.
21,566.—Needles for Knitting Machines.—J. K. and E. E. Kilbourn.
21,572.—Canal Boat.—John, Jefferson, and James McCausland.
21,574.—Preventing Nuts from Unscrewing.—S. Noblet.
21,587.—Harvester.—McC. Young, Jr.

EXTENSION REFUSED.

21,603.—Tempering Steel.—P. G. Gardiner.

DESIGNS PATENTED.

6,140.—Coffin.—Joseph P. Albin, Cincinnati, Ohio.
6,141.—Bottle.—Jerome B. Brown, Baltimore, Md.
6,142.—Fire Dog.—O. F. Fogelstrand, Kensington, Conn.
6,143.—Tea Service.—G. Gill, Taunton, Mass.
6,144.—Match Stand, etc.—C. H. Latham, Lowell, Mass.
6,145.—Burial Casket.—A. B. Lawrence, Warsaw, N. Y.
6,146.—Sad Iron.—I. H. Moss, Cincinnati, Ohio.
6,147 & 6,148.—Match Boxes.—T. Village, Cromwell, Conn.

TRADE MARKS REGISTERED.

993.—Brandy Bottle Caps.—Cazade & Crooks, New York city.
994.—Paper, etc.—Laroche Frères Du Martinet, Angoulême, France.
995.—Cloth Cutting Machine.—I. Fenno & Co., Boston, Mass.
996.—Bitters.—Anaclet L. Lacroix, St. Louis, Mo.
997.—Watches.—J. E. Roberts & Co., New York city.
998.—Sugars, etc.—A. Thomson & Co., New Orleans, La.
999.—Petroleum.—J. L. Thomas & Co., Exeter, England.

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How Can I Obtain a Patent?

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

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To Make an Application for a Patent.

The applicant for a patent should furnish a model of his invention if susceptible of one, although sometimes it may be dispensed with; or, if the invention be a chemical production, he must furnish samples of the ingredients of which his composition consists. These should be securely packed, the inventor's name marked on them, and sent by express, prepaid. Small models, from a distance, can often be sent cheaper by mail. The safest way to remit money is by a draft, or postal order, on New York, payable to the order of Munn & Co. Persons who live in remote parts of the country can usually purchase drafts from their merchants on their New York correspondents.

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Inventions Patented in England by Americans

[Compiled from the Commissioners of Patents' Journal.]

From September 10 to September 16, 1872, inclusive.

Attaching Buttons.—J. Keith, Providence, R. I.
Bale Tie.—G. L. Laughland, New Orleans, La.
Bridges, etc.—T. C. Clarke, Philadelphia, A. Bonzano, J. Griffen, Phœnixville, Pa.
Burnishing Photographs.—E. R. Weston, T. McDonald, East Corinth, Me.
Compressing Air.—A. C. Rand (of New York city), Glasgow, Scotland.
Cotton Machinery, etc.—J. McDonald, Concord, N. C.
Heeling Boots, etc.—J. W. Brooks, Boston, Mass.
Lacing Apparel, etc.—D. Heaton, Providence, R. I.
Mowing Machine.—W. H. Barlow, B. L. Walker, Sing Sing, N. Y.
Sewing Machine.—R. Ashe, Boston, Mass.
Shuttle Driving Mechanism.—J. Stever, Bristol, G. A. Boughton, J. E. Newton, Waterbury, Conn.
Steam Pump.—A. J. Reynolds (of White Plains, N. Y.), London, England.
Stuffing Mattresses, etc.—J. L. Kendall, Foxborough, Mass.
Telegraph.—J. Rowe, Paterson, N. J.
Tempering and Refining Steel.—W. N. Severance, South Bend, Ind.

NEW BOOKS AND PUBLICATIONS.

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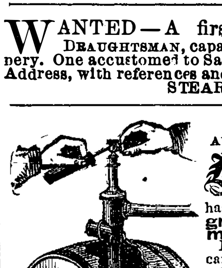

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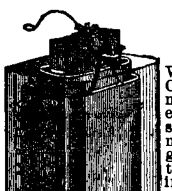

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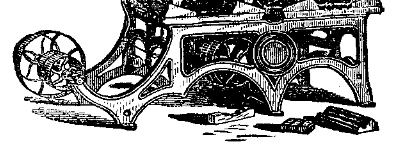

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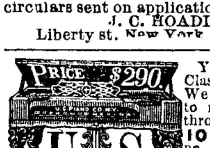

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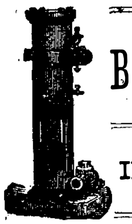

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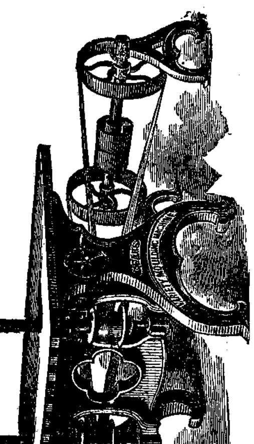

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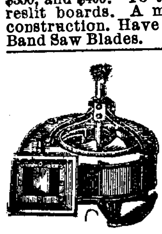

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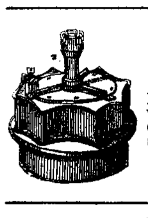

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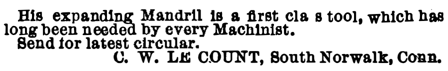

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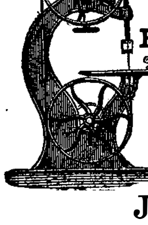

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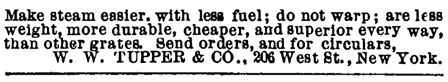

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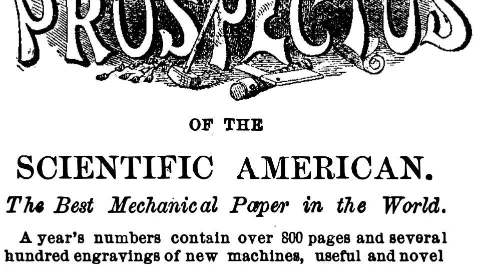

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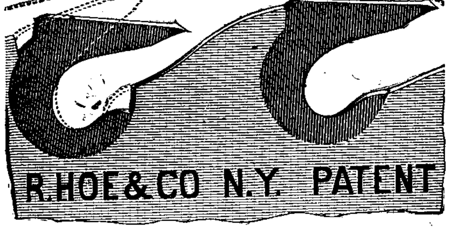

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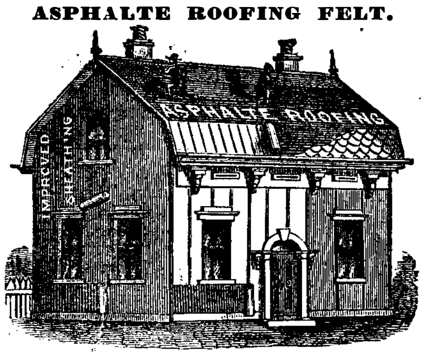

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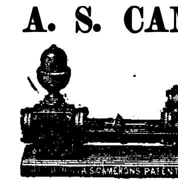

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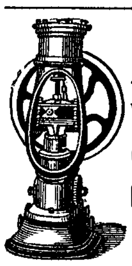

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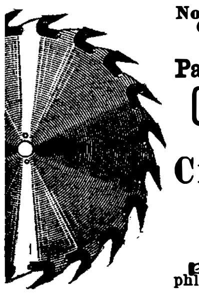

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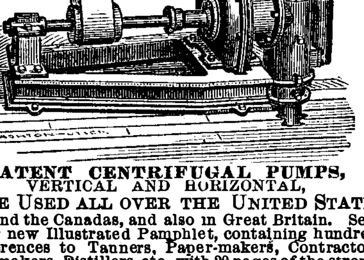

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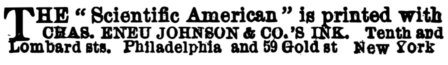

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